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BASIC ASSESSMENT REPORT

Basic Assessment for the proposed development of a 115 MW Solar Photovoltaic (PV) Facility and associated electrical infrastructure (i.e. Kenhardt PV 5), north-east of Kenhardt, in the Northern Cape

APPENDIX C: SPECIALIST STUDIES

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Soil Scientist (Pri.Sci.Nat.)
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AGRICULTURAL IMPACT ASSESSMENT FOR THE PROPOSED CONSTRUCTION OF THE SOLAR PHOTOVOLTAIC (PV) FACILITY, KENHARDT PV5 AND ASSOCIATED ELECTRICAL INFRASTRUCTURE, NEAR KENHARDT, IN THE NORTHERN CAPE

BASIC ASSESSMENT REPORT

Report by
Johann Lanz
for
CSIR – Environmental Management Services
PO Box 320
Stellenbosch
7600

11 December 2019

Johann Lanz
Professional profile

Education

• M.Sc. (Environmental Geochemistry)	University of Cape Town	1996 - June 1997
• B.Sc. Agriculture (Soil Science, Chemistry)	University of Stellenbosch	1992 - 1995
• BA (English, Environmental & Geographical Science)	University of Cape Town	1989 - 1991
• Matric Exemption	Wynberg Boy's High School	1983

Professional work experience

I am registered as a Professional Natural Scientist (Pri.Sci.Nat.) in the field of soil science, registration number 400268/12, and am a member of the Soil Science Society of South Africa.

- **Soil Science Consultant** **Self employed** **2002 - present**

  I run a soil science consulting business, servicing clients in both the environmental and agricultural industries. Typical consulting projects involve:

- Soil specialist study inputs to EIA's, SEA's and EMPR's. These have focused on impact assessments and rehabilitation on agricultural land, rehabilitation and re-vegetation of mining and industrially disturbed and contaminated soils, as well as more general aspects of soil resource management. Recent clients include: CSIR; SRK Consulting; Aurecon; Mainstream Renewable Power; SiVEST; Savannah Environmental; Subsolar; Red Cap Investments; MBB Consulting Engineers; Enviroworks; Sharples Environmental Services; Haw & Inglis; BioTherm Energy; Tiptrans.
- Soil resource evaluations and mapping for agricultural land use planning and management. Recent clients include: Cederberg Wines; Unit for Technical Assistance - Western Cape Department of Agriculture; Wedderwill Estate; Goedgedacht Olives; Zewenwacht Wine Estate, Lourensford Fruit Company; Kaarsten Boerdery; Thelema Mountain Vineyards; Rudera Wines; Flagstone Wines; Solms Delta Wines; Dornier Wines.

- **Soil Science Consultant** **Agricultural Consultors International (Tinie du Preez)** **1998 - end 2001**

  Responsible for providing all aspects of a soil science technical consulting service directly to clients in the wine, fruit and environmental industries all over South Africa, and in Chile, South America.

- **Contracting Soil Scientist** **De Beers Namaqualand Mines** **July 1997 - Jan 1998**

  Completed a contract to make recommendations on soil rehabilitation and re-vegetation of mined areas.

Publications

- Lanz, J. 2012. Soil health: sustaining Stellenbosch's roots. In: M Swilling, B Sebitosi & R Loots (eds). *Sustainable Stellenbosch: opening dialogues*. Stellenbosch: SunMedia.
- Lanz, J. 2010. Soil health indicators: physical and chemical. *South African Fruit Journal*, April / May 2010 issue.
- Lanz, J. 2009. Soil health constraints. *South African Fruit Journal*, August / September 2009 issue.
- Lanz, J. 2009. Soil carbon research. *AgriProbe*, Department of Agriculture.
- Lanz, J. 2005. Special Report: Soils and wine quality. *Wineland Magazine.*

I am a reviewing scientist for the *South African Journal of Plant and Soil*.

DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

	(For official use only)
File Reference Number:	
NEAS Reference Number:	DEA/EIA/
Date Received:	

Application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

PROJECT TITLE

THE PROPOSED CONSTRUCTION OF THE SOLAR PHOTOVOLTAIC (PV) FACILITY, KENHARDT PV5 AND ASSOCIATED ELECTRICAL INFRASTRUCTURE, NEAR KENHARDT, IN THE NORTHERN CAPE

Kindly note the following:

- This form must always be used for applications that must be subjected to Basic Assessment or Scoping & Environmental Impact Reporting where this Department is the Competent Authority.
- This form is current as of 01 September 2018. It is the responsibility of the Applicant / Environmental Assessment Practitioner (EAP) to ascertain whether subsequent versions of the form have been published or produced by the Competent Authority. The latest available Departmental templates are available at https://www.environment.gov.za/documents/forms.
- A copy of this form containing original signatures must be appended to all Draft and Final Reports submitted to the department for consideration.
- All documentation delivered to the physical address contained in this form must be delivered during the official Departmental Officer Hours which is visible on the Departmental gate.
- All EIA related documents (includes application forms, reports or any EIA related submissions) that are faxed; emailed; delivered to Security or placed in the Departmental Tender Box will not be accepted, only hardcopy submissions are accepted.

Departmental Details

Postal address:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Private Bag X447
Pretoria
0001

Physical address:

Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Environment House
473 Steve Biko Road
Arcadia

Queries must be directed to the Directorate: Coordination, Strategic Planning and Support at:
Email: EIAAdmin@environment.gov.za

1. SPECIALIST INFORMATION

Specialist Company Name:	Johann Lanz – Soil Scientist			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	4	Percentage Procurement recognition	100%
Specialist name:	Johann Lanz			
Specialist Qualifications:	M.Sc. (Environmental Geochemistry)			
Professional affiliation/registration:	Registered Professional Natural Scientist Member of the Soil Science Society of South Africa			
Physical address:	1a Wolfe Street, Wynberg, Cape Town, 7800			
Postal address:	1a Wolfe Street, Wynberg, Cape Town, 7800			
Postal code:	7800	Cell:	082 927 9018	
Telephone:	082 927 9018	Fax:	Who still uses a fax?	
E-mail:	johann@johannlanz.co.za			

2. DECLARATION BY THE SPECIALIST

I, **Johann Lanz**, declare that –

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the Specialist

Johann Lanz – Soil Scientist (sole proprietor)

Name of Company:

30/10/2019

Date

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, **Johann Lanz**, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

Johann Lanz – Soil Scientist (sole proprietor)

Name of Company

30/10/2019

Date

7225358 CST
M MENDE LA

Signature of the Commissioner of Oaths

2019.10.30.

Date

SUID-AFRIKAANSE POLISIEDIENS
STATION COMMANDER
WYNBERG KP
30 OCT 2019
STATION COMMANDER
WYNBERG CP
SOUTH AFRICAN POLICE SERVICE

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EXECUTIVE SUMMARY

The key findings of this study are:

- The proposed project area is dominated by shallow, red, sands to loamy sands on underlying rock, hard-pan carbonate, or hard-pan dorbank.
- The major limitations to agriculture are the severely limited climatic moisture availability and the shallow, rocky soils.
- As a result of these limitations, the agricultural use of the study area is limited to low intensity grazing only.
- The project site is classified with a predominant land capability evaluation value of 5 (low), although it varies from 4 to 7 across the site.
- The significance of all potential agricultural impacts is kept low by by the fact that the proposed site is on land of extremely limited agricultural potential.
- There are no agriculturally sensitive areas on the site and no parts of the site need to be avoided by the development.
- Three potential negative impacts of the development on agricultural resources and productivity were identified as:
    - Loss of agricultural land use
    - Soil degradation
    - Cumulative, regional loss of agricultural land use.
- One potential positive impact of the development on agricultural resources and productivity was identified as:
    - Increased financial security for farming operations from land rental to energy facility.
- All impacts (positive and negative) were assessed as having **low or very low significance after mitigation.**
- Recommended mitigation measures include implementation of an effective system of storm water run-off control; the maintenance of vegetation cover to mitigate erosion; and topsoil stripping, stockpiling and re-spreading to mitigate loss of topsoil on disturbed areas.
- Due to the low agricultural potential of the site, and the consequent low agricultural impact, there are no restrictions relating to agriculture which preclude authorisation of the proposed development and therefore, from an agricultural impact point of view, the development should be authorised.
- There are no conditions resulting from this assessment that need to be included in the Environmental Authorisation.
- The overall significance of the impact on agriculture for the construction, operation and decommissioning phases is assessed as **low to very low** (with mitigation actions applied effectively).

INTRODUCTION

Scope and objectives

This report presents the Soil and Agricultural Impact Assessment undertaken by Johann Lanz (an independent consultant), appointment by the CSIR, as part of the Basic Assessment (BA) Process for the proposed construction and operation of the Scatec Solar Photovoltaic Facility, Kenhardt PV5, near Kenhardt in the Northern Cape Province (see Figure 1).

The objectives of the study are to identify and assess all potential impacts of the proposed development on agricultural resources including soils and agricultural production potential, and to provide recommended mitigation measures, monitoring requirements, and rehabilitation guidelines for all identified potential impacts.

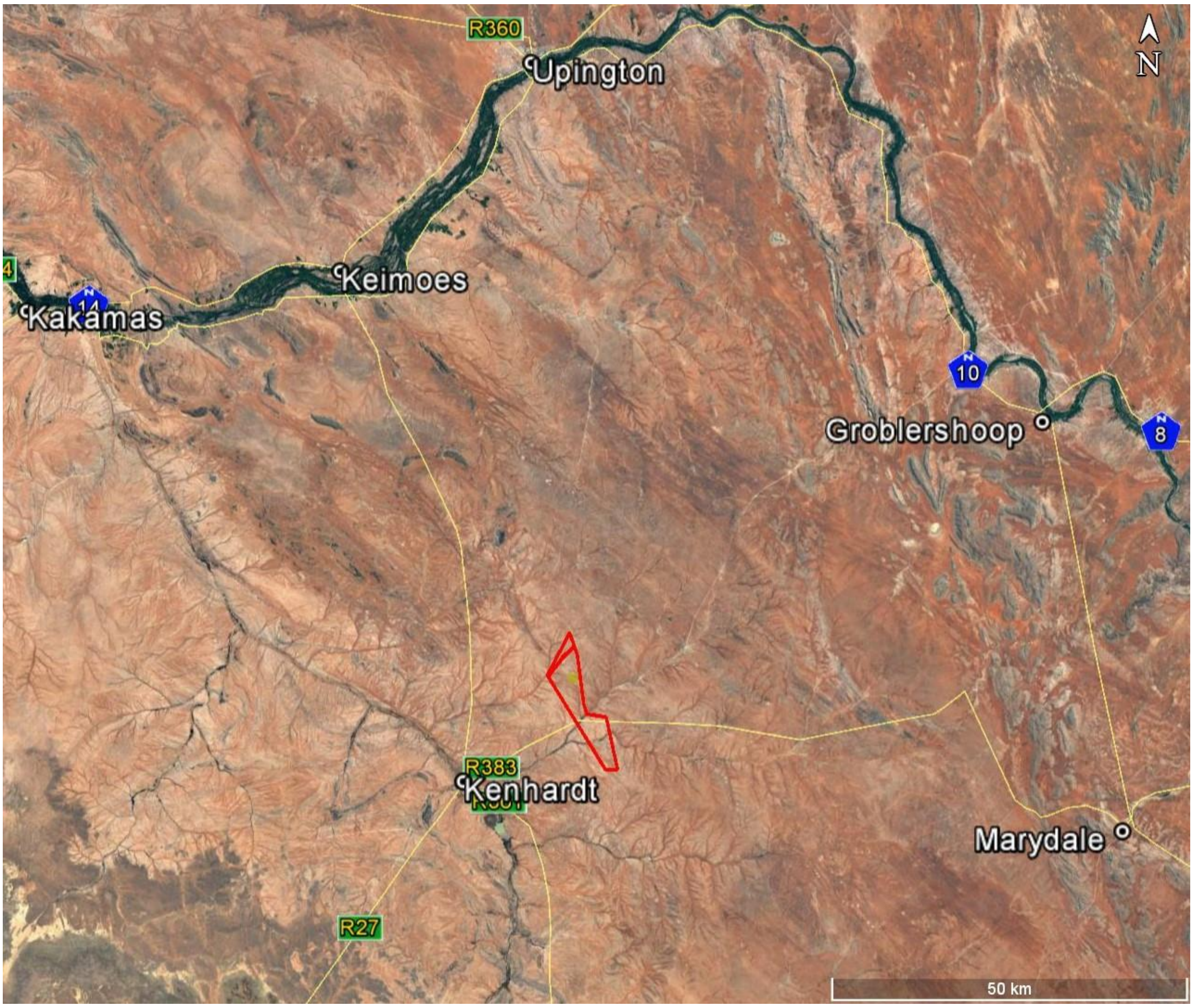

Figure 1: Location of Kenhardt PV5, north east of Kenhardt, showing farm boundary in red.

Terms of Reference

The following terms of reference apply to this study:

- Describe the existing environment in terms of soils, geology, land-use and agricultural potential. Significant soils and agricultural features or disturbances should be identified, as well as sensitive features and receptors within the project area. The description must include surrounding agricultural land uses and activities, to convey the local agricultural context.
- Describe and map soil types (soil forms), soil characteristics (soil depth, soil colour, limiting factors, and clay content of the top and sub soil layers), and degradation and erodibility of soils etc. to the extent necessary to inform this assessment.
- Varying sensitivities of the soils and agricultural potential must be mapped and highlighted.
- The assessment is to be based on existing information, findings of the Wind & Solar PV SEA for the Kenhardt REDZ (CSIR, 2015), and professional experience and field work conducted by the specialist, as considered necessary and in accordance with relevant legislated requirements. The assessment must also consider the maps generated by the National Screening Tool.
- Identify and assess the potential impacts of the proposed development on soils and agriculture, including impacts of associated infrastructure, such as the buildings, fencing etc.
- Identify any protocols, legal and permit requirements relating to soil and agricultural potential impacts that are relevant to this project and the implications thereof.
- Provide recommendations with regards to potential monitoring programmes;
- Determine mitigation and/or management measures which could be implemented to as far as possible reduce the effect of negative impacts and enhance the effect of positive impacts;
- Incorporate and address all issues and concerns raised by I&APs and the public (if applicable).
- Incorporate and address all review comments made by the Project Team (CSIR and Project Applicant).
- Provide review input on the preferred infrastructure layout and routes following the sensitivity analysis.
- Comply with the report templates provided by the CSIR, as well as the 2014 EIA Regulations (as amended), where it relates to specialist assessments.
- Review the Generic EMPr for 1) Power Lines and 2) Substations (GN 435) and confirm if there are any specific environmental sensitivities or attributes present on the site and any resultant site specific impact management outcomes and actions that are not included in

the pre-approved generic EMPr (Part B – Section 1). If so, provide a list of these specific impact management outcomes and actions based on the format of the report template provided by the CSIR.

- Provide sensitivities in KMZ format. Once the layout is finalised, infrastructure maps will be added to the specialist report.

Table Error! Bookmark not defined.**: Compliance with the Appendix 6 of the 2014 EIA Regulations (as Amended)**

Requirements of Appendix 6 – GN R326 EIA Regulations 7 April 2017	**Addressed in the Specialist Report**
1. (1) A specialist report prepared in terms of these Regulations must contain- α) details of- i. the specialist who prepared the report; and ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	 Title page CV following Title page
β) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Following CV
χ) an indication of the scope of, and the purpose for which, the report was prepared;	Section 1
(ca) an indication of the quality and age of base data used for the specialist report;	Section 2.1
(cb) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 5.4
δ) the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	N/A
ε) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 2
φ) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Section 4.7 & Figure 3
γ) an identification of any areas to be avoided, including buffers;	Section 4.7
η) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Figure 3; no agricultural environmental sensitivities identified
ι) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 2.2
φ) a description of the findings and potential implications of such findings on the impact of the proposed activity or activities;	Section 5
κ) any mitigation measures for inclusion in the EMPr;	Section 8
λ) any conditions for inclusion in the environmental authorisation;	Section 9
μ) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 8
ν) a reasoned opinion- i. whether the proposed activity, activities or portions thereof should be authorised; (ja) regarding the acceptability of the proposed activity or activities and ii. if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	 Section 9 Section 8 Section 8
ο) a description of any consultation process that was undertaken during the course of preparing the specialist report;	Not applicable

APPROACH AND METHODOLOGY

The approach for this study is to follow the protocol for the assessment and reporting of environmental impacts on agricultural resources which is linked to the national web-based environmental screening tool. The protocols have not been gazetted yet, but it is considered best practise to follow the assessment protocol because it represents the most recent thinking in this regard.

The tool identifies the majority of the site as low agricultural sensitivity, with only a very limited patch of medium sensitivity, and no higher sensitivity. The protocol therefore requires an Agricultural Compliance Statement.

An Agricultural Compliance Statement must verify that:

1. The site is of “medium” or “low” sensitivity for agricultural resources; and
2. Whether or not the proposed development will have an unacceptable negative impact on the agricultural production capability of the site.

It must contain:

1. Details and relevant expertise as well as the SACNASP registration number of the soil scientist/agricultural specialist preparing the statement including a curriculum vita;
2. A signed statement of independence by the specialist;
3. A map showing the proposed development footprint (including supporting infrastructure) with a 50 m buffered development envelope, overlaid on the agricultural sensitivity map generated by the national environmental screening tool;
4. Calculations of the total development footprint area for each land parcel as well as the total footprint area of the development (including supporting infrastructure);
5. Confirmation as to whether the development footprint is in line with the development limits set in the assessment protocol
6. Confirmation as to whether the sensitivity of the agricultural resource coincides with that indicated on the web-based screening tool;
7. Confirmation from the specialist that all reasonable measures have been taken through micro-siting to minimize fragmentation and disturbance of agricultural activities;
8. A substantiated statement from the agricultural specialist on the acceptability of the development and a recommendation on the approval or not of the development;
9. Any conditions to which the statement is subjected;
10. Where required, proposed impact management outcomes or any monitoring requirements for inclusion in the Environmental Management Programme (EMPr); and
11. A description of the assumptions made and any uncertainties or gaps in knowledge.

Because of the low agricultural sensitivity of the site, the assessment was a desktop analysis of existing soil and agricultural potential data for the site (see sources of information in the following section). This is considered entirely adequate for a thorough assessment of all the agricultural impacts of the proposed development.

A site visit was however made in November 2015 for the assessment of Phase 1of the Scatec PV development. The aim of the site assessment was to ground-truth the land type data and visually asses the erosion risk. It was an overview assessment, which involved driving and walking across the site, assessing topography and surface conditions, investigating existing cuttings in numerous excavations along the railway, and in animal burrows.

The potential impacts identified in this specialist study were assessed based on the criteria and methodology common to the whole impact assessment, outlined in Section D of the BA Report. The ratings of impacts were based on the specialist's knowledge and experience of the field conditions of the environment in which the proposed development is located, and of the impact of disturbances on that agricultural environment.

Sources of information

The following sources of information were used:

1. Soil data was sourced from the land type data set, of the Department of Agriculture, Forestry and Fisheries. This data set originates from the land type survey that was conducted from the 1970's until 2002. It is the most reliable and comprehensive national database of soil information in South Africa and although the data was collected some time ago, it is still entirely relevant as the soil characteristics included in the land type data do not change within time scales of hundreds of years.
2. Land capability data was sourced from the 2017 National land capability evaluation raster data layer produced by the Department of Agriculture, Forestry and Fisheries, Pretoria.
3. Rainfall and temperature data were sourced from The World Bank Climate Change Knowledge Portal.
4. Grazing capacity data was sourced from the 2018 Department of Agriculture, Forestry and Fisheries long-term grazing capacity map for South Africa, available on Cape Farm Mapper.
5. Satellite imagery of the site and surrounds was sourced from Google Earth.
6. The Strategic Environmental Assessment for wind and solar photovoltaic development in South Africa (DEA, 2015) was also consulted in terms of its sensitivity analysis of the area.

Assumptions and Limitations

The following assumptions were used in this specialist study:

- The study assumes that water for irrigation is not available across the site. This is based on the assumption that a long history of farming experience in an area will result in the exploitation of viable water sources if they exist, and none have been exploited in this area.

- Cumulative impacts are assessed by adding expected impacts from this proposed development to existing and proposed developments with similar impacts in a 30 km radius. The existing and proposed developments that were taken into consideration for cumulative impacts are listed in Appendix B.

The following limitation was identified in this study:

- The assessment rating of impacts is not an absolute measure. It is based on the subjective considerations and experience of the specialist, but is done with due regard and as accurately as possible within these constraints.

There are no other specific limitations or knowledge gaps relevant to this study.

DESCRIPTION OF PROJECT ASPECTS RELEVANT TO AGRICULTURAL IMPACTS

The facility will deliver a total capacity of 100MW. It will consist of arrays of photovoltaic panels supported by mounting structures in foundations, inverter stations, offices, operational and maintenance control centre, warehouse/workshop, ablution facilities, guard house, internal access roads, cabling, fencing, an on-site substation with a 132kv connection to the Eskom grid. The total footprint of the energy facility will utilise up to 250 hectares.

For agricultural impacts, the exact nature of the different infrastructure within the facility has very little bearing on the significance of impacts. What is of most relevance is simply the occupation of the land, and whether it is being occupied by a PV panel, a road, a building or a substation makes no difference. What is of most relevance therefore is simply the total footprint of the facility.

BASELINE ASSESSMENT OF THE SOILS AND AGRICULTURAL CAPABILITY

This section is organised in sub headings based on the DEA requirements for an agricultural study.

Climate and water availability

The site has an extremely low average rainfall of 171 mm per annum (The World Bank Climate Change Knowledge Portal, 2015). The average monthly rainfall distribution is shown in Figure 2. The low rainfall is a very significant agricultural constraint that seriously limits the level of agricultural production (including grazing) which is possible. There are no dams across the project area.

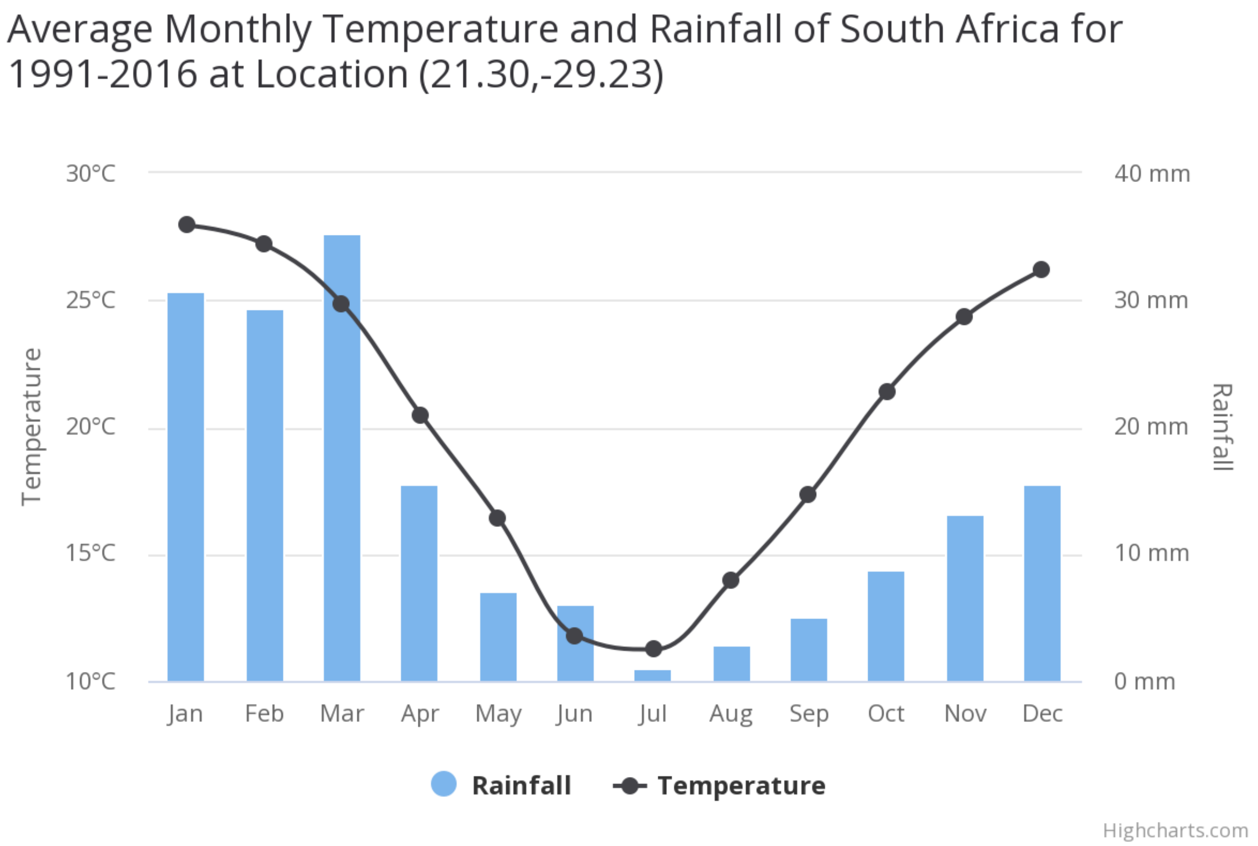

Figure** Error! Bookmark not defined.**: Historical climate data from the site (The World Bank Climate Change Knowledge Portal, undated).

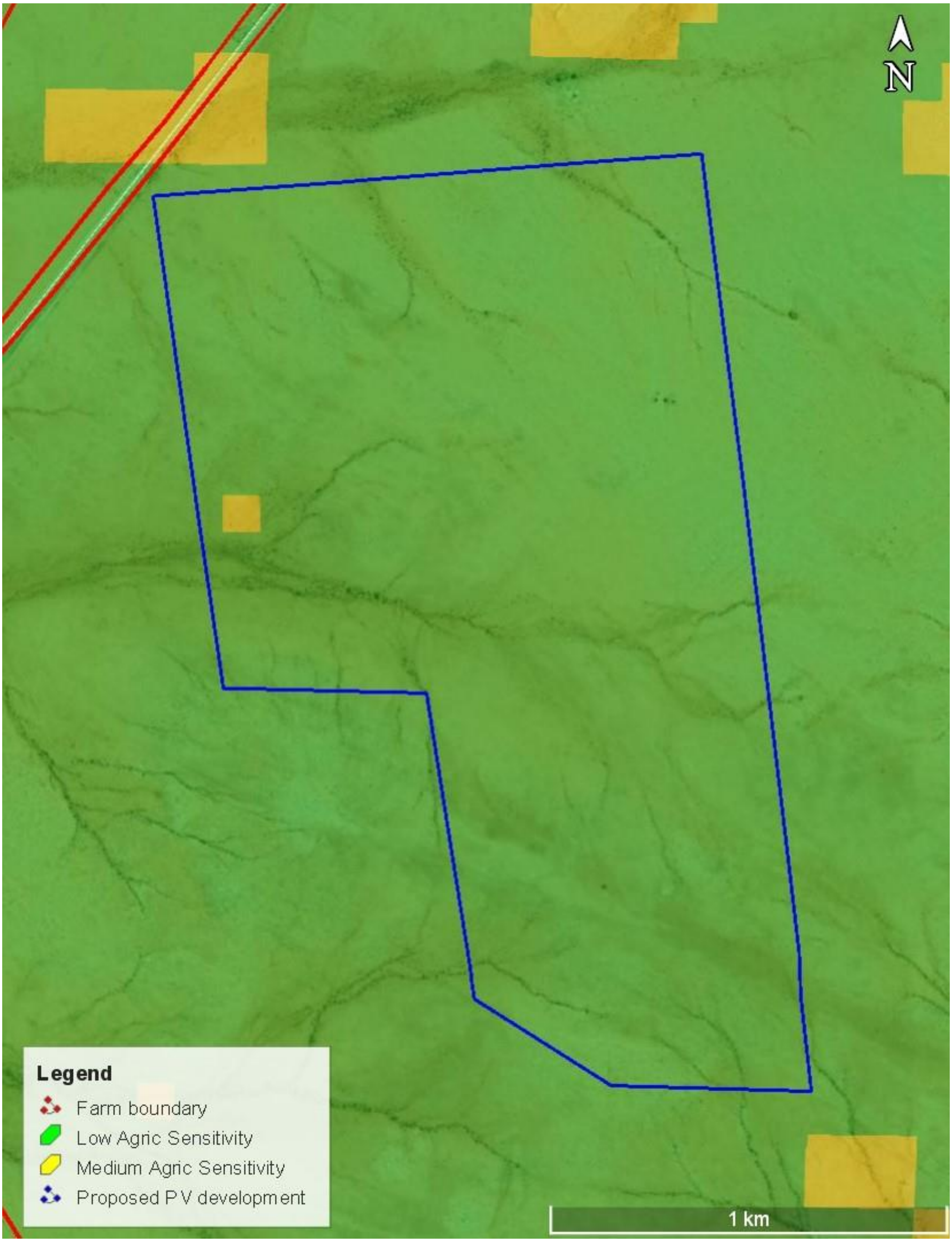

Figure *Error! Bookmark not defined.*___: Sensitivity map of proposed project area.___

Terrain, topography and drainage

The proposed development is located on level plains with some relief in the Northern Cape interior at an altitude of between 900 and 1000 meters. Slopes across the site are almost entirely less than 2%.

There are no perennial drainage courses within the project footprint. There are temporary drainage courses, typical of arid environments, where surface run-off would accumulate and flow, but this would only occur very occasionally, immediately after high rainfall events.

The underlying geology is migmatite, gneiss and granite of the Namaqualand Metamorphic Complex with abundant calcrete.

Soils

The land type classification is a nationwide survey that groups areas of similar soil, terrain and climatic conditions into different land types. The proposed development is located on two land types, Ag6 in the north and the very similar Ag2 in the south. These land types comprise predominantly shallow, red, sands to loamy sands on underlying rock, hard-pan carbonate, or hard-pan dorbank. The soils fall into the arid Silicic, Calcic, and Lithic soil groups according to the classification of Fey (2010). A summary detailing soil data for the land types is provided in Appendix 1. The previous field investigation confirmed that the soils on site are shallow, red sandy soils on underlying rock and hard-pan carbonate. Actual soil forms vary within short distances depending on rock ridges that run across the area and the extent of calcrete formation. There are numerous outcrops of rocky ridges at the soil surface across the entire area. All investigated sample points across the area were one of four soil forms: Coega, Mispah, Plooysberg or Hutton. However there is very little practical difference between these different soil forms. All have a clay content of approximately 7%, are shallow and are underlain by a hard impenetrable layer (either rock or hard-pan carbonate).

The land has low to moderate water erosion hazard, mainly due to the low slope, but is susceptible to wind erosion because of the sandy texture of the soil.

Agricultural capability

Land capability is defined as the combination of soil, climate and terrain suitability factors for supporting rainfed agricultural production. It is an indication of what level and type of agricultural production can sustainably be achieved on any land. The higher land capability classes are suitable as arable land for the production of cultivated crops, while the lower suitability classes are only suitable as non-arable grazing land, or at the lowest extreme, not even suitable for grazing. In 2017 DAFF released updated and refined land capability mapping across the whole of South Africa. This has greatly improved the accuracy of the land capability rating for any particular piece of land anywhere in the country. The new land capability mapping divides land capability into 15 different categories with 1 being the lowest and 15 being the highest. Values of below 8 are generally not suitable for production of cultivated crops. Detail of this land capability scale is shown in Table 2.

The project area is classified with a predominant land capability evaluation value of 5, although it varies from 4 to 7 across the site. Agricultural limitations that result in the low land capability classification are predominantly due to the very limited climatic moisture availability, with shallow soils as an additional factor. These factors render the site unsuitable for any kind of cultivation and limit it to low density grazing only.

The long-term grazing capacity of the site is low at 32 hectares per large stock unit.

Table Error! Bookmark not defined.**: Details of the 2017 Land Capability classification for South Africa.**

Land capability evaluation value	Description
1 2	Very Low
3 4	Very Low to Low
5	Low
6 7	Low to Moderate
8	Moderate
9 10	Moderate to High
11	High
12 13	High to Very High
14 15	Very High

Land use and development on and surrounding the site

The farm is located within a sheep farming agricultural region and land use for the farm and surrounding area is sheep farming only. There is no cultivation or any history of cultivation on the farm. The Sishen-Saldanha railway line with its associated infrastructure runs through the farm to the north of the PV site. Apart from fences, there is no agricultural infrastructure on the site. There are no buildings on the site.

Possible land use options for the site

Due to the climate and soil limitations, the land is considered unsuitable for any agricultural purposes other than low intensity grazing.

The site is within on of South Africa's eight proposed renewable energy development zones, and has therefore been identified as one of the most suitable areas in the country for renewable energy development, in terms of a number of environmental impact, economic and infrastructural factors. These factors include an assessment of the significance of the loss of agricultural land. Renewable energy development is therefore a very suitable land use option for the site.

Agricultural sensitivity

Agricultural sensitivity is a direct function of the capability of the land for agricultural production. This is because a negative impact on land of higher agricultural capability is more detrimental to agriculture than the same impact on land of low agricultural capability. A general assessment of agricultural sensitivity, in terms of loss of agricultural land in South Africa, considers arable land that can support viable production of cultivated crops, to have high sensitivity. This is because there is a scarcity of such land in South Africa, in terms of how much is required for food security. However, there is not a scarcity in the country of land that is only suitable as grazing land and such land is therefore not considered to have high agricultural sensitivity.

The national web-based environmental screening tool identifies the majority of the site as low agricultural sensitivity, with only a very limited patch of medium sensitivity, and with no higher sensitivity than medium.

Agricultural potential and conditions are very uniform across the site, and the choice of placement of facility infrastructure, including access roads and transmission lines therefore has negligible influence on the significance of agricultural impacts.

No agricultural high sensitivity areas occur within the investigated site and no parts of it therefore need to be avoided by the development. There are no required buffers.

ISSUES, RISKS AND IMPACTS

The potential impacts identified during the assessment are:

Construction phase

- Loss of agricultural land use;
- Soil degradation.

Operational phase

- Increased financial security for farming operations.

Decommissioning phase

- Soil degradation.

Cumulative impact

- Regional loss of agricultural land.

IMPACT ASSESSMENT

The focus and defining question of an agricultural impact assessment is to determine to what extent a proposed development will compromise (negative impacts) or enhance (positive impacts) current and/or future agricultural production. The significance of an impact is therefore a direct function of the degree to which that impact will affect current or future agricultural production. If there will be no impact on production, then there is no agricultural impact. Impacts that degrade the agricultural resource base pose a threat to production and therefore are within the scope of an agricultural impact assessment. Lifestyle impacts on the resident farming community, for example visual impacts, do not necessarily impact agricultural production and, if they do not, are not relevant to and within the scope of an agricultural impact assessment. Such impacts are better addressed within the impact assessments of other disciplines included in the EIA process.

For agricultural impacts, the exact nature of the different infrastructure within the facility has very little bearing on the significance of impacts. What is of most relevance is simply the occupation of the land, and whether it is being occupied by a PV panel, a road, a building or a substation makes no difference. What is of most relevance therefore is simply the total footprint of the facility.

The components of the project that can impact on soils, agricultural resources and productivity are:

- Occupation of the land by the total, direct, physical footprint of the proposed project including all roads.
- Construction (and decommissioning) activities that may disturb the soil profile and vegetation, for example for levelling, excavations, etc.

The significance of all potential agricultural impacts is kept low by by the fact that the proposed site is on land of extremely limited agricultural potential that is only viable for low intensity grazing.

The following potential agricultural impacts have been identified.

Construction phase

Loss of agricultural land use

Aspect / Activity	Occupation of the land by the project infrastructure
Type of impact	Direct
Potential Impact	Agricultural grazing land directly occupied by the development infrastructure, which includes all associated infrastructure, will become unavailable for agricultural use.
Status	Negative
Mitigation Required	None possible
Impact Significance (Pre-mitigation)	Low
Impact Significance (Post-Mitigation)	Not applicable because there is no possible mitigation
I&AP Concern	No

Soil degradation

Aspect / Activity	Construction related soil disturbance and changes to the land surface and run-off characteristics.
Type of impact	Direct

Potential Impact	Soil degradation can result from erosion, topsoil loss and contamination. Erosion can occur as a result of the alteration of the land surface run-off characteristics, which can be caused by construction related land surface disturbance, vegetation removal, and the establishment of hard surface areas including roads. Loss of topsoil can result from poor topsoil management during construction related excavations. Hydrocarbon spillages from construction activities can contaminate soil. Soil degradation will reduce the ability of the soil to support vegetation growth.
Status	Negative
Mitigation Required	Soil degradation can be effectively managed through mitigation measures. Implement an effective system of storm water run-off control. Maintain, where possible, all vegetation cover and facilitate re-vegetation of denuded areas throughout the site, to stabilize the soil against erosion. For below surface disturbances such as excavations, strip, stockpile and re-spread topsoil during rehabilitation.
Impact Significance (Pre-mitigation)	Low
Impact Significance (Post-Mitigation)	Low
I&AP Concern	No

Operational phase

Increased financial security for farming operations

Aspect / Activity	Payment of rental by the energy facility
Type of impact	Indirect
Potential Impact	Reliable income will be generated by the farming enterprises through the lease of the land to the energy facility. This is likely to increase their cash flow and financial security and thereby can improve farming operations.
Status	Positive
Mitigation	None

Required	
Impact Significance (Pre-mitigation)	Low
Impact Significance (Post-Mitigation)	Not applicable because there is no possible mitigation
I&AP Concern	No

Decommissioning phase

Soil degradation

Aspect / Activity	Decommissioning related soil disturbance.
Type of impact	Direct
Potential Impact	Soil degradation can result from erosion, topsoil loss and contamination. Erosion can occur as a result of the alteration of the land surface run-off characteristics, which can be caused by decommissioning related land surface disturbance and vegetation removal. Loss of topsoil can result from poor topsoil management during decommissioning related excavations. Hydrocarbon spillages from decommissioning activities can contaminate soil. Soil degradation will reduce the ability of the soil to support vegetation growth.
Status	Negative
Mitigation Required	Soil degradation can be effectively managed through mitigation measures. Maintain, where possible, all vegetation cover and facilitate re-vegetation of denuded areas throughout the site, to stabilize the soil against erosion. For below surface disturbances such as excavations, strip, stockpile and re-spread topsoil during rehabilitation.
Impact Significance (Pre-mitigation)	Low
Impact Significance (Post-Mitigation)	Low
I&AP Concern	No

Cumulative impacts

The cumulative impact of a development is the impact that development will have when its impact is considered together with the incremental impacts of other past, present or reasonably foreseeable future activities that will affect the same environment. The most important concept related to a cumulative impact is that of an acceptable level of change to an environment. A cumulative impact only becomes relevant when the impact of the proposed development will lead directly to the sum of impacts of all developments causing an acceptable level of change to be exceeded in the surrounding area. If the impact of the development being assessed does not cause that level to be exceeded, then the cumulative impact associated with that development is not significant.

The potential cumulative agricultural impact of importance is a regional loss or degradation of agricultural land. The defining question for assessing the cumulative agricultural impact is this:

> What level of loss of agricultural land is acceptable in the area, and will the loss associated with the Kenhardt PV5 facility, cause that level in the area to be exceeded?

DEA requires compliance with a specified methodology for the assessment of cumulative impacts. This is positive in that it ensures engagement with the important issue of cumulative impacts. However, the required compliance has some limitations and can, in my opinion, result in an over-focus on methodological compliance, while missing the more important task of effectively answering the above defining question.

The formal assessment of the cumulative impact of the Kenhardt PV5 facility has been assessed by consideration of other renewable energy projects located within a 30 km radius of the Kenhardt PV5 facility that had already received Environmental Authorisation (EA) at the start of this BA process on 15 November 2018.

Six PV developments have been identified within a radius of 30 km from the proposed Kenhardt PV5 facility. Details on these projects are provided in Appendix 2. All of these developments have very similar impacts within a very similar agricultural environment, within the same Renewable Energy Development Zone (REDZ).

All of these projects have the same agricultural impacts in an almost identical agricultural environment, and therefore the same mitigation measures apply to all. The cumulative impact is affecting an agricultural environment that has been declared a REDZ precisely because it is an environment that can accommodate numerous renewable energy developments without exceeding acceptable levels of agricultural land loss. This is primarily because of the low agricultural capability of land across the REDZ, and the fact that such land is not a scarce resource in South Africa.

In quantifying the cumulative impact, the area of land taken out of agricultural grazing as a result of all of the projects above will amount to a total of approximately 1,438 hectares. This is calculated using the industry standard of 2.5 hectares per megawatt for solar energy generation, as per DEA (2015). The 6 developments plus Kenhardt PV5 amount to a generation capacity of 575 megawatts. As a proportion of the area within a 30km radius (approximately 283,000 ha), this amounts to only 0.51% of the surface area. That is well within an acceptable limit in terms of loss of low potential agricultural land, of which there is no scarcity in the country. This is particularly so when considered within the context of the following two points:

- In order for South Africa to achieve its renewable energy generation goals, agriculturally zoned land will need to be used for renewable energy generation. It is far more preferable to incur a cumulative loss of agricultural land in a region such as the one being assessed, which has no cultivation potential, and low grazing capacity, than to lose agricultural land that has a higher potential, and that is much scarcer, to renewable energy development elsewhere in the country. The limits of acceptable agricultural land loss are therefore far higher in this region than in regions with higher agricultural potential.
- It is also preferable, from an impact point of view as well as from practical considerations, to rather have a concentrated node of renewable energy development within one area, as is the case around this project, than to spread out the same number of developments over a larger area. Therefore, if the cumulative impact is considered only for the node, it leads to a false impression of the magnitude of that impact because of the concentrated development within the node, and the absence of development surrounding it. When averaged over a greater area, the magnitude becomes much less.

Acceptable levels of change in terms of other areas of impact such as visual impact would be exceeded long before agricultural levels of change came anywhere near to being exceeded.

It should also be noted that there are few land uses, other than renewable energy, that are competing for agricultural land use in this area. The cumulative impact from developments, other than renewable energy, is therefore likely to be low.

Due to all of the considerations discussed above, the cumulative impact of loss of agricultural land use is assessed as having low significance. In terms of cumulative impact, therefore, the development can be authorised.

The cumulative impact is described in table format below.

Aspect / Activity	Occupation of and impact to the land by the project infrastructure of multiple developments	
Type of impact	Direct	
Potential Impact	Regional loss of agricultural land use	
Status	Negative	
Mitigation Required	There is no additional mitigation required for cumulative impacts, other than what has already been recommended for the project above.	
Impact Significance (Pre-mitigation)	Very low	
Impact Significance (Post-Mitigation)	Very low	
I&AP Concern		No

Assessment of the no-go alternative

The no-go alternative considers impacts that will occur to the agricultural environment in the absence of the proposed development. The one identified potential such impact is that due to continued low rainfall in the area, in addition to other economic and market pressures on farming, the agricultural enterprises will come under increased pressure in terms of economic viability.

The development has both positive and negative agricultural impacts.

The agricultural advantages and disadvantages associated with both the development and the no-go alternative – that is the extent to which the development and the no-go alternative will impact agricultural production - are more or less equal which results in their being, from an agricultural impact perspective, no preferred alternative between the development and the no-go.

IMPACT ASSESSMENT TABLES

The assessment of impacts and recommendation of mitigation measures as discussed above are collated in Table 3 below.

Table **Error! Bookmark not defined.**: Impact assessment summary table

Aspect/ Impact pathway	Nature of potential impact/risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk
										Without mitigation /management	With mitigation /management (residual risk /impact)	
CONSTRUCTION PHASE												

Occupation of the land by the project infrastructure	Loss of agricultural land use	Negative	Site	Long-term	Moderate	Very likely	High	Replaceable	None	Low	Low	4	Medium
Construction related soil and land disturbance	Soil degradation	Negative	Site	Medium-term	Moderate	Unlikely	High	Replaceable	storm water run-off control; Maintain vegetation cover; strip, stockpile and re-spread topsoil.	Low	Low	4	Medium
OPERATIONAL PHASE													
Payment of rental by the energy facility	Increased financial security for farming operations	Positive	Local	Long-term	Moderate	Unlikely	High	Replaceable	None	Low	Low	4	Medium
DECOMMISSIONING PHASE													
Decommissioning related soil and land disturbance	Soil degradation	Negative	Site	Medium-term	Moderate	Unlikely	High	Replaceable	Maintain vegetation cover; strip, stockpile and re-spread topsoil.	Low	Low	4	Medium
CUMULATIVE IMPACTS													
Occupation of and impact to the land by the project	Regional loss of agricultural land use	Negative	Regional	Long-term	Slight	Likely	High	Replaceable	None	Very low	Very low	5	Medium

infrastructure of multiple developments													

Impact assessment summary

Table **Error! Bookmark not defined.**: Overall Impact Significance

Phase	**Overall Impact Significance**
Construction	Low
Operational	Low
Decommissioning	Low
Nature of Impact	**Overall Impact Significance**
Cumulative - Construction	Very low
Cumulative - Operational	Very low
Cumulative - Decommissioning	Very low

LEGISLATIVE AND PERMIT REQUIREMENTS

The Subdivision of Agricultural Land Act (Act 70 of 1970) (SALA), requires that an application for a wind farm on agriculturally zoned land be approved by the Department of Agriculture, Forestry and Fisheries (DAFF). Despite the name of the Act, it does not apply only to subdivision, and its purpose is to ensure productive use of agriculturally zoned land. Therefore, even if land is not being subdivided or leased, SALA approval is required to develop agriculturally zoned land for non-agricultural purposes.

Power lines require the registration of a servitude for each farm portion crossed. In terms of the Subdivision of Agricultural Land Act (Act 70 of 1970) (SALA), the registration of a power line servitude requires written consent of the Minister if the following two conditions apply:

1. if the servitude width exceeds 15 metres; and
2. if Eskom is not the applicant for the servitude.

If one or both of these conditions do not apply, then no agricultural consent is required. Eskom is currently exempt from agricultural consent for power line servitudes.

The Act 70 of 1970 consent is separate from the EIA and needs to be applied for and obtained after the EIA.

Rehabilitation after disturbance to agricultural land is managed by the Conservation of Agricultural Resources Act (Act 43 of 1983) (CARA). No application is required in terms of CARA. The EIA process covers the required aspects of this.

ENVIRONMENTAL MANAGEMENT PROGRAMME INPUTS

The environmental management programme inputs for the protection of soil resources are presented in the tables below for each phase of the development.

Table Error! Bookmark not defined.**: Management plan for the planning and design phase**

Impact	**Mitigation / management objectives and outcomes**	**Mitigation / management actions**	**Monitoring**		
			Methodology	**Frequency**	**Responsibility**
Aspect: Protection of soil resources					
Erosion	That land disturbance and existence of hard surfaces causes no erosion on or downstream of the site.	Design an effective system of storm water run-off control, where it is required - that is at any points where run-off water might accumulate. The system must effectively collect and safely disseminate any run-off water from all hardened surfaces and it must prevent any potential down slope erosion.	Ensure that the storm water run-off control is included in the engineering design.	Once-off during the design phase.	Holder of the EA

Table Error! Bookmark not defined.**: Management plan for the construction phase**

Impact	**Mitigation / management objectives and outcomes**	**Mitigation / management actions**	**Monitoring**		
			Methodology	**Frequency**	**Responsibility**
Aspect: Protection of soil resources					
Erosion	That land disturbance and existence of hard surfaces causes no erosion on or downstream of the	Implement an effective system of storm water run-off control, where it is required - that is at any points where	Undertake a periodic site inspection to verify and inspect the effectiveness and integrity of the	Monthly	Environmental Control Officer (ECO)

	site.	run-off water might accumulate. The system must effectively collect and safely disseminate any run-off water from all hardened surfaces and it must prevent any potential down slope erosion.	storm water run-off control system and to specifically record the occurrence of any erosion on site or downstream. Corrective action must be implemented to the run-off control system in the event of any erosion occurring.		
Erosion	That vegetation clearing does not pose a high erosion risk.	Maintain where possible all vegetation cover and facilitate re-vegetation of denuded areas throughout the site, to stabilize disturbed soil against erosion.	Undertake a periodic site inspection to record the occurrence of and re-vegetation progress of all areas that require re-vegetation.	Every 3 months	Environmental Control Officer (ECO)
Topsoil loss	That no topsoil is lost	If an activity will mechanically disturb the soil below surface in any way, then any available topsoil should first be stripped from the entire surface to be disturbed and stockpiled for re-spreading during rehabilitation. During rehabilitation, the stockpiled topsoil must be evenly spread over the entire disturbed surface.	Record GPS positions of all occurrences of below-surface soil disturbance (eg excavations). Record date of topsoil stripping and replacement. Check that topsoil covers entire disturbed area.	As required, whenever areas are disturbed.	Environmental Control Officer (ECO)

Table Error! Bookmark not defined.**: Management plan for the operational phase**

Impact	Mitigation / management objectives and outcomes	Mitigation / management actions	Monitoring		
			Methodology	**Frequency**	**Responsibility**

Aspect: Protection of soil resources					
Erosion	That existence of hard surfaces causes no erosion on or downstream of the site.	Maintain the storm water run-off control system. Monitor erosion and remedy the storm water control system in the event of any erosion occurring.	Undertake a periodic site inspection to verify and inspect the effectiveness and integrity of the storm water run-off control system and to specifically record the occurrence of any erosion on site or downstream. Corrective action must be implemented to the run-off control system in the event of any erosion occurring.	Bi-annually	Facility Environmental Manager
Ersoion	That denuded areas are re-vegetated to stabilise soil against erosion	Facilitate re-vegetation of denuded areas throughout the site	Undertake a periodic site inspection to record the progress of all areas that require re-vegetation.	Bi-annually	Facility Environmental Manager

Table Error! Bookmark not defined.**: Management plan for the decommissioning phase**

Impact	Mitigation / management objectives and outcomes	Mitigation / management actions	Monitoring		
			Methodology	Frequency	Responsibility
Aspect: Protection of soil resources					
Erosion	That disturbance and existence of hard surfaces causes no erosion on or downstream of the site.	Maintain the storm water run-off control system. Monitor erosion and remedy the storm water control system in the event of any erosion occurring.	Undertake a periodic site inspection to verify and inspect the effectiveness and integrity of the storm water run-off control system and to specifically record the occurrence of any erosion on site or downstream.	Monthly	Environmental Control Officer (ECO)

			Corrective action must be implemented to the run-off control system in the event of any erosion occurring.		
Erosion	That vegetation clearing does not pose a high erosion risk.	Maintain where possible all vegetation cover and facilitate re-vegetation of denuded areas throughout the site, to stabilize disturbed soil against erosion.	Undertake a periodic site inspection to record the occurrence of and re-vegetation progress of all areas that require re-vegetation.	Every 3 months	Environmental Control Officer (ECO)
Topsoil loss	That no topsoil is lost	If an activity will mechanically disturb the soil below surface in any way, then any available topsoil should first be stripped from the entire surface to be disturbed and stockpiled for re-spreading during rehabilitation. During rehabilitation, the stockpiled topsoil must be evenly spread over the entire disturbed surface.	Record GPS positions of all occurrences of below-surface soil disturbance (eg excavations). Record date of topsoil stripping and replacement. Check that topsoil covers entire disturbed area.	As required, whenever areas are disturbed.	Environmental Control Officer (ECO)

CONCLUSIONS

South Africa has very limited arable land and it is therefore critical to ensure that development does not lead to an inappropriate loss of potentially arable land. The assessment has found that the proposed development will only impact agricultural land which is of extremely low agricultural potential and only suitable for low intensity grazing.

All agricultural impacts of the proposed development are assessed as being of low or very low significance. This is because of the limited agricultural potential of the proposed development site, which is a function of the climate, terrain and shallow soils. The fact that the footprint of disturbance of the wind farm is limited to a very small proportion of the surface area also limits the agricultural impact. The study area has low agricultural sensitivity because of its low potential and no parts of the site need to be avoided by the proposed development. No buffers are required.

FINAL SPECIALIST STATEMENT AND AUTHORISATION RECOMMENDATION

Due to the low agricultural potential of the site, and the consequent low agricultural impact, there are no restrictions relating to agriculture which preclude authorisation of the proposed development and therefore, from an agricultural impact point of view, the development should be authorised.

EA Condition Recommendations

There are no conditions resulting from this assessment, other than the recommended mitigation measures, that need to be included in the Environmental Authorisation.

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Fey, M. 2010. Soils of South Africa. Cambridge University Press, Cape Town.

Soil Classification Working Group. 1991. Soil classification: a taxonomic system for South Africa. Soil and Irrigation Research Institute, Department of Agricultural Development, Pretoria.

The World Bank Climate Change Knowledge Portal available at https://climateknowledgeportal.worldbank.org/country/south-africa/climate-data-historical

APPENDIX 1: SOIL DATA

Table Error! Bookmark not defined.**: Land type soil data for the site.**

Land type	**Soil series (forms)**	**Depth (mm)**			**Clay % A horizon**			**Clay % B horizon**			**Depth limiting layer**	
Fc269	Rock outcrop											36.6
	Glenrosa	100	-	150	6	-	15	10	-	20	so	27.8
	Mispah	50	-	100	6	-	15				R	23.4
	Oakleaf	300	>	1200	5	-	10	10	-	30	R,U,ca	6.2
	Valsrivier	100	-	200	5	-	15	35	-	55	vr,vp	3.6
	Hutton	50	-	250	0	-	5	5	-	25	R,so	0.9
	Swartland	100	-	150	6	-	15	35	-	55	vr,R	0.9
	Clovelly	300	>	1200	0	-	5	0	-	5	R	0.7
	Dundee	300	-	1200	0	-	5				R,U,ca	0.1

Depth limiting layers: R = hard rock; so = partially weathered bedrock; ca = soft carbonate; vp = dense, structured clay layer; vr = dense, red, structured clay layer; U = alluvium.

APPENDIX 2: RENEWABLE ENERGY PROJECTS CNOSIDERED FOR CUMULATIVE IMPACTS

DEFF REF NO	PROJECT TITLE	DATE APPLICATION RECIEVED	APPLICANT	EAP	LOCAL MUNICIPALITY	TECHNOLOGY	MW	EA STATUS
14/12/16/3/3/2/1072	THE 75 MW AMDA CHARLIE PV SEF NORTH OF KENHARDT WITHIN THE KAI !GARIB LM IN THE NORTHERN CAPE PROVINCE	2018/09/12	AMDA Charlie (Pty) Ltd	Cape Environmental Assessment Practitioners (Pty) Ltd	Kai !Garib Local Municipality	Solar PV	75	Approved
14/12/16/3/3/2/1073	THE 75 MW AMDA Alpha PV SEF NORTH OF KENHARDT WITHIN THE KAI !GARIB LM IN THE NORTHERN CAPE PROVINCE	2018/09/11	AMDA Charlie (Pty) Ltd	Cape Environmental Assessment Practitioners (Pty) Ltd	!Kheis Local Municipality	Solar PV	75	Approved
14/12/16/3/3/2/847	75mw Solar Photovoltaic Facility (Boven 4) on the remaining extent of Boven Rugzeer Farm 169, North East of Kenhradt in the Northern Cape Province	2015/10/18	Boven Solar PV4 (Pty) Ltd	CSIR	!Kheis Local Municipality	Solar PV	75	Approved
14/12/16/3/3/2/842	75MW solar energy facility (Gemsbok PV4) on Protion 3 of Gemsbok Bult farm 120 near Kenhardt within the Kheis Local Municipality in the Northern cape province	2015/10/28	Gemsbok Solar PV3 (Pty) Ltd	CSIR	!Kheis Local Municipality	Solar PV	75	Approved
14/12/16/3/3/2/843	75MW solar energy facility (Gemsbok PV5) on Protion 8 of Gemsbok Bult farm 120 near Kenhardt within the Kheis Local Municipality in the Northern cape province	2015/10/28	Gemsbok Solar PV3 (Pty) Ltd	CSIR	!Kheis Local Municipality	Solar PV	75	Approved
14/12/16/3/3/2/1035	The 100MW Skeerhok 3 PV SEF north-east of Kenhardt within the Kheis Local Municipality, Northern Cape Province	2017/09/19	Juwi Renewable Energies (Pty) Ltd	Juwi Renewable Energies (Pty) Ltd	!Kheis Local Municipality	Solar PV	100	Approved

HERITAGE IMPACT ASSESSMENT:

Basic Assessments for the proposed construction of the Kenhardt PV5 Solar Photovoltaic Facility and associated electrical infrastructure, near Kenhardt, Northern Cape.

SAHRA Case No.: TBC

Required under Section 38 (8) of the National Heritage Resources Act (No. 25 of 1999).

Report for:

CSIR – Environmental Management Services
P.O. Box 320, Stellenbosch, 7599
Tel: 021 888 2432
Email: kstroebel@csir.co.za

On behalf of:

Scatec Africa Solar (Pty) Ltd

Dr Jayson Orton
ASHA Consulting (Pty) Ltd
40 Brassie Street, Lakeside, 7945
Tel: (021) 788 1025 | 083 272 3225
Email: jayson@asha-consulting.co.za

07 December 2019

Specialist Declaration

I, Jayson Orton, as the appointed independent specialist, in terms of the 2014 EIA Regulations (as amended), hereby declare that:

- I act as the independent specialist in this application;
- I 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;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct, and do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 (as amended) and any specific environmental management Act;
- 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 have no vested interest in the proposed activity proceeding;
- 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;
- I have ensured that information containing all relevant facts in respect of the specialist input/study was distributed or made available to interested and affected parties and the public and that participation by interested and affected parties was facilitated in such a manner that all interested and affected parties were provided with a reasonable opportunity to participate and to provide comments on the specialist input/study;
- I have ensured that the comments of all interested and affected parties on the specialist input/study were considered, recorded and submitted to the competent authority in respect of the application;
- all the particulars furnished by me in this specialist input/study are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Name of Specialist: __Dr Jayson Orton_____________________

Signature of the specialist: ________________________________

Date: _________6 December 2019________________________

EXECUTIVE SUMMARY

ASHA Consulting (Pty) Ltd was appointed by Scatec Africa Solar (Pty) Ltd to conduct an assessment of the potential impacts to heritage resources that might occur through the proposed development of the Kenhardt PV5 solar energy facility on the farm Onder Rugzeer 168/RE and an associated powerline linking the facility to the existing Nieuwehoop Substation on Gemsbokbult 120/3. The line would cross Boven Rugzeer 169/RE in between the above two properties. The PV site is located 20 km northeast of Kenhardt in the Kenhardt Magisterial District and is centred on S29° 12’ 50” E21° 17’ 45”. The site is within the Upington Renewable Energy Development Zone.

Because the proposed development lies on a site already surveyed by the author in 2015, no new site visit was undertaken. The site is generally flat with minimal vegetation cover. What little there is tends to be focused along water courses. The broader study area features sandy/silty areas, small pans, water courses, gravel areas and quartz outcrops. The Sishen-Saldanha Railway passes through the powerline corridor and the existing Nieuwehoop Substation lies at the north-eastern end of the corridor.

Although isolated archaeological artefacts occur widely on the landscape, significant sites were found to be rare. Because they were already known prior to commencement of the project, the layout has already avoided these resources. The specialist palaeontological study finds that the study area is of generally low sensitivity and significant impacts are not expected. The landscape is also considered a heritage resource but because of the very remote location, the existing infrastructure and the height of the built elements of the project, significant impacts to the landscape are not expected. All impacts are expected to be of **low (negative)** significance before mitigation and **very low (negative)** afterwards.

It is recommended that the proposed Kenhardt PV5 facility and its associated powerline should be authorised but subject to the following conditions which should be incorporated into the Environmental Authorisation:

- It the pan close to Nieuwehoop Substation is to be disturbed then it should be checked for archaeological materials and a decision made as to whether mitigation is required; and
- A pre-construction survey focusing on the well-defined water courses should be carried out to check for further significant stone artefacts scatters; and
- If any palaeontological or archaeological material or human burials are uncovered during the course of development then work in the immediate area should be halted. The find would need to be reported to the heritage authorities and may require inspection by an archaeologist. Such heritage is the property of the state and may require excavation and curation in an approved institution.

Glossary

Background scatter: Artefacts whose spatial position is conditioned more by natural forces than by human agency

Early Stone Age: Period of the Stone Age extending approximately between 2 million and 200 000 years ago.

Handaxe: A bifacially flaked, pointed stone tool type typical of the Early Stone Age.

Holocene: The geological period spanning the last approximately 10-12 000 years.

Hominid: a group consisting of all modern and extinct great apes (i.e. gorillas, chimpanzees, orangutans and humans) and their ancestors.

Later Stone Age: Period of the Stone Age extending over the last approximately 20 000 years.

Middle Stone Age: Period of the Stone Age extending approximately between 200 000 and 20 000 years ago.

Pleistocene: The geological period beginning approximately 2.5 million years ago and preceding the Holocene.

Abbreviations

APHP: Association of Professional Heritage Practitioners

ASAPA: Association of Southern African Professional Archaeologists

BA: Basic Assessment

CSIR: Council for Scientific and Industrial Research

CRM: Cultural Resources Management

ECO: Environmental Control Officer

EIA: Environmental Impact Assessment

ESA: Early Stone Age

GPS: global positioning system

GP: General Protection

HIA: Heritage Impact Assessment

LSA: Later Stone Age

MSA: Middle Stone Age

NBKB: Ngwao-Boswa Ya Kapa Bokoni

NEMA: National Environmental Management Act (No. 107 of 1998)

NHRA: National Heritage Resources Act (No. 25) of 1999

PPP: Public Participation Process

PV: Photovoltaic

REDZ: Renewable Energy Development Zone

SAHRA: South African Heritage Resources Agency

SAHRIS: South African Heritage Resources Information System

Compliance with Appendix 6 of the 2014 EIA Regulations

Requirements of Appendix 6 – GN R326 (7 April 2017)	**Addressed in the Specialist Report**
1. (1) A specialist report prepared in terms of these Regulations must contain- a) details of- i. the specialist who prepared the report; and ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	Section 1.4 and Appendix 1
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Page ii (Preliminary Section of this report)
c) an indication of the scope of, and the purpose for which, the report was prepared;	Section 1.3
(cA) an indication of the quality and age of base data used for the specialist report;	Section 3
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Sections 7.1.3, 7.3 and 7.4
d) the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 3.2
e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 3
f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying alternatives;	Sections 1.1.2 and 1.1.3
g) an identification of any areas to be avoided, including buffers;	Section 5.7
h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Section 5.7
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 3.5
j) a description of the findings and potential implications of such findings on the impact of the proposed activity or activities;	Section 5
k) any mitigation measures for inclusion in the EMPr;	Sections 7 and 9
l) any conditions for inclusion in the environmental authorisation;	Section 12
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 9
n) a reasoned opinion- i. whether the proposed activity, activities or portions thereof should be authorised; (iA) regarding the acceptability of the proposed activity and activities; and ii. if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Section 11.1
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	Not Applicable
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	Not Applicable
q) any other information requested by the competent authority.	Not Applicable
2. Where a government notice gazetted by the Minister provides for any protocol of minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply	Not Applicable

Contents

1. INTRODUCTION

ASHA Consulting (Pty) Ltd was appointed by Scatec Africa Solar (Pty) Ltd to conduct an assessment of the potential impacts to heritage resources that might occur through the proposed development of the Kenhardt PV5 solar energy facility on the farm Onder Rugzeer 168/RE and an associated powerline linking the facility to the existing Nieuwehoop Substation on Gemsbokbult 120/3. The line would cross Boven Rugzeer 169/RE in between the above two properties. The PV site is located 20 km northeast of Kenhardt in the Kenhardt Magisterial District and is centred on S29° 12' 50" E21° 17' 45" (Figures 1 & 2).

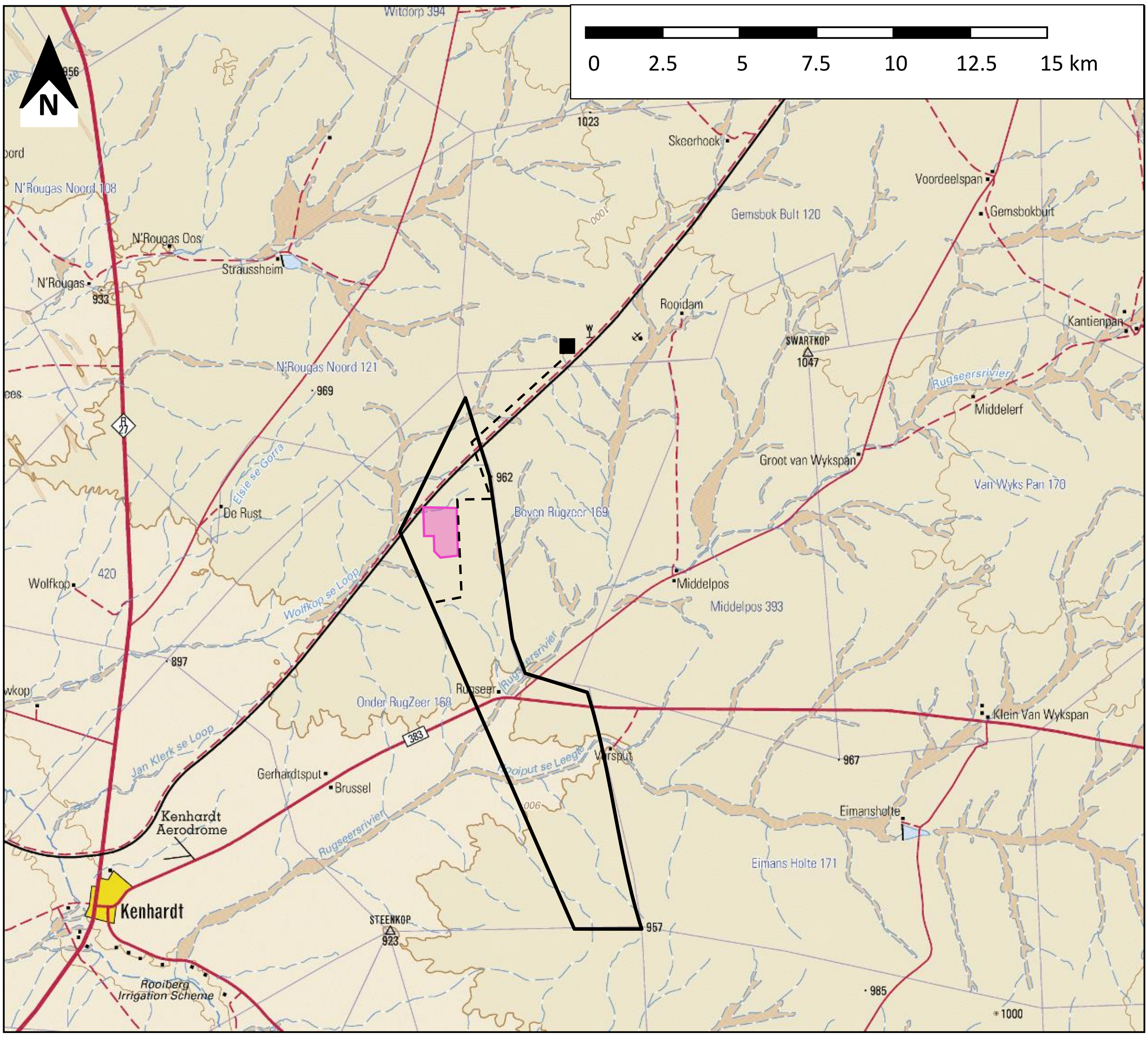

Figure 1: Extract from 1:250 000 topographic map 2920 showing the location of the PV5 site (pink polygon). The extent of Onder Rugzeer 168/RE is outlined in black, while the proposed power line corridor is shown by the dashed black line (but note that it is shown as a line purely for mapping purposes). The black square is the Nieuwehoop Substation. Source: Chief Directorate: National Geo-Spatial Information. Website: www.ngi.gov.za.

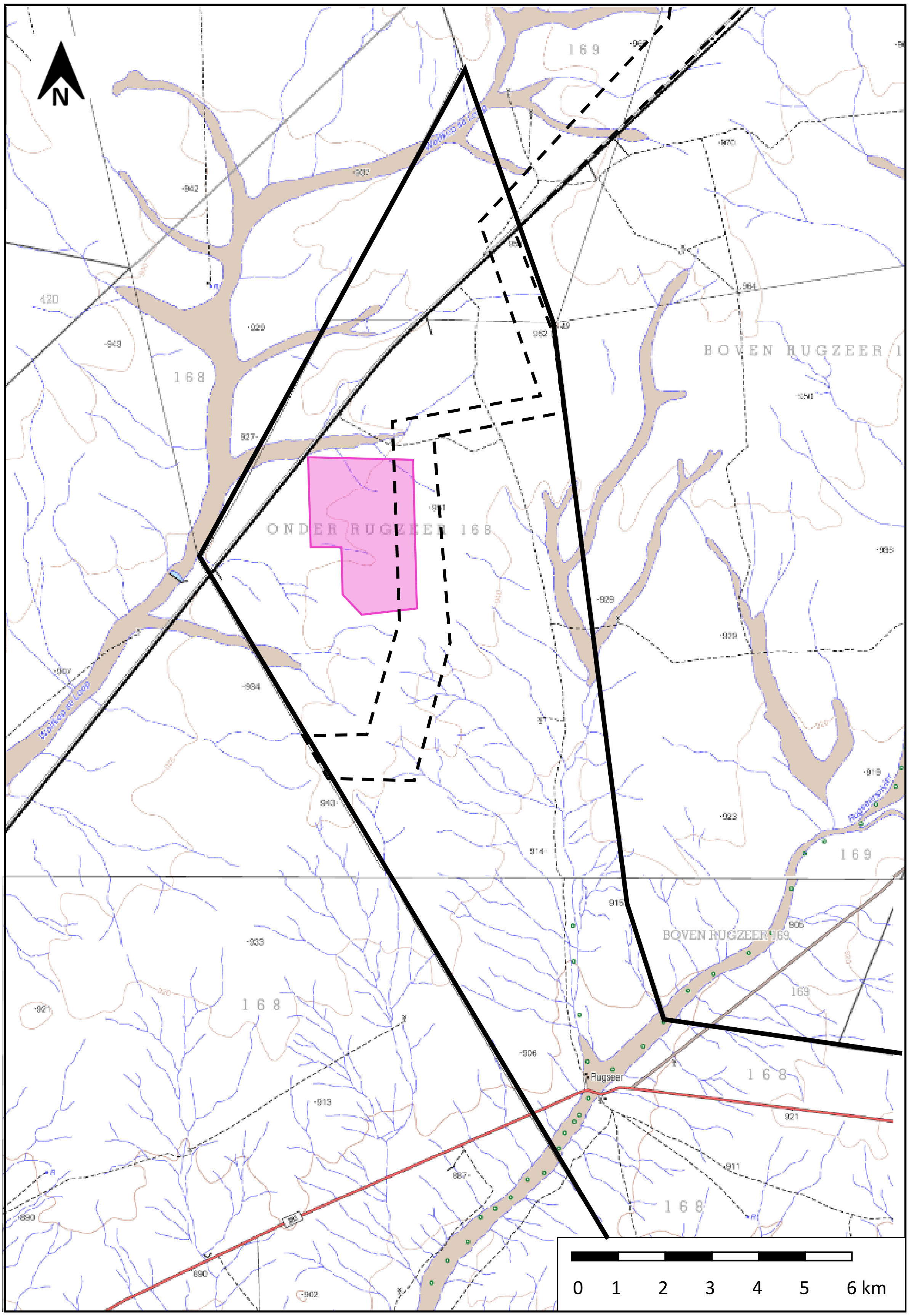

Figure 2: *Extract from 1:50 000 mapsheets 2921AB & 2921AD showing the location of the PV5 site (pink polygon). The extent of Onder Rugzeer 168/RE is outlined in black, while the proposed power line corridor is shown by the dashed black polygon. Source: Chief Directorate: National Geo-Spatial Information. Website: www.ngi.gov.za.*

The project is located in the Upington REDZ (#7), with the town of Kenhardt being just outside the south-western corner of this REDZ. The REDZs represent areas where wind and solar photovoltaic development is being incentivised from resource, socio-economic and environmental perspectives.

In terms of the National Environmental Management Act (Act 107 of 1998, as amended) (NEMA) and the 2014 NEMA EIA Regulations promulgated in Government Gazette 40772 and Government Notice (GN) R326, R327, R325 and R324 on 7 April 2017, wind and solar PV projects located within a REDZs are subject to a Basic Assessment (BA) and reduced decision-making period by the authorities.

1.1. The proposed project

In 2015/16, CSIR conducted an EIA and prepared an Environmental Management Programme (EMPr) for the proposed development of three 75 megawatt (MW) solar photovoltaic (PV) facilities near Kenhardt in the Northern Cape Province, on behalf of Scatec Solar Africa (Pty) Ltd (hereinafter referred to as Scatec). These projects were referred to as Kenhardt PV 1, 2 and 3 and received Environmental Authorisation on 7 August 2017 (PV facilities), and 22 September 2017 (supporting electrical infrastructure).

Scatec is proposing to design, construct and operate Phase 2 of this project, which consists of an additional three 100 MW Solar PV power generation facilities, south of Upington in the Northern Cape Province (referred to as Kenhardt PV 4, 5 and 6). The proposed facilities will be constructed on the farm Onder Rugzeer 168/RE, which is situated alongside the farm Boven Rugzeer (Remaining Extent of Farm Number 169) and the proposed Eskom Nieuwehoop Substation. Each 100 MW plant will cover an approximate footprint of up to 250 hectares.

1.1.1. Project description

The proposed project will make use of PV solar technology to generate electricity from the sun's energy. The Applicant is proposing to develop a facility with a possible maximum installed capacity of 100 MW of electricity from PV solar energy.

Once a Power Purchase Agreement (PPA) is awarded, the proposed facility will generate electricity for at least 20 years. The proposed facility will consist of the following components:

- Solar Field, comprising Solar Arrays with a maximum height of 10m and maximum footprint of 250 hectares per project (detailed provided below), including the following:
  - PV Modules;
  - Single Axis Tracking structures (aligned north-south), Fixed Axis Tracking (aligned east-west), Dual Axis Tracking (aligned east-west and north-south) or Fixed Tilt Mounting Structure (all options will be considered in the design);
  - Solar module mounting structures comprised of galvanised steel and aluminium; and
  - Foundations which will likely be drilled and concreted into the ground.
- Building Infrastructure
  - Offices (maximum height 7m and footprint of 1000 m^2);
  - Operational and maintenance control centre (maximum height 7m and footprint 500 m^2);
  - Warehouse/workshop (maximum height 7m and footprint 500 m^2);
  - Ablution facilities (maximum height 7m and footprint 50 m^2);
  - 24 inverter/Inverter stations (height from 2.5m to 7m and footprint 2500 m^2);

- On-site substation building (footprint 20 000 m^2).; and
- Guard Houses (height 3m, footprint 40 m^2).

- Associated Infrastructure
  - 132 kV overhead transmission line to connect to the existing Eskom Nieuwehoop substation (see further detail below);
  - Associated electrical infrastructure at the Eskom Nieuwehoop Substation (including but not limited to feeders, Busbars, transformer bay and extension to the platform at the Eskom Nieuwehoop Substation);
  - On-site substation;
  - Battery storage (approx. $200m^2$)
  - Internal 33 kV transmission lines/underground cables (either underground to maximum depth of 1m or above ground with height of 9m);
  - Underground low voltage cables or cable trays (underground to maximum depth of 1m);
  - Access roads. Maximum 8m wide with options from the north or south;
  - Internal gravel roads (width of 4m);
  - Fencing (2.6-3.0 m high);
  - Panel maintenance and cleaning area;
  - Stormwater channels; and
  - Temporary work area during the construction phase (i.e. laydown area of up to 5 ha).

The total maximum project footprint is 250 hectares including the PV facility and all associated infrastructure and roads but excluding the power lines.

The power line detail is as follows:

- High Voltage 132 kV Overhead Transmission Lines from PV sites to Nieuwehoop substation, to be located within a corridor of approximately 300m wide (refer to the attached kmz files). The specialists are required to assess the entire corridor for sensitivities, and this assessment will be used to identify the specific power line routes. The specific power lines will have the following specifications:
  - Height of between 22.5 m and 30 m;
  - The servitude for the 132 kV power line will be 31m wide. Note that the entire servitude will not be cleared of vegetation. Vegetation clearance within the servitude will be undertaken in compliance with relevant standards and specifications.
  - Length from site to grid connection is still to be confirmed but will be approximately 10 km.

1.1.2. Identification of alternatives

No alternative sites or technologies have been identified for the development. The site is within a REDZ which means that it has been identified as suitable for this type of development. Furthermore, a corridor has been identified for the powerline which allows some flexibility in the final footprint so that impacts can be more easily avoided.

1.1.3. Aspects of the project relevant to the heritage study

All aspects of the proposed development are relevant since excavations for foundations may impact on archaeological and/or palaeontological remains, while the above-ground aspects create potential visual (contextual) impacts to the cultural landscape and any significant heritage sites that might be visually sensitive.

1.2. Terms of reference

Specialists are required to:

- Describe the regional and local features;
- Conduct a field survey to search for sensitive areas;
- Map the sensitive features;
- Assess (identifying and rate) the potential impacts on the environment from the proposed PV facility and associated substation and powerline;
- Specialists are required to clearly demonstrate which impacts apply to the PV facility, substations and power lines;
- Assess cumulative impacts expected from other PV projects in the area;
- Identify relevant legislation and legal requirements; and
- Provide recommendations on possible mitigation measures and rehabilitation procedures/ management guidelines.

1.3. Scope and purpose of the report

A heritage impact assessment (HIA) is a means of identifying any significant heritage resources before development begins so that these can be managed in such a way as to allow the development to proceed (if appropriate) without undue impacts to the fragile heritage of South Africa. This HIA report aims to fulfil the requirements of the heritage authorities such that a comment can be issued by them for consideration by the National Department of Environmental Affairs (DEA) who will review the Basic Assessment (BA) and grant or refuse authorisation. The HIA report will outline any management and/or mitigation requirements that will need to be complied with from a heritage point of view and that should be included in the conditions of authorisation should this be granted.

1.4. The author

Dr Jayson Orton has an MA (UCT, 2004) and a D.Phil (Oxford, UK, 2013), both in archaeology, and has been conducting Heritage Impact Assessments and archaeological specialist studies in South Africa (primarily in the Western Cape and Northern Cape provinces) since 2004 (please see curriculum vitae included as Appendix 1). He has also conducted research on aspects of the Later Stone Age in these provinces and published widely on the topic. He is an accredited heritage practitioner with the Association of Professional Heritage Practitioners (APHP; Member #43) and also holds archaeological accreditation with the Association of Southern African Professional Archaeologists (ASAPA) CRM section (Member #233) as follows:

- Principal Investigator: Stone Age, Shell Middens & Grave Relocation; and
- Field Director: Colonial Period & Rock Art.

2. HERITAGE LEGISLATION

The National Heritage Resources Act (NHRA) No. 25 of 1999 protects a variety of heritage resources as follows:

- Section 34: structures older than 60 years;
- Section 35: palaeontological, prehistoric and historical material (including ruins) more than 100 years old as well as military remains more than 75 years old;
- Section 36: graves and human remains older than 60 years and located outside of a formal cemetery administered by a local authority; and
- Section 37: public monuments and memorials.

Following Section 2, the definitions applicable to the above protections are as follows:

- Structures: "any building, works, device or other facility made by people and which is fixed to land, and includes any fixtures, fittings and equipment associated therewith";
- Palaeontological material: "any fossilised remains or fossil trace of animals or plants which lived in the geological past, other than fossil fuels or fossiliferous rock intended for industrial use, and any site which contains such fossilised remains or trace";
- Archaeological material: a) "material remains resulting from human activity which are in a state of disuse and are in or on land and which are older than 100 years, including artefacts, human and hominid remains and artificial features and structures"; b) "rock art, being any form of painting, engraving or other graphic representation on a fixed rock surface or loose rock or stone, which was executed by human agency and which is older than 100 years, including any area within 10m of such representation"; c) "wrecks, being any vessel or aircraft, or any part thereof, which was wrecked in South Africa, whether on land, in the internal waters, the territorial waters or in the maritime culture zone of the Republic, as defined respectively in sections 3, 4 and 6 of the Maritime Zones Act, 1994 (Act No. 15 of 1994), and any cargo, debris or artefacts found or associated therewith, which is older than 60 years or which SAHRA considers to be worthy of conservation"; and d) "features, structures and artefacts associated with military history which are older than 75 years and the sites on which they are found";
- Grave: "means a place of interment and includes the contents, headstone or other marker of such a place and any other structure on or associated with such place"; and
- Public monuments and memorials: "all monuments and memorials a) "erected on land belonging to any branch of central, provincial or local government, or on land belonging to any organisation funded by or established in terms of the legislation of such a branch of government"; or b) "which were paid for by public subscription, government funds, or a public-spirited or military organisation, and are on land belonging to any private individual."

Section 3(3) describes the types of cultural significance that a place or object might have in order to be considered part of the national estate. These are as follows:

a) its importance in the community, or pattern of South Africa's history;
b) its possession of uncommon, rare or endangered aspects of South Africa's natural or cultural heritage;
c) its potential to yield information that will contribute to an understanding of South Africa's natural or cultural heritage;
d) its importance in demonstrating the principal characteristics of a particular class of South Africa's natural or cultural places or objects;
e) its importance in exhibiting particular aesthetic characteristics valued by a community or cultural group;
f) its importance in demonstrating a high degree of creative or technical achievement at a particular period;

g) its strong or special association with a particular community or cultural group for social, cultural or spiritual reasons;
h) its strong or special association with the life or work of a person, group or organisation of importance in the history of South Africa; and
i) sites of significance relating to the history of slavery in South Africa.

While landscapes with cultural significance do not have a dedicated Section in the NHRA, they are protected under the definition of the National Estate (Section 3). Section 3(2)(c) and (d) list "historical settlements and townscapes" and "landscapes and natural features of cultural significance" as part of the National Estate. Furthermore, Section 3(3) describes the reasons a place or object may have cultural heritage value; some of these speak directly to cultural landscapes.

Section 38(8) of the NHRA states that if an impact assessment is required under any legislation other than the NHRA then it must include a heritage component that satisfies the requirements of S.38(3). Furthermore, the comments of the relevant heritage authority must be sought and considered by the consenting authority prior to the issuing of a decision. Under the National Environmental Management Act (No. 107 of 1998; NEMA), as amended, the project is subject to a BA. The present report provides the heritage component. Ngwao-Boswa Ya Kapa Bokoni (Heritage Northern Cape; for built environment and cultural landscapes) and the South African Heritage Resources Agency (SAHRA for archaeology and palaeontology) are required to provide comment on the proposed project in order to facilitate final decision making by the DEA.

3. METHODS

3.1. Literature survey and information sources

A survey of available literature was carried out to assess the general heritage context into which the development would be set. This literature included published material, unpublished commercial reports and online material, including reports sourced from the South African Heritage Resources Information System (SAHRIS). The 1:250 000 and 1:50 000 maps were sourced from the Chief Directorate: National Geo-Spatial Information. Data were also collected via a field survey carried out in 2015.

3.2. Field survey

The broader study area was subjected to a detailed foot survey by two archaeologists over four days on 28 to 31 October 2015. This was during spring but, in this very dry area, the season makes no meaningful difference to vegetation covering and hence the ground visibility for the archaeological survey. Other heritage resources are not affected by seasonality. During the survey the positions of finds and survey tracks were recorded on a hand-held Global Positioning System (GPS) receiver set to the WGS84 datum. Photographs were taken at times in order to capture representative samples of both the affected heritage and the landscape setting of the proposed development.

The 2015 survey covered a large part of the farm portion in order to allow flexibility in the location of the PV projects then proposed. The present development falls entirely within areas already surveyed as shown in Figure 3.

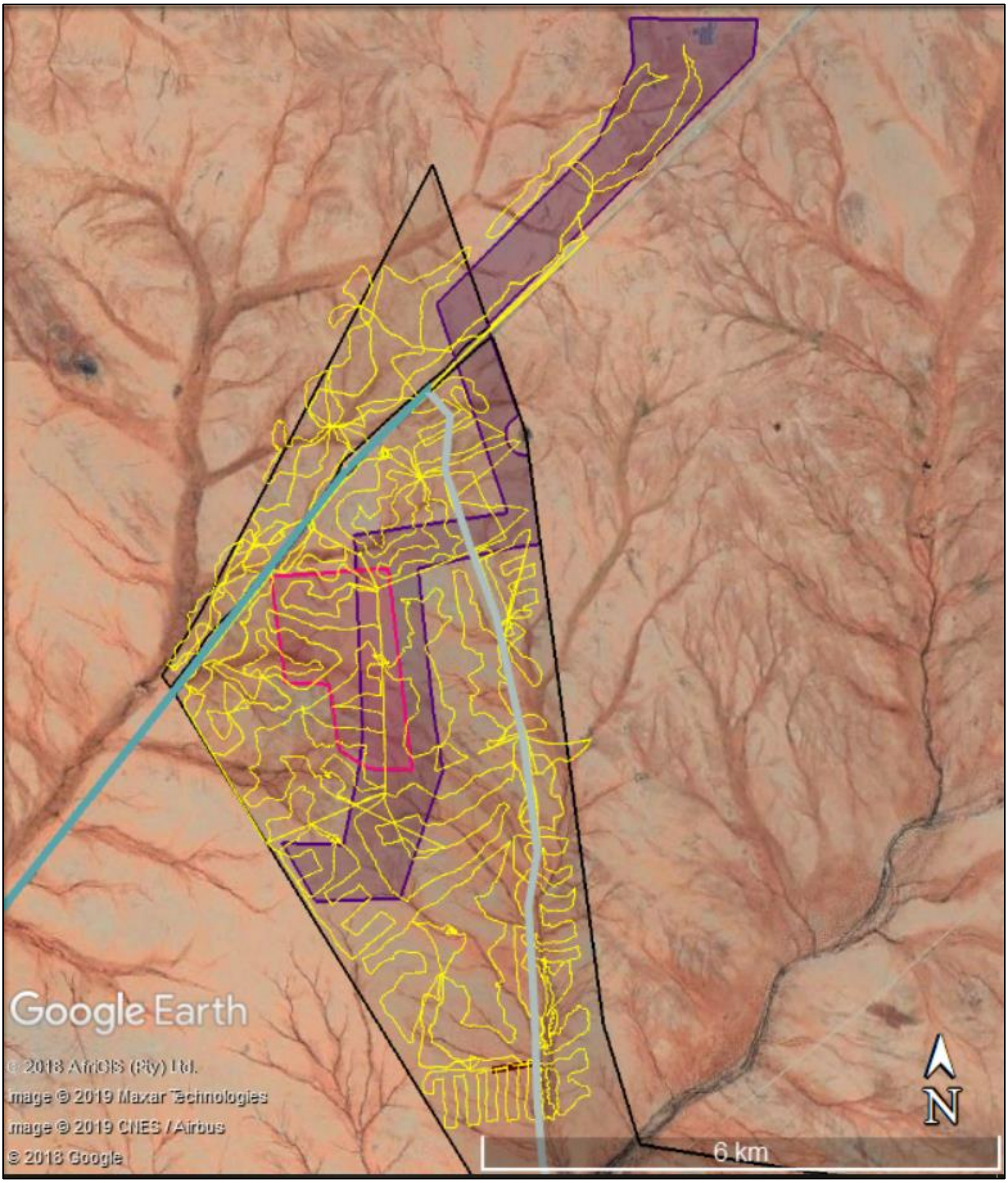

Figure 3: *Aerial view of the study area showing the farm portion (black polygon), the proposed PV5 site (pink polygon), the powerline corridor (purple polygon), two access road options (turquoise and grey lines), and the 2015 survey tracks (yellow lines).*

3.3. Impact assessment

For consistency among specialist studies, the impact assessment was conducted through application of a scale supplied by the CSIR.

3.4. Grading

Section 7 of the NHRA provides for the grading of heritage resources into those of National (Grade 1), Provincial (Grade 2) and Local (Grade 3) significance. Grading is intended to allow for the identification of the appropriate level of management for any given heritage resource. Grade 1 and 2 resources are intended to be managed by the national and provincial heritage resources authorities, while Grade 3 resources would be managed by the relevant local planning authority. These bodies are responsible for grading, but anyone may make recommendations for grading.

It is intended under S.7(2) that the various provincial authorities formulate a system for the further detailed grading of heritage resources of local significance but this is generally yet to happen. SAHRA (2007) has formulated its own system[1] for use in provinces where it has commenting authority. In this system sites of high local significance are given Grade IIIA (with the implication that the site should be preserved in its entirety) and Grade IIIB (with the implication that part of the site could be mitigated and part preserved as appropriate) while sites of lesser significance are referred to as having 'General Protection' (GP) and rated as GP A (high/medium significance, requires mitigation), GP B (medium significance, requires recording) or GP C (low significance, requires no further action).

3.5. Assumptions and limitations

The study was carried out at the surface only and hence any completely buried archaeological sites or fossils could not be readily located. Similarly, it is not always possible to determine the depth of such material visible at the surface.

Cumulative impacts are assessed by adding expected impacts from this proposed development to existing and proposed developments with similar impacts in a 30 km radius.

3.6. Consultation processes undertaken

The NHRA requires consultation as part of an HIA but, since the present study falls within the context of an EIA which includes a public participation process (PPP), no dedicated consultation was undertaken as part of the HIA. Interested and affected parties would have the opportunity to provide comment on the heritage aspects of the project during the PPP.

4. PHYSICAL ENVIRONMENTAL CONTEXT

4.1. Site context

The site is located in a rural area that is used primarily for small stock grazing. A large substation lies to the northeast (at the north-eastern end of the powerline corridor) and the Sishen-Saldanha Railway Line and its gravel service road cross the powerline corridor. Although no other renewable energy facilities are present, others have been proposed and the site lies within the Upington REDZ.

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[1] The system is intended for use on archaeological and palaeontological sites only.

4.2. Site description

The PV site and powerline corridor are very flat with sparse vegetation. There tends to be slightly denser vegetation along the many small water courses that cross the general area but some intervening areas are almost devoid of plant cover. Quartz gravel occurs in places but the ground is generally of hard sand or silt. Figures 4 to 8 show a selection of views of the study area to illustrate their general character.

Figure 4: *View towards the southwest from the powerline corridor and into the PV site.*

Figure 5: *View towards the south from just outside the northern edge of the PV study area. The visible wind pump is just outside the PV site.*

Figure 6: *View towards the west from the eastern edge of the PV study area. The low hill (a quartz outcrop) visible in the centre is beyond the site boundary.*

Figure 7: *View towards the east along the northern part of the powerline corridor with the Nieuwehoop Substation visible in the background.*

Figure 8: *view towards the north in the southern part of the powerline corridor.*

5. FINDINGS OF THE HERITAGE STUDY

This section describes the heritage resources recorded in the study area during the course of the project.

5.1. Palaeontology

The SAHRIS Palaeosensitivity Map shows both the powerline corridor and PV study area to be od largely moderate palaeontological sensitivity (Figure 9). Patches of exposed igneous bedrock are indicated as being of zero sensitivity.

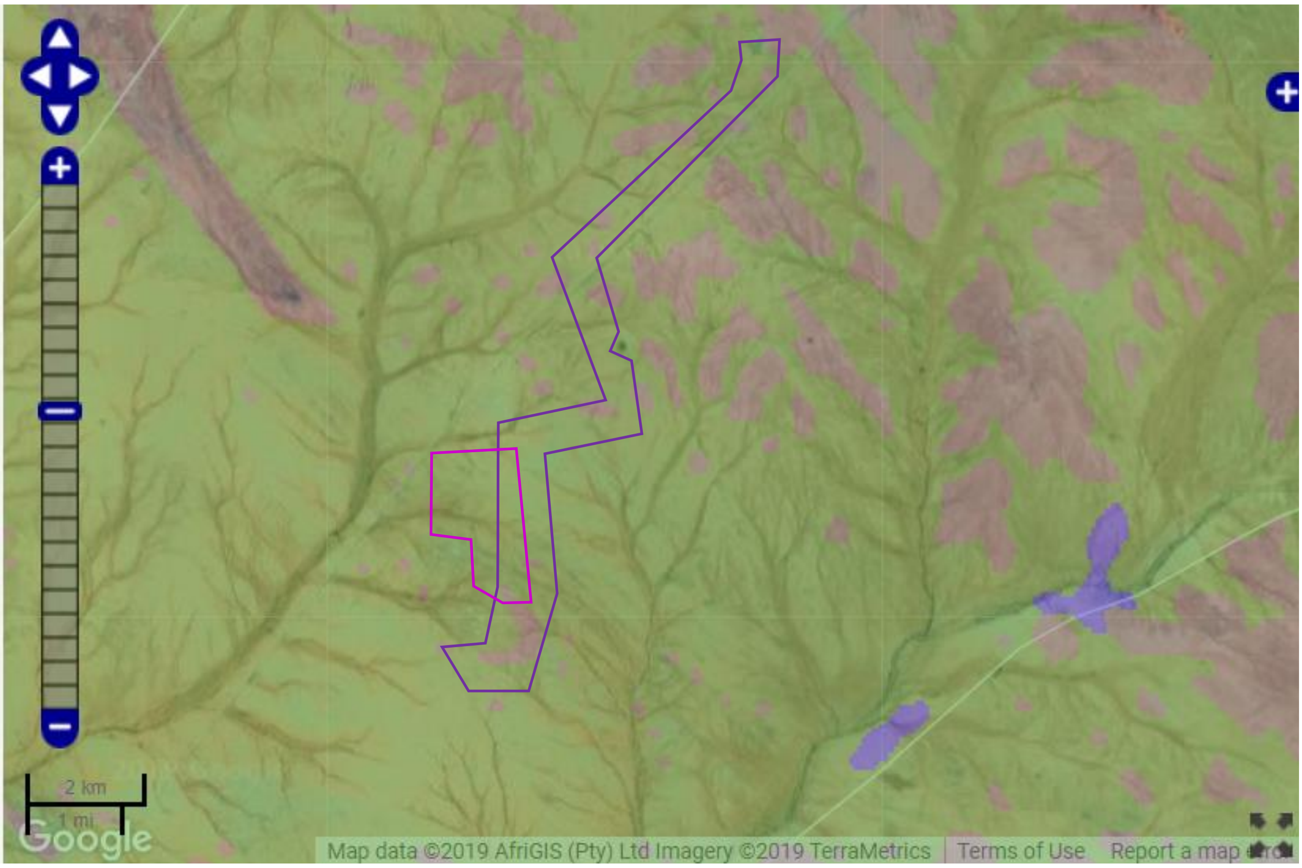

Figure 9: *Extract from the SAHRIS Palaeosensitivity Map showing the powerline corridor (purple polygon) and PV area (pink polygon) to be of moderate sensitivity (green shading) with small areas of zero sensitivity (grey shading).*

A specialist palaeontological study by Dr John Almond is contained in Appendix 2. This study indicates that the unfossiliferous bedrock is fairly widely mantled by Late Caenozoic superficial deposits that may contain rare fossils. Of greater importance, however, are deeper pan deposits which may contain fossils and even associated archaeology but which have not yet been reported from this part of Bushmanland. Almond considers the overall palaeontological sensitivity of the study area to be low.

5.2. Archaeology

5.2.1. Desktop study

Bushmanland is well known for the vast expanses of gravel that occur in places and which frequently contain stone artefacts in varying densities (Beaumont et. al 1995). Such material is referred to as 'background scatter' and is invariably of very limited significance. At times, however, the scatter can become very dense and mitigation work is occasionally called for. The artefacts located in these contexts largely date to the Pleistocene and originate in the Early Stone Age (ESA) and Middle Stone Age (MSA). They are not associated with any other archaeological materials, since these would have long since decomposed and disappeared. Previous experience immediately east of the present site suggests that such dense accumulations of artefacts are unlikely to occur in this area.

Of potentially more significance, however, are Later Stone Age (LSA) sites which are commonly located along the margins of water features in Bushmanland. These features include both pans and ephemeral drainage lines. Such sites were identified both on and to the east of the present study area in association with small pans and drainage lines, but more often the former (Orton 2014a, 2014b, 2014c, 2015a, 2015b, 2015c, 2016a, 2016b, 2016c, 2016d, 2016e, 2016f, 2016g, 2018a, 2018b, 2018c, 2018d). One highly significant pan site has been found in the vicinity of the study area, about 16 km northeast of the Nieuwehoop Substation (Orton 2018a). These sites typically contain mostly stone artefacts, but fragments of ostrich eggshell (used as water containers and also as a food source) and pottery are also found at times, while bone is rare and likely confined to sites that are very recent. Similar LSA sites can also be found in association with rocky outcrops. Orton (2016c) documented a suite of LSA/historical sites along a section of river bank some 11.5 km south of the Nieuwehoop Substation. These appeared to be contact period sites and one of them included a rusted pen knife handle with the portrait and name of Paul Kruger on it. This may indicate that a Boer commando had camped there. Morris (2009), on the other hand, noted that a search along the banks of the Hartbees River close to Kenhardt, where he expected elevated frequencies of archaeological material, revealed virtually nothing.

Another kind of archaeological site fairly commonly encountered in Bushmanland is small rock outcrops that have been quarried as a source of stone material for making stone tools. Such occurrences have frequently been recorded in the area.

Rock engravings are known from the broader area (Louw Roux Bushmanland 2013). From the limited information available, these appear to be naturalistic images produced by the Bushmen. Geometric images, produced by the Khoekhoen, are not well known from the area (Orton 2013), although David Morris (pers. comm. 2015) has seen examples in the region. Painted art is also very rare but again, examples are known with one being a short distance east of the present study area (Orton 2016f) and another along the Sak River near Kenhardt (Orton, personal observation 2017). Both are of geometric images.

Historical resources tend to be rarer than Stone Age ones. Orton (2018d) located an old farmstead that is now purely archaeological in nature having been raised to the ground. It is the only such site known from the area and included an ash midden with many glass and ceramic artefacts. Isolated fragments of glass and ceramics are occasionally seen in the wider area.

5.2.2. Site visit

All archaeological finds made on the property in the 2015 survey are recorded in Appendix 3 and mapped in Appendix 4. The majority have been avoided by the present development footprint.

A few finds were made within the powerline corridor. These included half a bored stone and a scatter of stone artefacts. The bored stone was far less symmetrical than expected and had also been used as a hammerstone (Figures 10 & 11). The artefact scatter included materials of mixed age but two diagnostic MSA flakes both had faceted platforms and a colonial period white refined earthenware fragment is likely no older than the late 19th century (Figure 12). Flaked quartz outcrops were found in various parts of the broader study area with one being inside the powerline corridor at Waypoint 207. Figure 13 shows a classic example of one of these flaked outcrops from Waypoint 737 which was located just outside the powerline corridor. An ESA handaxe made in quartzite was also found in the corridor.

Figure 10: *Plan view of the bored stone fragment found at Waypoint 220. Scale in cm.*

Figure 11: *Cross-section view of the bored stone fragment found at Waypoint 220. Scale in cm.*

Figure 12: *Artefacts found at Waypoint 220. Two colonial period ceramics are at upper right. Scale in cm.*

Figure 13: *An example of a flaked quartz outcrop at Waypoint 737 showing the typical hammering damage.*

The only finds made within the PV5 study area, aside from the bored stone and artefact scatter mentioned above, were three flaked quartz outcrops displaying evidence of flakes having been removed for artefact manufacture and two isolated handaxes. The study area was otherwise devoid of anything other than isolated background scatter artefacts.

5.3. Graves

Isolated graves, or features thought to be graves, are widespread across the dry interior of South Africa and may relate to either precolonial occupation, early colonial farmers (trekboers) or to the Anglo-Boer War. No graves or possible graves were found in the present powerline corridor or PV5 study area.

5.4. Historical aspects and the Built environment

5.4.1. Desktop study

The Anglo-Boer War was fought across much of the Northern Cape interior, but information on the role of Kenhardt appears difficult to locate. The town was occupied by the Boers in late February 1900 after they convinced the magistrate that they had a large gun and would fire on the town if it did not surrender. They later surrendered to the British who occupied the town on 31st March 1900. By mid-1900 there were perhaps 100 Cape Rebels detained in a camp outside of Kenhardt (Grobler 2004). The British raised a local force known as the Border Scouts in Upington in May 1900. Many were mixed-race individuals, some local farmers, others Kalahari hunters, but all disliked the Boers. The scouts were responsible for a large area of the north-western Cape Colony centred on Upington and Kenhardt. They eventually numbered 786 by January 1901 and were under the command of Major John Birbeck (AngloBoerWar.com 2015; Rodgers 2011). At the beginning of 1902 there were 150 Border Scouts stationed at Kenhardt. Two boers, H.L. Jacobs and A.C. Jooste, were accused of treason and executed in the town on 24 July 1901 (Grobler 2004). A memorial stands there to their honour (Green Kalahari n.d.). Events around Kenhardt were likely not that important and this execution does not even feature in the Boer War timeline provided by Packenham (1993: 291-294). No major action appears to have taken place around Kenhardt, although the Boers are known to have attacked a patrol on 17th May 1901, while the British attacked a Boer position on 25th June 1901 (AngloBoerWar.com 2015).

From an archaeological point of view the only material remains possibly related to occupation around the time of the Boer War are the series of contact period river bank scatters mentioned above.

The farm complexes of the area all appear to be 20th century in age with the only older one known being the ruined and largely raised one noted above (Orton 2018d).

The Onder Rugzeer Farm dates back to 1883 but three portions were removed in 1928 and 1929. Portion 4 was removed for the railway line in 1991 leaving the current remainder.

5.4.2. Site visit

Aside from isolated archaeological artefacts (i.e. glass and ceramics), no historical heritage resources were noted in the study area.

5.5. Cultural landscapes and scenic routes

The cultural landscape is rather weakly developed and relates to the keeping of small stock in the region. The landscape is characterised by wide open space with occasional fence lines, farm tracks and wind pumps and is rather more natural than cultural in nature. In the vicinity of the study area it is compromised by the presence of the railway line and substation. The site is located well away from the R27 which may be considered a scenic route. Nevertheless, the landscape is considered to be a heritage resource.

5.6. Statement of significance and provisional grading

Section 38(3)(b) of the NHRA requires an assessment of the significance of all heritage resources. In terms of Section 2(vi), ''cultural significance'' means aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance. The reasons that a place may have cultural significance are outlined Section 3(3) of the NHRA (see Section 2 above).

Palaeontological resources are hard to predict but, given the lack of large pans, any fossils present in the study area would likely have medium significance for their scientific value and could be considered GPA.

The archaeological resources of the broader study area are deemed to have low to medium cultural significance for their scientific value. Most are deemed to be GPC but a few can be considered GPA because they have some research value. No sites worthy of a higher grading than GPC occur within the powerline corridor or PV5 study area.

The landscape is considered to have low-medium cultural significance for its aesthetic value (the SAHRA grading system is not for grading landscapes).

5.7. Summary of heritage indicators

Palaeontological resources are likely to be scarce but if significant fossils are present then they should be studied.

- Indicator: Significant fossils should not be damaged or destroyed without prior study and possibly rescue.

Archaeological resources are widespread but generally of very low significance. If they cannot be avoided, more important resources should be studied and possibly rescued prior to disturbance. Figures 14 and 15 show the locations of those resources in the area deemed to have cultural significance and that should be either avoided or mitigated.

- Indicator: Significant archaeological sites should not be damaged or destroyed without prior study and mitigation where needed.

Although no graves or possible graves are known from within the study area, others have been seen in the vicinity.

- Indicator: Damage to unmarked graves should be minimised prior to their study and exhumation (if they cannot be avoided).

The landscape is generally very flat and, being within a REDZ, has been earmarked for this type of development.

- Indicator: The landscape should not be visually dominated by the development when viewed from a distance.

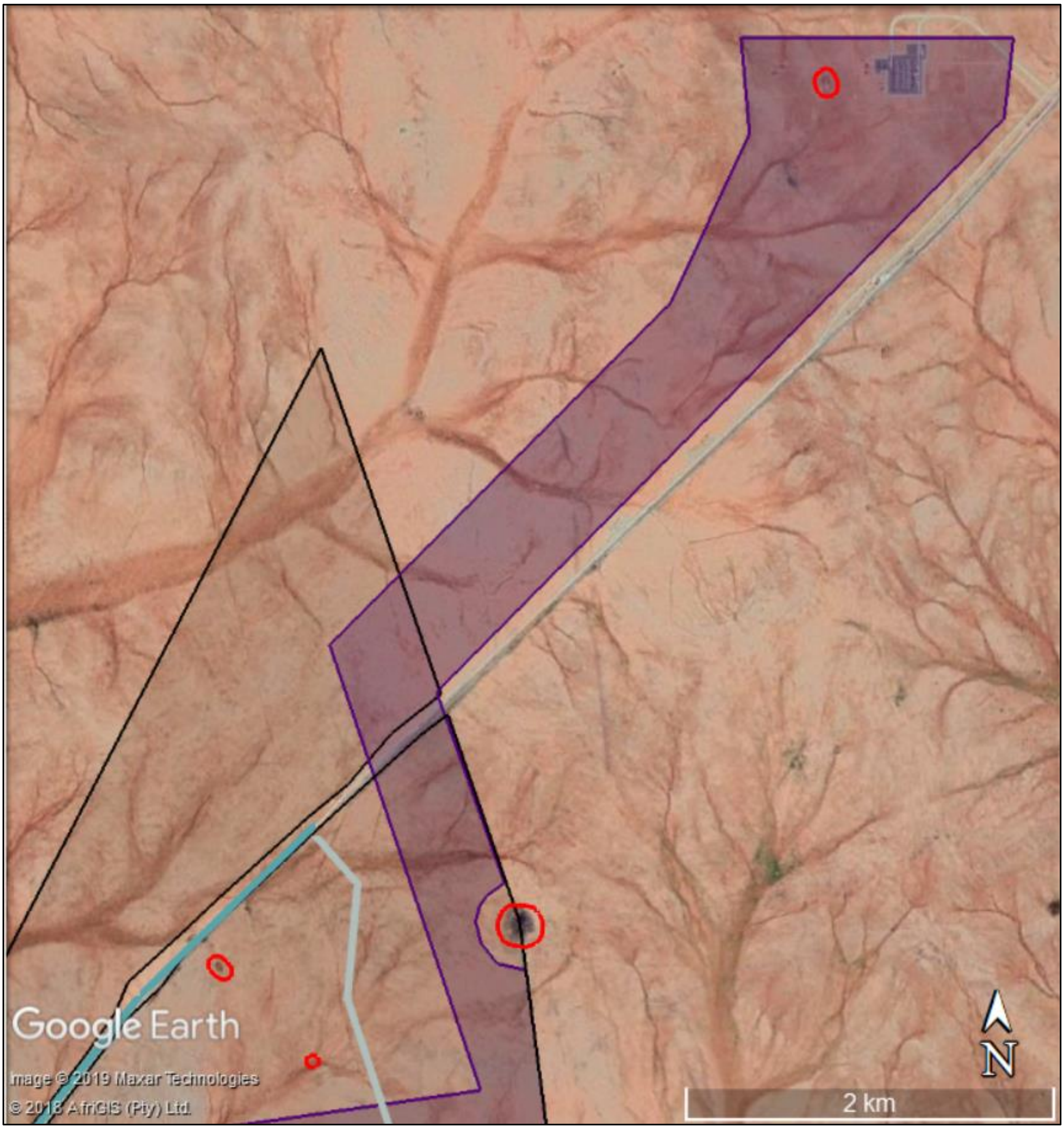

Figure 14: *Aerial view of the northern part of the study area showing the powerline corridor (purple shaded polygon) and sensitive archaeological sites (including their buffers; red polygons).*

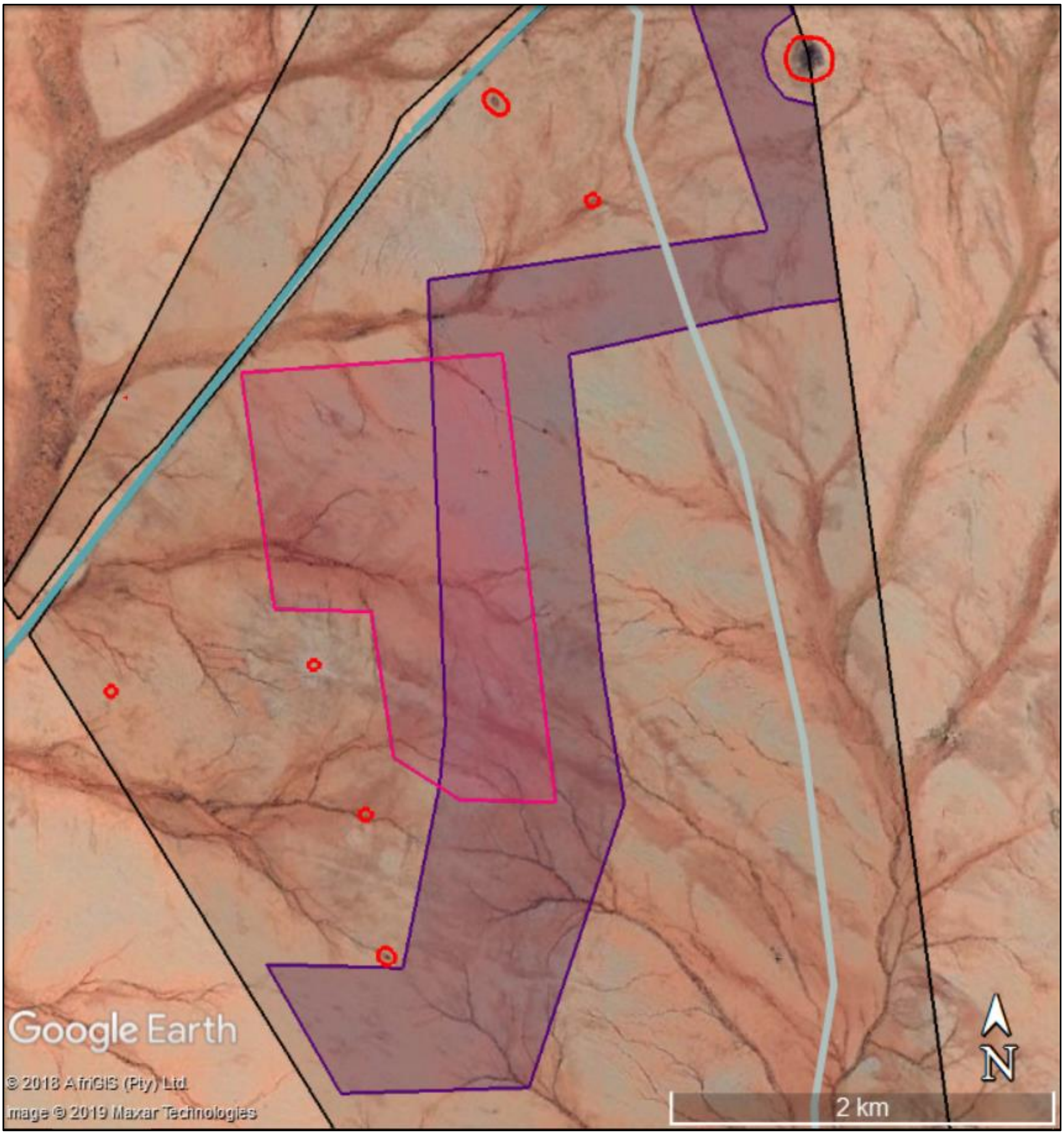

Figure 15: *Aerial view of the northern part of the study area showing the powerline corridor (purple shaded polygon), the PV5 site (pink shaded polygon), and sensitive archaeological sites (including their buffers; red polygons).*

6. ISSUES, RISKS AND IMPACTS

The potential heritage issues identified include:

- The destruction or damage of fossils;
- The destruction or damage of archaeological materials;
- The destruction or damage of graves;

The addition of an industrial-type facility to a rural landscape.

No heritage-related issues have been raised during consultation for this project.

6.1. Identification of potential impacts/risks

The potential issues identified are applicable largely to the construction phase but one will endure throughout operation. The expected impacts that may result are as follows:

Construction Phase
- Impacts to palaeontology
- Impacts to archaeology
- Impacts to graves
- Impacts to the landscape

Operational Phase
- Impacts to the landscape

Decommissioning Phase
- Impacts to the landscape

Cumulative impacts
- Impacts to palaeontology
- Impacts to archaeology
- Impacts to graves
- Impacts to the landscape

7. IMPACT ASSESSMENT

Note that palaeontological impacts have been assessed by the palaeontological specialist and are not included here. Because their impacts will be negligible, the two access roads make no difference at all to the assessments and are considered within all assessments provided below. Likewise, the substation, which will be within the PV footprint, does not affect the ratings and is also not specifically assessed.

7.1. Direct Impacts

7.1.1. Construction Phase

Potential impacts to archaeological resources

Direct negative impacts to archaeological resources can result when the site is cleared and during construction. Because no significant archaeological resources are known from the study area, impacts are expected to be unlikely, although they would be permanent. The significance of impacts would be **low (negative)** before mitigation. Mitigation would entail being alert for possible archaeological sites during construction and reporting these to an archaeologist or the heritage authorities so that further actions can be proposed and taken as required. With mitigation the impacts are likely to be of

very low (negative) significance. There are no fatal flaws from an archaeological perspective. The assessment is provided in Table 1.

Aspect/Activity	Site preparation and construction
Type of Impact (i.e. Impact Status)	Direct
Potential Impact	Clearing of the site and excavations for construction may damage or destroy significant archaeological materials.
Status	Negative
Mitigation Required	Report any accidental finds made during development so that further action can be taken as required.
Impact Significance (Pre-Mitigation)	Low (Level 4)
Impact Significance (Post-Mitigation)	Very low (Level 5)
I&AP Concern	No

Potential impacts to graves

Direct negative impacts to graves can result when the site is cleared and during construction. Because no graves or potential graves are known from the study area, impacts are expected to be unlikely, although they would be permanent. The significance of impacts would be **low (negative)** before mitigation. Mitigation would entail being alert for possible graves during construction and reporting these to an archaeologist or the heritage authorities so that further actions can be proposed and taken as required. With mitigation the impacts are likely to be of **very low (negative)** significance. There are no fatal flaws from the perspective of graves. The assessment is provided in Table 1.

Aspect/Activity	Site preparation and construction
Type of Impact (i.e. Impact Status)	Direct
Potential Impact	Clearing of the site and excavations for construction may damage or destroy graves.
Status	Negative
Mitigation Required	Reporting any accidental finds made during development so that further action can be taken as required.
Impact Significance (Pre-Mitigation)	Low (Level 4)
Impact Significance (Post-Mitigation)	Very low (Level 5)
I&AP Concern	No

Potential impacts to the landscape

Direct negative impacts to the landscape can result when the site is cleared and during construction because of the loss of natural vegetation and presence of construction equipment and industrial-type structures in the landscape. The proposed development is located far from any scenic routes, is fairly low and is located within a REDZ, but if it is built, impacts will very likely occur and would be long term. The significance of impacts would be **low (negative)** before mitigation. Mitigation would entail ensuring that the minimum amount of land is disturbed by remaining within the authorised footprint and using earthy colours where possible on buildings in order to reduce visual contrast. With mitigation the impacts are likely to be of **very low (negative)** significance. There are no fatal flaws from a landscape perspective. The assessment is provided in Table 1.

Aspect/Activity	Site preparation and construction
Type of Impact (i.e. Impact Status)	Direct
Potential Impact	Clearing of the site and construction of the facility may result in visual impacts to the landscape.
Status	Negative
Mitigation Required	Reporting any accidental finds made during development so that further action can be taken as required.
Impact Significance (Pre-Mitigation)	Low (Level 4)
Impact Significance (Post-Mitigation)	Very low (Level 5)
I&AP Concern	No

7.1.2. Operation Phase

Potential impacts to the landscape

Direct negative impacts to the landscape can result through the presence of industrial-type structures and powerlines in the landscape. The proposed development is located far from any scenic routes, is fairly low and is located within a REDZ, but if it is built, impacts will very likely occur and would be long term. The significance of impacts would be **low (negative)** before mitigation. Mitigation would entail ensuring that all maintenance activities remain within the authorised footprint. With mitigation the impacts are likely to be of **very low (negative)** significance. There are no fatal flaws from a landscape perspective. The assessment is provided in Table 2.

Aspect/Activity	Facility operation and maintenance
Type of Impact (i.e. Impact Status)	Direct
Potential Impact	The presence of the facility and powerlines may result in visual impacts to the landscape.
Status	Negative
Mitigation Required	Ensure that all maintenance activities remain within the authorised footprint.
Impact Significance (Pre-Mitigation)	Low (Level 4)
Impact Significance (Post-Mitigation)	Very low (Level 5)
I&AP Concern	No

7.1.3. Decommissioning Phase

Potential impacts to the landscape

Direct negative impacts to the landscape can result during decommissioning because of the construction vehicles and general activity in the landscape. The proposed development is located far from any scenic routes and is located within a REDZ, but if it is built and then decommissioned then impacts will very likely occur and would be long term due to the difficulty of adequately rehabilitating dry areas. The significance of impacts would be **low (negative)** before mitigation. Mitigation would entail ensuring that no new land is disturbed by remaining within the authorised footprint and ensuring that the site is rehabilitated as best as possible. With mitigation the impacts are likely to be of **very low (negative)** significance. There are no fatal flaws from a landscape perspective. The assessment is provided in Table 2.

Aspect/Activity	Site preparation and construction
Type of Impact (i.e. Impact Status)	Direct
Potential Impact	Clearing of the site and construction of the facility may result in visual impacts to the landscape.
Status	Negative
Mitigation Required	Ensure that all decommissioning activities remain within the authorised footprint.
Impact Significance (Pre-Mitigation)	Low (Level 4)
Impact Significance (Post-Mitigation)	Very low (Level 5)
I&AP Concern	No

7.1.4. Cumulative Impacts

The existing and proposed developments that were taken into consideration for cumulative impacts are shown in Figure 16. The assessment includes the three other facilities previously proposed by the same developer on the same farm portion (i.e. Onder Rugzeer 168/RE) being considered here as well as two others currently proposed and under assessment separately.

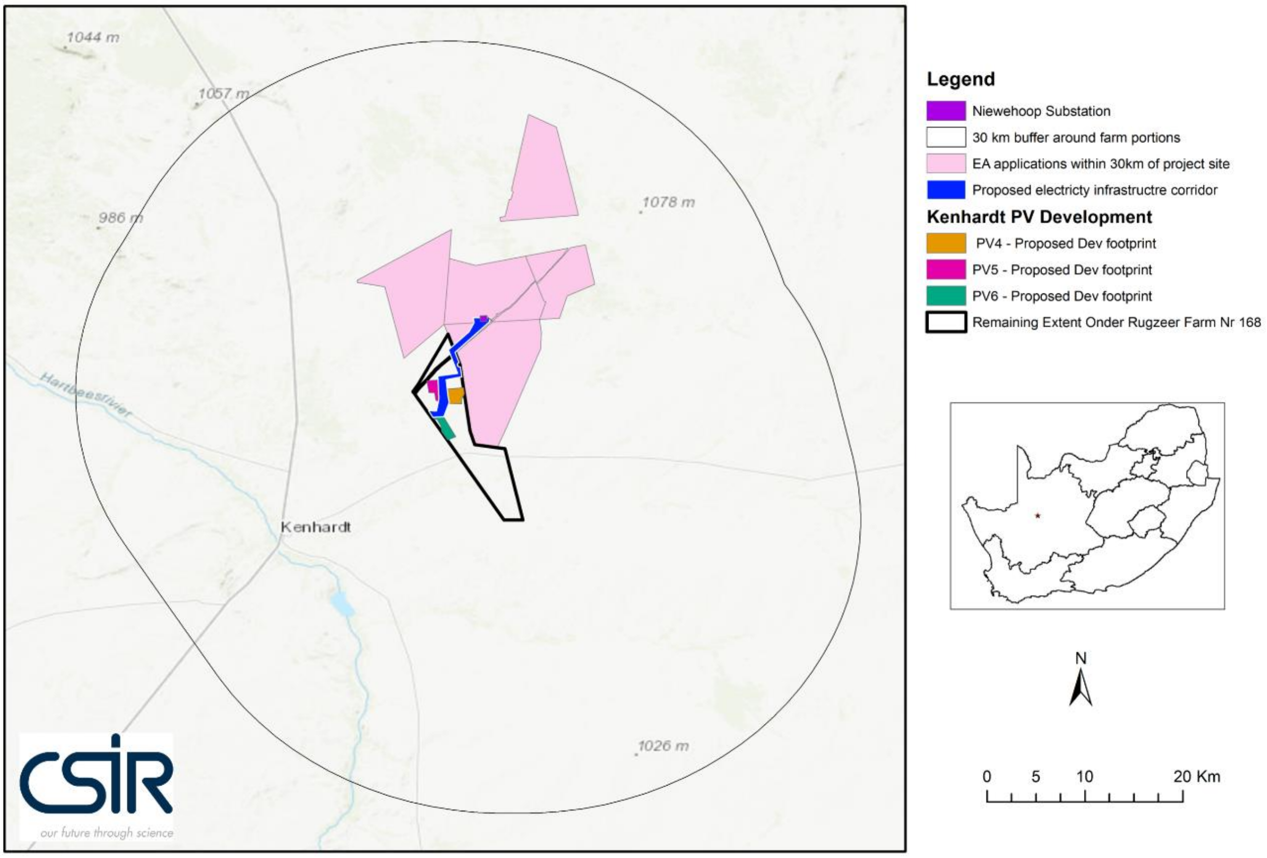

Figure 16: *Map showing the locations of other proposed solar energy facilities within 30 km of the study area.*

Potential cumulative impacts to archaeological resources

Direct negative impacts to archaeological resources can result during clearing and construction. Because few highly significant archaeological resources are known from the region and tend to be avoided by developments, impacts are expected to be unlikely, although they would be permanent. The significance of impacts would be **low (negative)** before mitigation. Mitigation would entail being alert for possible archaeological sites during construction and reporting these to an archaeologist or the heritage authorities so that further actions can be proposed and taken as required. With mitigation the impacts are likely to be of **very low (negative)** significance. There are no fatal flaws from the point of view of cumulative impacts to archaeology. The assessment is provided in Table 3.

Aspect/Activity	**Site preparation and construction**
Type of Impact (i.e. Impact Status)	Direct
Potential Impact	Clearing of the site and excavations for construction may damage or destroy significant archaeological materials.
Status	Negative
Mitigation Required	Report any accidental finds made during development so that further action can be taken as required.
Impact Significance (Pre-Mitigation)	Low (Level 4)
Impact Significance (Post-Mitigation)	Very low (Level 5)
I&AP Concern	No

Potential cumulative impacts to graves

Direct negative impacts to graves can result during clearing and construction. Because graves and potential graves tend to be rare in the region and, where known, tend to be avoided by developments, impacts are expected to be unlikely, although they would be permanent. The significance of impacts would be **low (negative)** before mitigation. Mitigation would entail being alert for possible graves during construction and reporting these to an archaeologist or the heritage authorities so that further actions can be proposed and taken as required. With mitigation the impacts are likely to be of **very low (negative)** significance. There are no fatal flaws from the point of view of cumulative impacts to graves. The assessment is provided in Table 3.

Aspect/Activity	**Site preparation and construction**
Type of Impact (i.e. Impact Status)	Direct
Potential Impact	Clearing of the site and excavations for construction may damage or destroy graves.
Status	Negative
Mitigation Required	Reporting any accidental finds made during development so that further action can be taken as required.
Impact Significance (Pre-Mitigation)	Low (Level 4)
Impact Significance (Post-Mitigation)	Very low (Level 5)
I&AP Concern	No

Potential cumulative impacts to the landscape

Direct negative impacts to the landscape can result during clearing and construction activities because of the loss of natural vegetation and presence of construction equipment and industrial-type structures in the landscape. The proposed development and others nearby are located far from any scenic routes, are fairly low and are located within a REDZ. However, if they are built, impacts will very likely occur and would be long term. The significance of impacts would be **low (negative)** before mitigation. Mitigation would entail ensuring that the minimum amount of land is disturbed by remaining within the authorised footprints and using earthy colours where possible on buildings in order to reduce visual contrast. With mitigation the impacts are likely to be of **very low (negative)** significance. There are no fatal flaws from the point of view of cumulative impacts to the landscape. The assessment is provided in Table 3.

Aspect/Activity	**Site preparation and construction**
Type of Impact (i.e. Impact Status)	Direct
Potential Impact	Clearing of the site and construction of the facility may result in visual impacts to the landscape.
Status	Negative
Mitigation Required	Reporting any accidental finds made during development so that further action can be taken as required.
Impact Significance (Pre-Mitigation)	Low (Level 4)
Impact Significance (Post-Mitigation)	Very low (Level 5)
I&AP Concern	No

7.2. The No-Go alternative

The No-Go alternative wold entail the site staying as it is. No solar energy facility wold be developed, no electricity would be generated and agricultural activities would continue. No impacts are expected from this alternative and the significance would thus be **neutral**.

7.3. Existing impacts to heritage resources

There are currently few obvious threats to heritage resources on the site. Excavation of pans to create small dams is a threat to archaeological resources and has been observed to occur quite widely in Bushmanland. In addition, natural degradation, weathering and erosion will affect fossils, rock art and archaeological materials. Trampling from grazing animals and/or farm/other vehicles may damage archaeological materials and/or fossils.

7.4. Levels of acceptable change

Any impact to an archaeological or palaeontological resource or a grave is deemed unacceptable until such time as the resource has been inspected and studied further if necessary. Impacts to the landscape are difficult to quantify but in general a development that visually dominates the landscape from many vantage points is undesirable. Because of the height of the majority of the proposed development and the existing infrastructure present in the area, such an impact is not envisaged.

Table 1: Impact assessment summary table – Construction Phase direct impacts.

Aspect/ Impact pathway	Nature of potential impact/risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of residual impact/risk	Confidence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
CONSTRUCTION PHASE													
Clearing of site and construction of facility	**Impacts to archaeological resources**	Negative	Site	Permanent	Moderate	Unlikely	Non-reversible	Moderate	Report accidental finds during development	Low	Very Low	5	High
	Impacts to graves	Negative	Site	Permanent	Moderate	Unlikely	Non-reversible	High	Report accidental finds during development	Low	Very Low	5	High
	Impacts to the rural landscape	Negative	Local	Long-term	Moderate	Very likely	Moderate (rehabilitation after decommissioning)	Moderate	Ensure no impacts outside authorised footprint; Where possible use earthy colours on buildings	Low	Very low	5	High

Table 2: Impact assessment summary table – Operation and Decommissioning Phase direct impacts.

Aspect/ Impact pathway	Nature of potential impact/risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of residual impact/risk	Confidence level
										Without mitigation /management	With mitigation /management (residual		
OPERATION PHASE													
Existence of facility in the rural landscape	**Impacts to the landscape**	Negative	Loca l	Long-term	Moderate	Very likely	Moderate (rehabilitation after decommissioning)	Moderate	Ensure that all maintenance activities remain within the authorised footprint.	Low	Very low	5	High
DECOMMISSIONING PHASE													
Decommiss ioning activities in the rural landscape	**Impacts to the landscape**	Negative	Loca l	Long-term	Moderate	Very likely	Moderate (rehabilitation after decommissioning)	Moderate	Ensure that all decommissioning activities remain within the authorised footprint.	Low	Very low	5	High

Table 3: Impact assessment summary table – Cumulative impacts

Aspect/ Impact pathway	Nature of potential impact/risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of residual impact/risk	Confidence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
ALL PHASEs													
Clearing of site and construction of facility	**Impacts to archaeological resources**	Negative	Site	Permanent	Moderate	Unlikely	Non-reversible	Moderate	Report accidental finds during development	Low	Very Low	5	High
	Impacts to graves	Negative	Site	Permanent	Moderate	Unlikely	Non-reversible	High	Report accidental finds during development	Low	Very Low	5	High
	Impacts to the rural landscape	Negative	Local	Long-term	Moderate	Very likely	Moderate (rehabilitation after decommissioning)	Moderate	Ensure no impacts outside authorised footprint; Where possible use earthy colours on buildings	Low	Very low	5	High

7.5. Impact assessment summary

Overall, impacts to heritage resources are expected to be of very low significance after mitigation because no significant impacts were identified for the project footprints and should heritage resources be found during construction these can be reported and easily mitigated. The same would apply to all other facilities and cumulative impacts are thus also expected to be of very low significance.

Table 4: *Overall impact significance (post mitigation).*

Phase	Overall Impact Significance
Construction	Very low (negative)
Operational	Very low (negative)
Decommissioning	Very low (negative)
Cumulative - Construction	Very low (negative)
Cumulative - Operational	Very low (negative)
Cumulative - Decommissioning	Very low (negative)

8. LEGISLATIVE AND PERMIT REQUIREMENTS

No permits are required but in terms of S.38(8) of the NHRA a comment from SAHRA must be sought prior to submission and considered by DEA prior to their decision-making. Should the footprint change and significant archaeological or palaeontological resources are impacted, or if such resources are discovered accidentally during construction, then SAHRA may require that a permit application be submitted to allow for the mitigation of these resources.

9. ENVIRONMENTAL MANAGEMENT PROGRAMME INPUTS

No specific monitoring is required other than to ensure that all work remains within the authorised footprint. Staff will need to be aware of the possibility of finding heritage resources and should know how to report these (firstly to the Environmental Control Officer (ECO) and/or Construction Manager and/or Contractor and secondly to an archaeologist or SAHRA). This information should be communicated by the ECO at the start of construction.

10. EVALUATION OF IMPACTS RELATIVE TO SUSTAINABLE SOCIAL AND ECONOMIC BENEFITS

Section 38(3)(d) of the NHRA requires an evaluation of the impacts on heritage resources relative to the sustainable social and economic benefits to be derived from the development.

It is difficult to specify the actual number of construction phase employment opportunities that will be created at this stage; however between 90 and 150 skilled and 400 and 460 unskilled employment opportunities are expected be created. During operation approximately 20 skilled and 40 unskilled employment opportunities will be created over the 20 year lifespan of the proposed facility.

11. CONCLUSIONS

The report has found that very few impacts to heritage resources are expected to occur. This is largely because the facility design has avoided known significant resources on the site. There are no significant impacts expected from either the PV plant, the substation or the powerline. Neither access road will cause impacts and both options are acceptable.

Table 5: *Heritage indicators and design responses.*

Indicator	Project Response
Significant fossils should not be damaged or destroyed without prior study and possibly rescue.	No significant palaeontological resources were identified within the project footprint. The EMPr will provide for the reporting of any chance finds made during construction.
Significant archaeological sites should not be damaged or destroyed without prior study and possibly rescue.	With the exception of the small pan close to the Nieuwehoop Substation, the project design has already avoided all known significant archaeological resources. The pan should be easily avoidable by the powerline and the EMPr will provide for the reporting of any chance finds made during construction.
Damage to unmarked graves should be minimised prior to their study and exhumation (if they cannot be avoided).	The EMPr will provide for the reporting of any chance finds made during construction.
The landscape should not be visually dominated by the development when viewed from a distance.	Because of the remote location of the facility, the existing infrastructure present (i.e. Nieuwehoop Substation and railway line) and the relatively low height of built features, such impacts are not expected.

No significant impacts are expected to arise from the proposed project. Significant archaeological resources on the site have been buffered as required and these are mapped in Figures 14 & 15. Only one of these– a pan in the powerline corridor – falls within the overall footprint and should be easily avoided.

11.1. Reasoned opinion of the specialist

Because of the very low significance of potential impacts to heritage resources and the very low likelihood of significant impacts occurring, it is recommended that the proposed PV5 solar energy facility and associated powerline should be authorised within the footprint proposed.

12. RECOMMENDATIONS

It is recommended that the proposed Kenhardt PV5 facility and its associated powerline should be authorised but subject to the following conditions which should be incorporated into the Environmental Authorisation:

- It the pan close to Nieuwehoop Substation is to be disturbed then it should be checked for archaeological materials and a decision made as to whether mitigation is required; and
- A pre-construction survey focusing on the well-defined water courses should be carried out to check for further significant stone artefacts scatters; and
- If any palaeontological or archaeological material or human burials are uncovered during the course of development then work in the immediate area should be halted. The find would need to be reported to the heritage authorities and may require inspection by an archaeologist. Such heritage is the property of the state and may require excavation and curation in an approved institution.

13. REFERENCES

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Orton, J. 2015a. Scoping and Environmental Impact Assessment for the proposed development of a 75 Mw Solar Photovoltaic Facility (Kenhardt PV 1) on the Remaining Extent of Onder Rugzeer Farm 168, North-East of Kenhardt, Northern Cape Province: EIA Report - Heritage Impact Assessment. Unpublished report prepared for CSIR. Muizenberg: ASHA Consulting (Pty) Ltd.

Orton, J. 2015b. Scoping and Environmental Impact Assessment for the proposed development of a 75 Mw Solar Photovoltaic Facility (Kenhardt PV 2) on the Remaining Extent of Onder Rugzeer Farm 168, North-East of Kenhardt, Northern Cape Province: EIA Report - Heritage Impact Assessment. Unpublished report prepared for CSIR. Muizenberg: ASHA Consulting (Pty) Ltd.

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APPENDIX 1 – Curriculum Vitae

Curriculum Vitae

Jayson David John Orton

ARCHAEOLOGIST AND HERITAGE CONSULTANT

Contact Details and personal information:

Address: 40 Brassie Street, Lakeside, 7945
Telephone: (021) 789 0327
Cell Phone: 083 272 3225
Email: jayson@asha-consulting.co.za

Birth date and place: 22 June 1976, Cape Town, South Africa
Citizenship: South African
ID no: 760622 522 4085
Driver's License: Code 08
Marital Status: Married to Carol Orton
Languages spoken: English and Afrikaans

Education:

SA College High School	Matric	1994
University of Cape Town	B.A. (Archaeology, Environmental & Geographical Science) 1997	
University of Cape Town	B.A. (Honours) (Archaeology)*	1998
University of Cape Town	M.A. (Archaeology)	2004
University of Oxford	D.Phil. (Archaeology)	2013

*Frank Schweitzer memorial book prize for an outstanding student and the degree in the First Class.

Employment History:

Spatial Archaeology Research Unit, UCT	Research assistant	Jan 1996 – Dec 1998
Department of Archaeology, UCT	Field archaeologist	Jan 1998 – Dec 1998
UCT Archaeology Contracts Office	Field archaeologist	Jan 1999 – May 2004
UCT Archaeology Contracts Office	Heritage & archaeological consultant	Jun 2004 – May 2012
School of Archaeology, University of Oxford	Undergraduate Tutor	Oct 2008 – Dec 2008
ACO Associates cc	Associate, Heritage & archaeological consultant	Jan 2011 – Dec 2013
ASHA Consulting (Pty) Ltd	Director, Heritage & archaeological consultant	Jan 2014 –

Professional Accreditation:

Association of Southern African Professional Archaeologists (ASAPA) membership number: 233
CRM Section member with the following accreditation:

- Principal Investigator: Coastal shell middens (awarded 2007)
  Stone Age archaeology (awarded 2007)
  Grave relocation (awarded 2014)
- Field Director: Rock art (awarded 2007)
  Colonial period archaeology (awarded 2007)

Association of Professional Heritage Practitioners (APHP) membership number: 43

- Accredited Professional Heritage Practitioner

➢ *Memberships and affiliations:*

South African Archaeological Society Council member	2004 – 2016
Assoc. Southern African Professional Archaeologists (ASAPA) member	2006 –
UCT Department of Archaeology Research Associate	2013 –
Heritage Western Cape APM Committee member	2013 –
UNISA Department of Archaeology and Anthropology Research Fellow	2014 –
Fish Hoek Valley Historical Association	2014 –
Kalk Bay Historical Association	2016 –
Association of Professional Heritage Practitioners member	2016 –

Fieldwork and project experience:

Extensive fieldwork and experience as both Field Director and Principle Investigator throughout the Western and Northern Cape, and also in the western parts of the Free State and Eastern Cape as follows:

Feasibility studies:
- Heritage feasibility studies examining all aspects of heritage from the desktop

Phase 1 surveys and impact assessments:
- Project types
    - Notification of Intent to Develop applications (for Heritage Western Cape)
    - Desktop-based Letter of Exemption (for the South African Heritage Resources Agency)
    - Heritage Impact Assessments (largely in the Environmental Impact Assessment or Basic Assessment context under NEMA and Section 38(8) of the NHRA, but also self-standing assessments under Section 38(1) of the NHRA)
    - Archaeological specialist studies
    - Phase 1 archaeological test excavations in historical and prehistoric sites
    - Archaeological research projects
- Development types
    - Mining and borrow pits
    - Roads (new and upgrades)
    - Residential, commercial and industrial development
    - Dams and pipe lines
    - Power lines and substations
    - Renewable energy facilities (wind energy, solar energy and hydro-electric facilities)

Phase 2 mitigation and research excavations:
- ESA open sites
    - Duinefontein, Gouda, Namaqualand
- MSA rock shelters
    - Fish Hoek, Yzerfontein, Cederberg, Namaqualand
- MSA open sites
    - Swartland, Bushmanland, Namaqualand
- LSA rock shelters
    - Cederberg, Namaqualand, Bushmanland
- LSA open sites (inland)
    - Swartland, Franschhoek, Namaqualand, Bushmanland
- LSA coastal shell middens
    - Melkbosstrand, Yzerfontein, Saldanha Bay, Paternoster, Dwarskersbos, Infanta, Knysna, Namaqualand
- LSA burials
    - Melkbosstrand, Saldanha Bay, Namaqualand, Knysna
- Historical sites
    - Franschhoek (farmstead and well), Waterfront (fort, dump and well), Noordhoek (cottage), variety of small excavations in central Cape Town and surrounding suburbs
- Historic burial grounds
    - Green Point (Prestwich Street), V&A Waterfront (Marina Residential), Paarl

Awards:

Western Cape Government Cultural Affairs Awards 2015/2016: Best Heritage Project.

APPENDIX 2 – Palaeontological study

APPENDIX 3 – Archaeological finds

All finds made in the broader study area during the 2015 survey are listed in the table below. The first column indicates which waypoints fall within the powerline and three PV study areas. All finds are listed in order to give further archaeological context to the finds.

PV/ PL	Way point	Co-ordinates	Description	Grade	Suggested Mitigation
	201	S29 12 06.7 E21 17 01.7	Flaked quartz outcrop with a few artefacts around it.	GPC	
	202	S29 11 18.4 E21 17 37.9	Flaked quartz outcrop with a few artefacts around it.	GPC	
	204	S29 10 47.0 E21 18 13.8	Flaked quartz outcrop with a few artefacts around it.	GPC	
PL	207	S29 11 57.4 E21 18 58.7	Flaked quartz outcrop with a few artefacts around it.	GPC	
PV5	208	S29 12 33.8 E21 17 15.8	Flaked quartz outcrop with a few artefacts around it.	GPC	
	209	S29 12 18.6 E21 16 45.9	Flaked quartz outcrop with a few artefacts around it.	GPC	
	210	S29 12 33.0 E21 18 49.6	Flaked quartz outcrop with a few artefacts around it.	GPC	
PV4	212	S29 13 34.3 E21 18 54.4	Flaked quartz outcrop with a few artefacts around it.	GPC	
	213	S29 13 49.7 E21 18 56.0	Single quartzite handaxe.	GPC	
	214	S29 14 10.4 E21 19 18.1	Patch of quartz cobbles with artefacts scattered in between.	GPC	
	215	S29 14 18.2 E21 19 10.9	Flaked quartz outcrop with a few artefacts around it.	GPC	
	216	S29 14 26.7 E21 19 12.2	Flaked quartz outcrop with a few artefacts around it.	GPC	
PV6	217	S29 15 01.5 E21 17 56.9	Isolated quartzite handaxe about 18 cm long.	GPC	
PV6	218	S29 14 50.6 E21 18 06.3	Flaked quartz outcrop with a few artefacts around it.	GPC	
PV6	219	S29 14 44.9 E21 18 01.5	Flaked quartz outcrop with a few artefacts around it.	GPC	
PL PV5	220	S29 12 51.8 E21 17 53.5	Half a bored stone. It was square in plan view and the hole is very skew through the stone. The intact side has been used as a hammer stone.	GPC	
PL PV5	221	S29 12 51.7 E21 17 54.7	A single quartzite handaxe with retouch on the butt end.	GPC	
PV5	222	S29 12 50.0 E21 17 46.3	A single quartz handaxe (very short, about 9 cm long).	GPC	
	223	S29 13 11.8 E21 17 24.1	Flaked quartz outcrop with a few artefacts around it. This is part of a larger quartz hill/ridge.	GPC	
	224	S29 13 11.5 E21 17 23.5	On the crest of the above quartz ridge there is a natural hollow of about 2.5 m by 1.5 m. Within this space is a pile of quartz blocks. In the sand and hyrax dung in the hollow there are a number of pieces of bottle glass, a shotgun cartridge, several ostrich eggshell fragments, two retouched cryptocrystalline silica (CCS) artefacts (a scraper	GPA	Avoid with a buffer of at least 30 m or conduct archaeological excavations in the hollow to rescue artefacts and data.

PV/ PL	Way point	Co-ordinates	Description	Grade	Suggested Mitigation
			and a miscellaneous retouched piece) and many quartz flakes. To the northeast, just below the quartz outcrop, there is a semi-circular 'clearing' amongst the quartz rocks and gravel but there did not appear to be artefacts in it.		Test excavate and expand if necessary in 'clearing' and map whole site (schematic scale drawing) (4 hours)
	225	S29 13 12.6 E21 17 19.7	LSA scatter of quartz, quartzite and ostrich eggshell in a sandy area between quartz gravel patches.	GPC	
	226	S29 13 40.6 E21 17 31.4	Flaked quartz outcrop with a few artefacts around it.	GPC	
	227	S29 13 44.6 E21 17 38.0	Massive quartz outcrop/hill standing at least 3 m above the surrounding land with a small shelter facing east-northeast. The floor has a number of glass fragments and a few quartz artefacts. There is also an area where the outcrop has been flaked.	GPC	
	228	S29 13 37.1 E21 17 34.0	Quartz artefacts scatter in sandy area alongside a river. One quartzite flake also seen.	GPC	
	229	S29 13 36.5 E21 17 33.5	A large scatter of quartz artefacts in a sandy area along a river. Nothing diagnostic seen but presumably it is LSA.	GPA	Avoid with a buffer of at least 30 m or conduct archaeological excavations to rescue artefacts and data (8 hours).
	230	S29 13 43.1 E21 17 27.5	Quartz gravel patch with quartz artefacts in between.	GPC	
	231	S29 13 57.3 E21 17 09.1	Flaked quartz outcrop with a few artefacts around it.	GPC	
PL PV6	232	S29 14 02.2 E21 17 36.9	Scatter of adiagnostic quartz artefacts about 50 m south of small pan. There appears to be a generally elevated density of quartz background scatter all around the pan, except to the northwest where the surface is coated in calcrete gravel.	GPC	
PV6	233	S29 14 00.8 E21 17 37.8	LSA scatter of quartz, quartzite and crypto-crystalline silica (CCS) spread around southern edge of pan.	GPA	Avoid with a buffer of at least 40 m from the centre of the pan or conduct archaeological excavations to rescue artefacts and data (4 hours).
PV6	234	S29 14 00.2 E21 17 37.2	Light LSA scatter of quartz, quartzite, CCS and silcrete located in the sandy outflow area of the pan (northwest side).	GPA	Avoid with a buffer of at least 40 m from the centre of the pan or conduct archaeological excavations to rescue artefacts and data (4 hours).
	723	S29 12 07.6 E21 17 14.9	Flaked quartz outcrop with a few artefacts around it.	GPC	
	724	S29 12 32.3 E21 16 55.0	Large flaked quartz outcrop with a few artefacts around it.	GPC	

PV/ PL	Way point	Co-ordinates	Description	Grade	Suggested Mitigation
	725	S29 11 55.6 E21 17 17.0	Large flaked quartz outcrop with a few flakes around it. Situated on a large, low rise covered in quartz gravel.	GPC	
	726	S29 11 53.7 E21 18 17.0	Likely grave. It is a loosely rectangular area packed with quartz cobbles that are all of similar size (showing human selection). Although some stones have been spread a few metres away with time, there is no quartz present in the general area. The substrate is very sandy (ephemeral stream bed) and well suited to excavation. It is not possible to tell if the grave is historical or pre-historic.	IIIA	Avoid with a buffer of at least 5 m or test excavate to check for human remains and then make a decision to avoid or exhume in line with required process.
	727	S29 11 55.0 E21 18 24.1	A light scatter of undiagnostic quartz flakes.	GPC	
	728	S29 11 37.1 E21 17 57.4	LSA artefact scatter along the north-western margin of a pan. Mostly quartz but quartzite, silcrete and crypto-crystalline silica (CCS) are also present. A partially made clear quartz backed bladelet was noted. Three waypoints were taken to define the site but only the first is provided here.	GPA	Avoid with a buffer of at least 75 m from the centre of the pan or conduct archaeological excavations to rescue artefacts and data (8 hours).
	729	S29 11 38.2 E21 17 59.1	Fairly dense artefact scatter of uncertain (and probably mixed) age located to the southeast of a pan. Mostly quartz but quartzite, silcrete and CCS are also present.	GPA	Avoid with a buffer of at least 75 m from the centre of the pan or conduct archaeological excavations to rescue artefacts and data (8 hours).
	730-737	Central location: S29 11 59.2 E21 17 49.8	Eight flaked quartz outcrops situated on a large, quartz-coated hill. Ephemeral artefact scatter in the gravel is almost all quartz but occasional other materials are evident. Co-ordinates for waypoint 735 are provided.	GPC	
	738	S29 12 25.8 E21 17 09.6	Flaked quartz outcrop with a few artefacts around it.	GPC	
	739	S29 13 15.9 E21 16 44.5	Two loose 'mounds' of quartz in a sandy area but close to a quartz gravel patch. These may be graves.	IIIA	Avoid with a buffer of at least 5 m or test excavate to check for human remains and then make a decision to avoid or exhume in line with required process.
PV5	740	S29 12 44.1 E21 17 20.8	Flaked quartz outcrop with a few artefacts around it.	GPC	
PV5	741	S29 12 28.8 E21 17 26.0	Flaked quartz outcrop with a few artefacts around it.	GPC	
	742	S29 12 26.8 E21 16 47.4	Likely grave. Rock slab planted on end deeply into the ground. It could not be moved. The slab is perfectly vertical, while exposed bedrock is generally dipping. It is in a sandy area with no other rocks present in the vicinity. It faces southwest/northeast.	IIIA	Avoid with a buffer of at least 30 m or test excavate to check for human remains and then make a decision to avoid or exhume in

PV/ PL	Way point	Co-ordinates	Description	Grade	Suggested Mitigation
					line with required process.
PV4	743	S29 13 22.7 E21 18 49.4	Flaked quartz outcrop with a few artefacts around it.	GPC	
	744	S29 13 35.8 E21 19 05.5	Flaked quartz outcrop with a few artefacts around it.	GPC	
	745	S29 15 19.9 E21 19 08.8	Low density, widespread LSA scatter of quartz and ostrich eggshell fragments spread along the river bank.	GPC	
	746	S29 15 16.4 E21 19 16.9	A set of about 8 to 11 small mounds of quartz at the edge of an area with much quartz gravel. It seems unlikely to be a graveyard, but yet is certainly not natural.	Unknown	Avoid with a buffer of at least 30m or test excavation to check if any human remains are present then make a decision to avoid or exhume in line with required process.
	747	S29 15 15.4 E21 19 18.1	A single quartzite handaxe. Tip is broken but remaining length is 17 cm.	GPC	
	748	S29 14 50.3 E21 19 17.9	Cluster of quartz cobbles with a few artefacts in between.	GPC	
	749	S29 14 46.7 E21 19 06.4	Ephemeral LSA scatter of quartz and ostrich eggshell located on the river terrace.	GPC	
	750	S29 14 45.3 E21 19 06.0	Ephemeral LSA scatter of quartz and ostrich eggshell located on the river terrace.	GPC	
	751	S29 15 15.4 E21 19 09.6	Small, but very dense scatter of ostrich eggshell fragments. One piece is definitely flaked and is quite likely a flask mouth fragment. Probably more than 100 pieces altogether.	GPC	
	752	S29 15 16.5 E21 19 05.4	Fragment of glass that looks like it is from a case bottle. Although the glass does not look all that old, there are bubbles in the glass.	GPC	
	753	S29 15 30.5 E21 19 04.6	Light LSA scatter of quartz and ostrich eggshell.	GPC	
	754	S29 15 29.9 E21 19 08.2	LSA ostrich eggshell scatter with rare quartz artefacts present.	GPC	
	755	S29 15 33.8 E21 19 11.5	Small cluster of about fifteen quartz rocks with a few pieces of ostrich eggshell.	GPC	
	756	S29 15 38.8 E21 19 12.1	Scatter of adiagnostic quartz artefacts.	GPC	
PV6	757	S29 15 14.9 E21 18 53.5	Flaked quartz outcrop with four fragments of bottle glass present. Bottle base has a small nipple on it. Base has been flaked.	GPC	
PV6	758	S29 14 55.1 E21 18 46.1	Bedrock exposure in stream with a slightly elevated density scatter of quartz around it. A careful search revealed no grinding grooves.	GPC	
PV6	759	S29 14 21.2 E21 18 41.2	Flaked quartz outcrop with a few artefacts around it.	GPC	
PV6	760	S29 14 34.5 E21 18 27.4	Large, dense quartz scatter with eight clusters. Presumably Holocene LSA, although no diagnostic artefacts or organic materials were seen. One quartzite cobble that might have been a hammer stone was present, as was a split quartzite cobble.	GPA	Avoid with a buffer of at least 75 m from GPS point or conduct archaeological excavations to rescue

PV/ PL	Way point	Co-ordinates	Description	Grade	Suggested Mitigation
			Eight waypoints were taken for the scatters at this site but only the middlemost one is provided here.		artefacts and data (24 hours).
PV6	761	S29 14 35.4 E21 18 31.9	Small LSA scatter of quartz with some ostrich eggshell and one bone fragment.	GPC	
PV6	762	S29 14 42.9 E21 18 27.8	Flaked quartz outcrop with a few artefacts around it.	GPC	
PL	763	S29 12 32.8 E21 18 08.1	A mixed age scatter of MSA, LSA and historical material along the south side of a pan. It is too mixed to be of much value.	GPC	
	764	S29 12 32.6 E21 18 21.0	Adiagnostic scatter of quartz artefacts. Essentially a high density area of background scatter.	GPC	
PV4	765	S29 13 37.6 E21 18 51.0	Flaked quartz outcrop with a few artefacts around it.	GPC	
PV6	766	S29 14 04.2 E21 18 18.5	Flaked quartz outcrop with a few artefacts around it.	GPC	
PV6	767	S29 14 00.1 E21 17 21.7	Flaked quartz outcrop with a few artefacts around it.	GPC	
PL	n/a	S29 11 30.0 E21 18 58.0	This koppie is the rocky koppie along the eastern margin of the site. It was not surveyed because of the change in layout after the 2015 survey. However, the eastern half of it on the neighbouring farm has been examined for another project (Orton 2016c) and archaeological resources do occur on the koppie. The grade applied is based on the eastern side.	GPA	Avoid koppie with a buffer of 120 m from the summit of the koppie.
PL	n/a	S29 09 03.0 E21 20 00.0	A pan occurs in the north-eastern end of the powerline corridor. It was not visited but given that archaeological materials occur around virtually every pan in Bushmanland, it is likely that some will be present here. He grade is based on what is likely to occur.	GPA	Avoid pan with a buffer of 30 m from the edge of the silty area.

APPENDIX 4 – Mapping

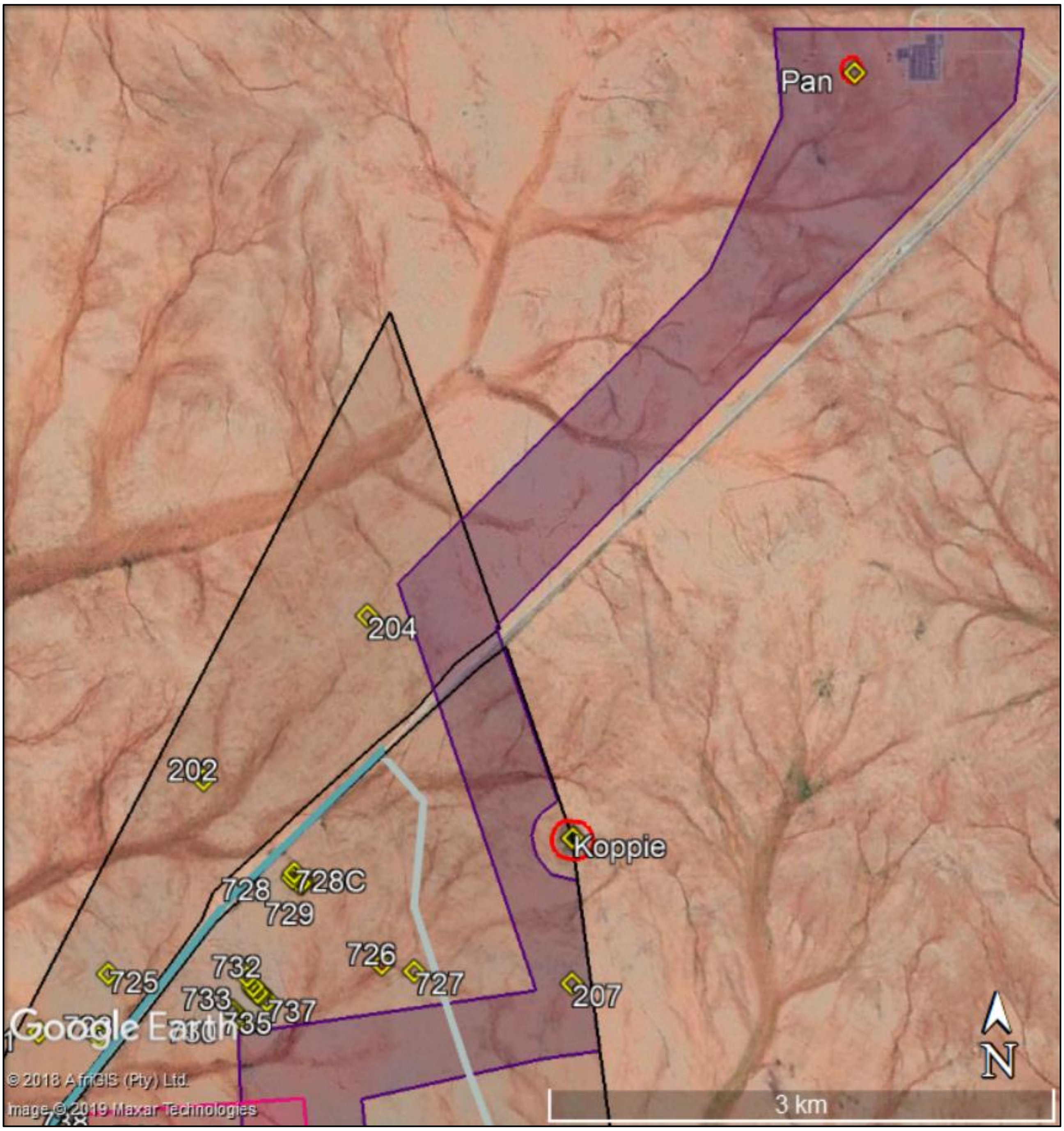

Figure A4.1: *Aerial view of the northern part of the powerline corridor showing all archaeological finds (numbered yellow symbols).*

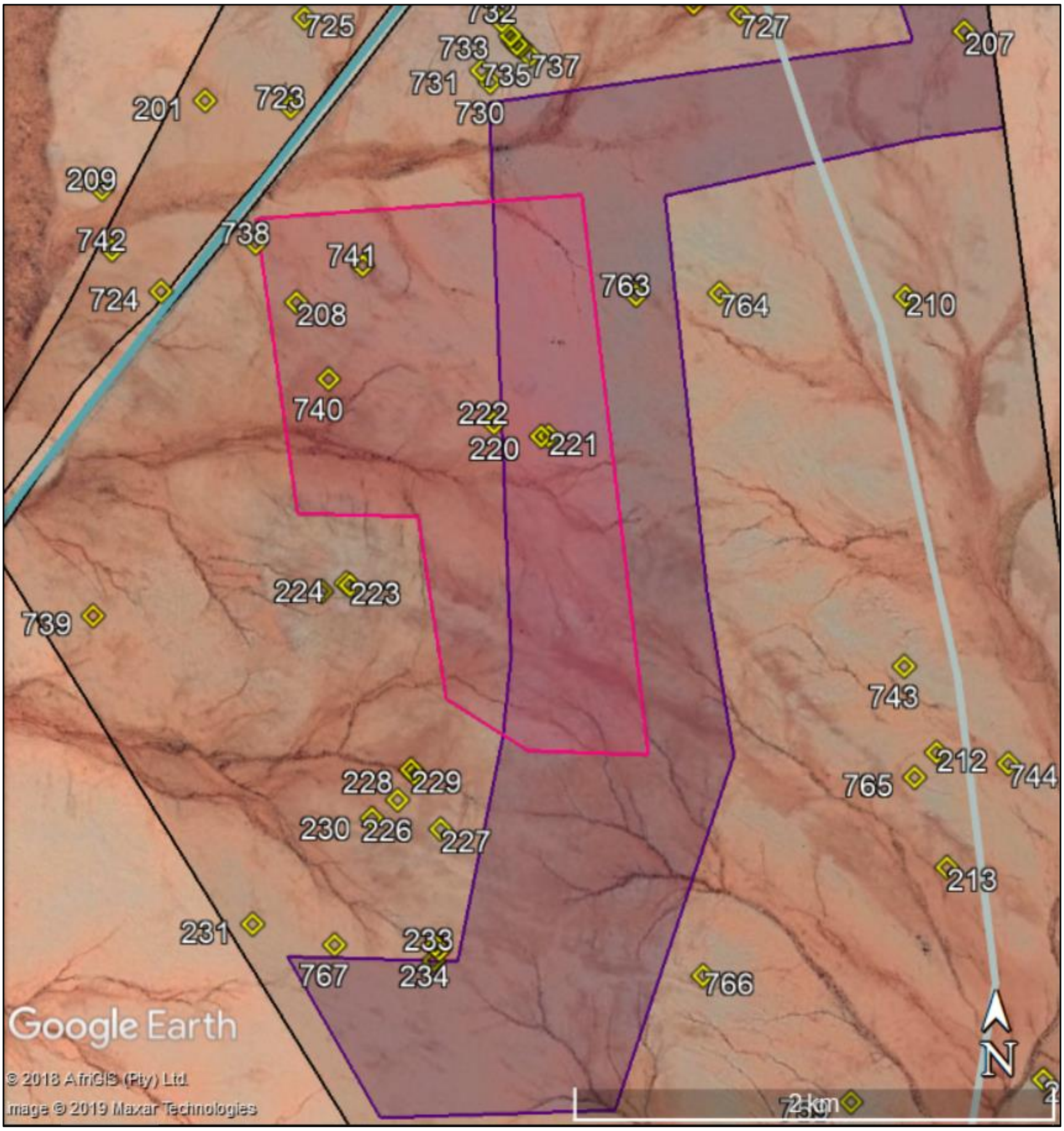

Figure A4.2: *Aerial view of the southern part of the powerline corridor (purple polygon) and the PV5 study area (pink polygon) showing all archaeological finds (numbered yellow symbols).*

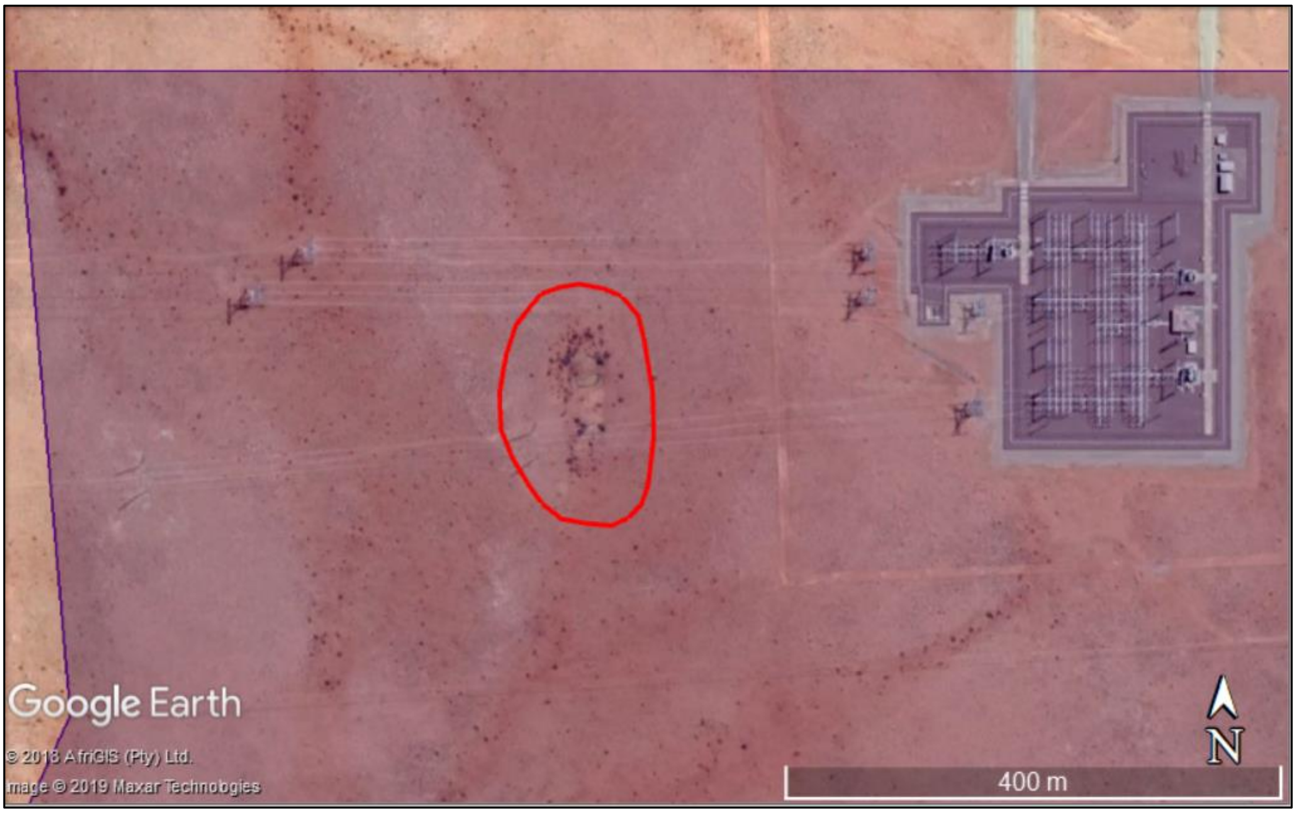

Figure A4.3: *Aerial view of the far northern end of the powerline corridor showing the sensitive area (red circle).*

PALAEONTOLOGICAL IMPACT ASSESSMENT:

Basic Assessment for the Proposed Development of a 100 MW Solar Photovoltaic Facility (KENHARDT PV5) on Onder Rugzeer Farm 168 and associated electrical infrastructure, north-east of Kenhardt, Northern Cape Province

Report prepared for:

CSIR – Environmental Management Services

P O Box 320

Stellenbosch 7599

South Africa

Report prepared by:

Dr John Almond - Natura Viva cc

P.O. Box 12410

Mill Street, Cape Town, 8010

South Africa

December 2019

SPECIALIST EXPERTISE

Dr John Almond has an Honours Degree in Natural Sciences (Zoology) as well as a PhD in Palaeontology from the University of Cambridge, UK. He has been awarded post-doctoral research fellowships at Cambridge University and in Germany, and has carried out palaeontological research in Europe, North America, the Middle East as well as North and South Africa and Madagascar. For eight years he was a scientific officer (palaeontologist) for the Geological Survey / Council for Geoscience in the RSA. His current palaeontological research focuses on fossil record of the Precambrian - Cambrian boundary and the Cape Supergroup of South Africa. He has recently written palaeontological reviews for several 1: 250 000 geological maps published by the Council for Geoscience and has contributed educational material on fossils and evolution for new school textbooks in the RSA.

Since 2002 Dr Almond has also carried out numerous palaeontological impact assessments for developments and conservation areas in the Western, Eastern and Northern Cape, Free State, Northwest, Mpumalanga and Gauteng under the aegis of his Cape Town-based company *Natura Viva* cc. He was a long-standing member of the Archaeology, Palaeontology and Meteorites Committee for Heritage Western Cape (HWC) and an advisor on palaeontological conservation and management issues for the Palaeontological Society of South Africa (PSSA), HWC and SAHRA. He is currently compiling technical reports on the provincial palaeontological heritage of Western, Northern and Eastern Cape for SAHRA and HWC. Dr Almond is an accredited member of PSSA and APHAP (Association of Professional Heritage Assessment Practitioners – Western Cape).

SPECIALIST DECLARATION

I, Dr John Edward Almond, as the appointed independent specialist, in terms of the 2014 EIA Regulations, hereby declare that I:

- I act as the independent specialist in this application;
- I 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;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct, and do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 and any specific environmental management Act;
- 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 have no vested interest in the proposed activity proceeding;
- 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;
- I have ensured that information containing all relevant facts in respect of the specialist input/study was distributed or made available to interested and affected parties and the public and that participation by interested and affected parties was facilitated in such a manner that all interested and affected parties were provided with a reasonable opportunity to participate and to provide comments on the specialist input/study;
- I have ensured that the comments of all interested and affected parties on the specialist input/study were considered, recorded and submitted to the competent authority in respect of the application;
- all the particulars furnished by me in this specialist input/study are true and correct; and
- I realize that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

John E. Almond

Signature of the specialist:

Name of Specialist: Dr John Edward Almond

Date: 3 December 2019

EXECUTIVE SUMMARY

Scatec Solar Africa (PTY) Ltd is proposing to develop a 100 MW Solar PV power generation facility, to be known as the Kenhardt PV5, on Onder Rugzeer Farm 168, situated *c*. 20 km north-east of Kenhardt, Northern Cape Province. The preferred site for the proposed PV facility and the associated 132 kV transmission line to the existing Nieuwehoop Substation is underlain at depth by Precambrian basement rocks (*c*. 1-2 billion years old) assigned to the Namaqua-Natal Province. These ancient igneous and high-grade metamorphic rocks - mainly granites and gneisses of the Keimoes Suite and Jacomynspan Group - crop out at surface in small areas and are entirely unfossiliferous. A large proportion of the basement rocks are mantled by a range of superficial sediments of Late Caenozoic age that may contain sparse fossil remains. These predominantly thin, unconsolidated deposits include small patches of calcretes, gravelly to sandy river alluvium, pan sediments, surface gravels, colluvium (scree) as well as Pleistocene to Recent wind-blown sands of the Gordonia Formation (Kalahari Group). Most of these younger rock units are of widespread occurrence and low palaeontological sensitivity. Scientifically important vertebrate fossil remains (*e.g.* Pleistocene mammalian bones and teeth) have been recorded within older stratified pan and river sediments elsewhere in the Bushmanland region where they are often associated with stone artefacts, while a limited range of trace fossils (*e.g.* plant root casts, termitaria and other invertebrate burrows) may be found within calcrete horizons. The Kenhardt region in the south-western portion of REDZ7 was assessed as of low sensitivity in the Strategic Environmental Assessment for Wind and Solar Photovoltaic Energy in South Africa (Almond *in* Fourie *et al.* 2014).

No previously recorded areas or sites of exceptional fossil heritage sensitivity or significance have been identified within the Kenhardt PV project area as a whole. Due to the inferred scarcity of scientifically important fossil remains within the PV5 study area, the overall impact significance of the construction phase of the proposed solar energy project is assessed as VERY LOW (before and after mitigation). No significant impacts on fossil heritage are anticipated during the operational and decommissioning phases of the proposed solar energy facility. The potentially fossiliferous sedimentary rock units represented within the study area (*e.g.* Gordonia sands, calcrete) are of widespread occurrence and this is also likely to apply to most of the fossils they contain. It is concluded that the cumulative impacts on fossil heritage resource posed by the known alternative energy and other infrastructural developments in the region – including the two other proposed Scatec Solar PV projects on Onder Rugzeer Farm 168 - is very low. There are no fatal flaws in the proposed solar facility development, nor are there objections to its authorisation as far as fossil heritage conservation is concerned, since significant impacts on scientifically valuable fossils or fossil sites are not anticipated here. The no-go option (no solar developments) will have a neutral impact on local palaeontological heritage resources. The only proposed condition to accompany environmental authorisation is that the recommendations for monitoring and mitigation included in the EMPr are fully complied with.

Given the general low palaeontological sensitivity of the eastern Bushmanland region, as determined from desktop and field-based studies, as well as the inferred very low impact significance of the Kenhardt PV5 100 MW Solar PV Facility and transmission line for fossil heritage conservation, there are no objections on palaeontological heritage grounds to authorisation of the project. No specialist palaeontological monitoring or mitigation is recommended here, pending the potential discovery of significant new fossil remains during construction. During the construction phase all substantial bedrock excavations should be monitored for fossil material by the responsible Environmental Control Officer. Should significant fossil remains - such as vertebrate bones and teeth, plant-rich fossil lenses, petrified wood or dense fossil burrow assemblages - be exposed during construction, the responsible Environmental Control Officer should safeguard these, preferably *in situ*. The South African Heritage Resources Authority (SAHRA) should be alerted as soon as possible (Contact details: SAHRA, 111 Harrington Street, Cape Town. P.O. Box 4637, Cape Town 8000, South Africa. Phone : +27 (0)21 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za). This is so that appropriate action can be taken by a professional palaeontologist, at the developer's expense. Mitigation would normally involve the scientific recording and judicious sampling or collection of fossil material as well as associated geological data (*e.g.* stratigraphy, sedimentology, taphonomy) by a professional palaeontologist. The palaeontologist concerned with mitigation work will need a valid fossil collection permit from SAHRA and any material collected would have to be curated in an approved depository (*e.g.* museum or university collection). These recommendations should be included within the EMPr for the proposed solar energy facility development and associated electrical infrastructure.

In this report the entire site for the proposed Kenhardt PV5 100 MW Solar Photovoltaic (PV) Facility on Onder Rugzeer Farm 168 has been assessed based on the worst case scenario. From a palaeontological heritage impact point of view, the applicant can select any 250 ha area within the surveyed area to build the PV plant, provided that the recommended mitigation measures are implemented as applicable.

LIST OF ABBREVIATIONS

DEA	Department of Environmental Affairs
EIA	Environmental Impact Assessment
PIA	Palaeontological Impact Assessment
SAHRA	South African Heritage Resources Agency
Ma / mya	Million years ago
REDZ	Renewable Energy Development Zone

GLOSSARY

Definitions	
Basement Rocks	Ancient igneous and metamorphic rocks (usually unfossiliferous) underlying the sedimentary cover rocks in a given region
Calcrete	Pedogenic limestone (*i.e.* limestone generated by soil processes within soils and surface rock debris), generally associated with seasonally arid climates.
Fossiliferous	Containing fossil remains
Igneous Rocks	Rocks that have crystallised from a molten state (magma / lava); *e.g*. granite.
Metamorphic	Rocks that have recrystallized under conditions of altered (usually highly elevated) temperature and pressure; *e.g.* gneiss.
Precambrian	Older than 541 million years old (mya).
Pleistocene Epoch	Time period between *c*. 2.6 mya and 10 000 years ago (associated with a series of major glaciations in the northern hemisphere).

COMPLIANCE WITH THE APPENDIX 6 OF THE 2014 EIA REGULATIONS

Requirements of Appendix 6 – GN R982	**Addressed in the Specialist Report**
1. (1) A specialist report prepared in terms of these Regulations must contain- a) details of- i. the specialist who prepared the report; and ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	p1
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	p2
c) an indication of the scope of, and the purpose for which, the report was prepared;	Section 1.1
d) the date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Not Applicable
e) a description of the methodology adopted in preparing the report or carrying out the specialised process;	Section 1.1
f) the specific identified sensitivity of the site related to the activity and its associated structures and infrastructure;	Section 1.3
g) an identification of any areas to be avoided, including buffers;	Not Applicable
h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Section 1.3
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 1.1.4
j) a description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment;	Section 1.5, 1.6, 1.7 and 1.8
k) any mitigation measures for inclusion in the EMPr;	Section 1.7 and Section 1.8
l) any conditions for inclusion in the environmental authorisation;	Section 1.8
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 1.8
n) a reasoned opinion- i. as to whether the proposed activity or portions thereof should be authorised; and ii. if the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Section 1.8
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	Not Applicable
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	Not applicable
q) any other information requested by the competent authority.	Not applicable

TABLE OF CONTENTS

TABLES AND FIGURES

PALAEONTOLOGICAL IMPACT ASSESSMENT

This chapter presents the findings of the desktop Palaeontological Impact Assessment that was prepared by Dr. John Almond (of Natura Viva cc) as part of the Basic Assessment (BA) for the proposed Kenhardt PV5 project and associated 132 kV transmission line within the Northern Cape Province.

1.1. INTRODUCTION AND METHODOLOGY

1.1.1. Scope and Objectives

The proposed Kenhardt PV5 100 MW Solar Photovoltaic (PV) Facility and associated electrical infrastructure project area overlies potentially fossiliferous sedimentary rocks. Desktop Palaeontological Impact Assessments (Almond 2016a-d) were previously requested by the South African Heritage Resources Agency (SAHRA) Archaeology, Palaeontology and Meteorites Unit for the Kenhardt PV 1, 2 and 3 Solar Facilities on Farm Onder Rugzeer 168, including the supporting electrical infrastructure, which have all been subsequently authorised. A comparable palaeontological heritage desktop assessment has accordingly been undertaken here for the combined Basic Assessment for the newly proposed Kenhardt PV5 100 MW Solar Photovoltaic (PV) Facility and associated electrical infrastructure.

Linked to the above, this report provides a desktop assessment of potential impacts on local palaeontological (*i.e.* fossil) heritage within the study area for the proposed Kenhardt PV5 100 MW Solar PV Facility on Onder Rugzeer Farm 168, situated *c*. 20 km north-east of Kenhardt, Northern Cape Province. The report contributes to the BA for this alternative energy development and includes recommendations for inclusion in the EMPr.

The overall objectives of the specialist study are to:

- Determine the current conditions in sufficient detail so that there is a baseline against which impacts can be identified and measured.
- Identify potential impacts that may occur during the construction, operational and decommissioning phases of the proposed development, as well as impacts associated with future environmental changes if the “no-go” option is implemented (both positive and negative).
- Assess the impacts in terms of direct, indirect and cumulative impacts.
- Provide recommendations with regards to potential monitoring programmes.
- Determine mitigation and/or management measures which could be implemented to as far as possible reduce the effect of negative impacts and enhance the effect of positive impacts.
- Incorporate and address all issues and concerns raised in relation to palaeontological impacts.

1.1.2. Terms of Reference

The Terms of Reference for the present study, as defined by the CSIR, are as follows:

Prepare and undertake a desktop study on the palaeontology and fossil heritage within the proposed project area, based on:

- a review of all relevant palaeontological and geological literature, including geological maps and previous reports,

- data on the proposed development (e.g. location of footprint, depth and volume of bedrock excavation envisaged).

- Describe the type and location of known fossil heritage sites in the study area, and characterize all items that may be affected by the proposed project.
- Note fossils and associated sedimentological features of palaeontological relevance (photos, maps, aerial or satellite images, and stratigraphic columns).
- Evaluate the potential for occurrence of palaeontology and fossil heritage features within the study area.
- Identify and rate potential direct, indirect and cumulative impacts of the proposed project on the palaeontology and fossil heritage during the construction, operational and decommissioning phases of the project. Study the cumulative impacts of the project by considering the impacts of existing industries/solar PV plants within the area (as well as those PV plants that are proposed), together with the impact of the proposed project.
- Provide recommendations and suggestions regarding fossil heritage management on site, including conservation measures, as well as promotion of local fossil heritage (e.g. for public education, schools) to ensure that the impacts are limited.
- Determine mitigation and/or management measures which could be implemented to as far as possible reduce the effect of negative impacts and enhance the effect of positive impacts;
- Incorporate and address all issues and concerns raised by I&APs and the public (if applicable).
- Incorporate and address all review comments made by the Project Team (CSIR and Project Applicant).
- Provide review input on the preferred infrastructure layout and routes following the sensitivity analysis.
- Comply with the report templates provided by the CSIR, as well as the 2014 EIA Regulations (as amended), where it relates to specialist assessments.
- Review the Generic EMPr for 1) Power Lines and 2) Substations (GN 435) and confirm if there are any specific environmental sensitivities or attributes present on the site and any resultant site specific impact management outcomes and actions that are not included in the pre-approved generic EMPr (Part B – Section 1). If so, provide a list of these specific impact management outcomes and actions based on the format of the report template provided by the CSIR.

1.1.3. Approach and Methodology

In preparing a palaeontological desktop study the potentially fossiliferous rock units (groups, formations etc.) represented within the study area are determined from geological maps and satellite images. The known fossil heritage within each rock unit is inventoried from the published scientific literature, previous palaeontological impact studies in the same region, and the author's field experience and palaeontological database (consultation with professional colleagues as well as examination of institutional fossil collections may play a role here). This data is then used to assess the palaeontological sensitivity of each rock unit to development (provisional tabulations of palaeontological sensitivity of all formations in the Western, Eastern and Northern Cape have already been compiled by J. Almond and colleagues (*e.g.* Almond & Pether 2008). The likely impact of the proposed development on local fossil heritage is then determined on the basis of (1) the palaeontological sensitivity of the rock units concerned and (2) the nature and scale of the development itself, most significantly the extent of fresh bedrock excavation envisaged. When rock units of moderate to high palaeontological sensitivity are present within the development footprint, a Phase 1 field assessment study by a professional palaeontologist is usually warranted to identify any palaeontological hotspots and make specific recommendations for any mitigation required before or during the construction phase of the development. However, due to the low palaeontological sensitivity of the present study area a Phase 1 field assessment is not required and a desktop assessment is being undertaken instead (i.e. this study).

On the basis of the desktop and Phase 1 field assessment studies, the likely impact of the proposed development on local fossil heritage and any need for specialist mitigation are then determined. Adverse palaeontological impacts normally occur during the construction rather than the operational or decommissioning phase. Phase 2 mitigation by a professional palaeontologist – normally involving the recording and sampling of fossil material and associated geological information (*e.g.* sedimentological data) may be required (a) in the pre-construction phase where important fossils are already exposed at or near the land surface and / or (b) during the construction phase when fresh fossiliferous bedrock has been exposed by excavations. To carry out mitigation, the palaeontologist involved will need to apply for a palaeontological collection permit from the relevant heritage management authorities for the Northern Cape, *i.e.* the South African Heritage Resources Agency (Contact details: SAHRA, 111 Harrington Street, Cape Town. P.O. Box 4637, Cape Town 8000, South Africa. Phone : +27 (0)21 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za). It should be emphasized that, providing appropriate mitigation is carried out, the majority of developments involving bedrock excavation can make a positive contribution to our understanding of local palaeontological heritage.

1.1.4. Assumptions and Limitations

The accuracy and reliability of palaeontological specialist studies as components of Heritage Impact Assessments are **generally** limited by the following constraints:

1. Inadequate database for fossil heritage for much of South Africa, given the large size of the country and the small number of professional palaeontologists carrying out fieldwork here. Most development study areas – including the Scatec Solar project area - have never been surveyed by a palaeontologist.

2. Variable accuracy of geological maps which underpin these desktop studies. For large areas of terrain these maps are largely based on aerial photographs alone, without ground-truthing. The maps generally depict only significant ("mappable") bedrock units as well as major areas of superficial "drift" deposits (alluvium, colluvium) but for most regions give little or no idea of the level of bedrock outcrop, depth of superficial cover (soil etc.), degree of bedrock weathering or levels of small-scale tectonic deformation, such as cleavage. All of these factors may have a major influence on the impact significance of a given development on fossil heritage and can only be reliably assessed in the field.

3. Inadequate sheet explanations for geological maps, with little or no attention paid to palaeontological issues in many cases, including poor locality information.

4. The extensive relevant palaeontological "grey literature" - in the form of unpublished university theses, impact studies and other reports (e.g. of commercial mining companies) - that is not readily available for desktop studies.

5. Absence of a comprehensive computerized database of fossil collections in major South African institutions which can be consulted for impact studies. A Karoo fossil vertebrate database is now accessible for impact study work.

In the case of palaeontological desktop studies without supporting Phase 1 field assessments these limitations may variously lead to either:

(a) underestimation of the palaeontological significance of a given study area due to ignorance of significant recorded or unrecorded fossils preserved there, or

(b) overestimation of the palaeontological sensitivity of a study area, for example when originally rich fossil assemblages inferred from geological maps have in fact been destroyed by tectonism or weathering, or are buried beneath a thick mantle of unfossiliferous “drift” (soil, alluvium *etc.*).

Since most areas of South Africa have not been studied palaeontologically, a palaeontological desktop study usually entails inferring the presence of buried fossil heritage within the study area from relevant fossil data collected from similar or the same rock units elsewhere, sometimes at localities far away. Where substantial exposures of bedrocks or potentially fossiliferous superficial sediments are present in the study area, the reliability of a palaeontological impact assessment may be significantly enhanced through field assessment by a professional palaeontologist.

In the case of the Scatec Solar project area near Kenhardt in the Northern Cape, bedrock exposure is limited due to extensive cover by superficial deposits (*e.g.* alluvium, soils, surface gravels), especially in areas of low relief, as well as by pervasive *bossieveld* vegetation. For this reason, as well as the low palaeontological sensitivity of the sedimentary rocks mapped in the project area, a desktop-level rather than field-based assessment was considered appropriate for this study. Despite the lack of palaeontological field data from the project area itself, confidence levels in the conclusions reached in the desktop study are moderately high because of the author’s field experience of the sedimentary rocks represented in the wider Bushmanland region (See reference list for previous palaeontological assessments in the area; *e.g.* Almond 2009, 2011, 2014a-e, Almond 2016a-n, 2017, 2018a-b). Recent palaeontological heritage assessments for several other alternative energy developments in the region have been taken into consideration (*e.g.* the Nieuwehoop Solar Park just to the east of the Scatec Solar project area).

In terms of the impact assessment, the methodology adopted is outlined in Chapter 4 of the EIA Report, which also notes the developments within a 30 km radius that have been considered in order to assess cumulative impacts.

1.1.5. Sources of Information

The information used in this desktop study was based on the following sources:

1. A detailed project outline supplied by the CSIR - Environmental Management Services.
2. Previous desktop palaeontological assessment reports for study areas in the Kenhardt region by the author (Almond 2009, 2011, 2014a-e, 2016a-n, 2017, 2018a-b).
3. A review of the relevant scientific literature, including published geological maps (e.g. 1: 250 000 scale geological map sheet 2920 Kenhardt published by the Council for Geoscience, Pretoria) and accompanying sheet explanations (*e.g.* Slabbert *et al*. 1999)
4. The author’s previous field experience with the formations concerned and their palaeontological heritage (*cf* Almond and Pether 2008; SAHRIS website).

1.1.6. Declaration of Independence of Specialists

Refer to the first page of this Basic Assessment Report for the Curriculum Vitae of Dr. John Almond, which highlights his experience and expertise. The declaration of independence by the specialist is provided on Page 2 and in Box 10.1 below.

BOX 10.1: DECLARATION OF INDEPENDENCE

I, John Almond, declare that I am an independent consultant and have no business, financial, personal or other interest in the proposed Kenhardt PV 1 Project, application or appeal in respect of which I 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 my performing such work.

John E. Almond

Dr John E. Almond, *Natura Viva* cc, Cape Town, RSA

1.2. DESCRIPTION OF PROJECT ASPECTS RELEVANT TO PALAEONTOLOGICAL HERITAGE IMPACTS

The proposed solar facility will consist of the following components:

- Solar Field, comprising Solar Arrays with a maximum height of 10m and maximum footprint of 250 hectares per project, including the following:
  - PV Modules;
  - Single Axis Tracking structures (aligned north-south), Fixed Axis Tracking (aligned east-west), Dual Axis Tracking (aligned east-west and north-south) or Fixed Tilt Mounting Structure (all options will be considered in the design);
  - Solar module mounting structures comprised of galvanised steel and aluminium; and
  - Foundations which will likely be drilled and concreted into the ground.

- Building Infrastructure
  - Offices (maximum height 7m and footprint of 1000 m^2);
  - Operational and maintenance control centre (maximum height 7m and footprint 500 m^2);
  - Warehouse/workshop (maximum height 7m and footprint 500 m^2);
  - Ablution facilities (maximum height 7m and footprint 50 m^2);
  - 24 Converter/Inverter stations (height from 2.5m to 7m and footprint 2500 m^2);
  - On-site substation building (footprint 20 000 m^2).; and
  - Guard Houses (height 3m, footprint 40 m^2).

- Associated Infrastructure
  - 132 kV overhead transmission line with a 31 m wide servitude to connect to the existing Eskom Nieuwehoop substation (A 300 m wide corridor is assessed here);
  - Associated electrical infrastructure at the Eskom Nieuwehoop Substation (including but not limited to feeders, busbars, transformer bay and extension to the platform at the Eskom Nieuwehoop Substation);
  - On-site substation;
  - Battery storage (approx. 200m^2);
  - Internal 33 kV transmission lines/underground cables (either underground to maximum depth of 1m or above ground with height of 9m);
  - Underground low voltage cables or cable trays (underground to maximum depth of 1m);

- Access roads. Maximum 8m wide, including proposed upgrade of the jeep track to a road to reach PV6;
- Internal gravel roads (width of 4m);
- Fencing;
- Panel maintenance and cleaning area;
- Stormwater channels; and
- Temporary work area during the construction phase (*i.e.* laydown area of maximum 5 ha).

The total maximum project footprint is 250 hectares, including the PV facility and infrastructure such as roads for each PV facility.

As noted above, the Scatec Solar project area near Kenhardt is located in a region of Bushmanland that is underlain by potentially fossiliferous sedimentary rocks of Late Tertiary or Quaternary age as well as by unfossiliferous basement rocks (discussed in Section 1.3 of this chapter). The construction phase of the proposed development will entail substantial excavations into the superficial sediment cover and locally into the underlying bedrock as well. These include, for example, surface clearance operations, excavations for the solar array footings, underground cables, access and internal gravel roads, 132 kV transmission line towers, on-site substation, laydown areas, stormwater channels, water pipelines (if required) and foundations for buildings (offices, operational control centre, warehouse/workshop). All these developments may adversely affect potential, legally-protected fossil heritage resources within the study area by destroying, disturbing or permanently sealing-in fossils at or beneath the surface of the ground that are then no longer available for scientific research or other public good.

The planning, operational and decommissioning phases of the proposed solar energy facility are very unlikely to involve additional adverse impacts on local palaeontological heritage, however.

1.3. DESCRIPTION OF THE AFFECTED ENVIRONMENT

In this section of the report an outline of the geology of the proposed Kenhardt PV5 project area is first given, based on the relevant geological maps and scientific literature. This is followed by a brief review of fossil heritage that has previously been recorded from the sedimentary rock units that are represented within the project area.

1.3.1. Geological Context

As mentioned above, the project area for the proposed Phase 2 Kenhardt PV projects on the Farm Onder Rugzeer 168, located some 20 km northeast of Kenhardt, Northern Cape, is situated within the semi-arid Bushmanland region between *c.* 950 to 900 m amsl, with a general slope towards the south. It is drained by a dendritic network of shallow, southwest-flowing tributary streams of the Hartbeesrivier, such as the Rugseersrivier in the south and the Wolfkop se Loop in the north (Figure 1).

The geology of the study area is shown on 1: 250 000 geology sheet 2920 Kenhardt (Council for Geoscience, Pretoria) (Figure 2). The entire area is underlain at depth by a variety of Precambrian basement rocks that are *c*. 1-2 billion years old and are assigned to the **Namaqua-Natal Province**. These ancient igneous and high-grade metamorphic rocks - mainly granites and gneisses - crop out at surface as small patches and are entirely unfossiliferous. The Precambrian crustal rocks are transected by a NW-SE trending fault zone and lie to the north of the major Wolfkop Fault. The basement rock units represented in the combined PV5 and transmission line study area includes the **Jacomyns Pan Group** (gneisses of the

Sandnoute Formation) and the **Keimoes Suite** (Elsie se Gorra Granite). These rock units are described in the Kenhardt 1: 250 000 sheet explanation by Slabbert *et al.* (1999) and placed in the context of the Namaqua-Natal Province by Cornell *et al.* (2006). However, they are entirely unfossiliferous and so will not be discussed further here.

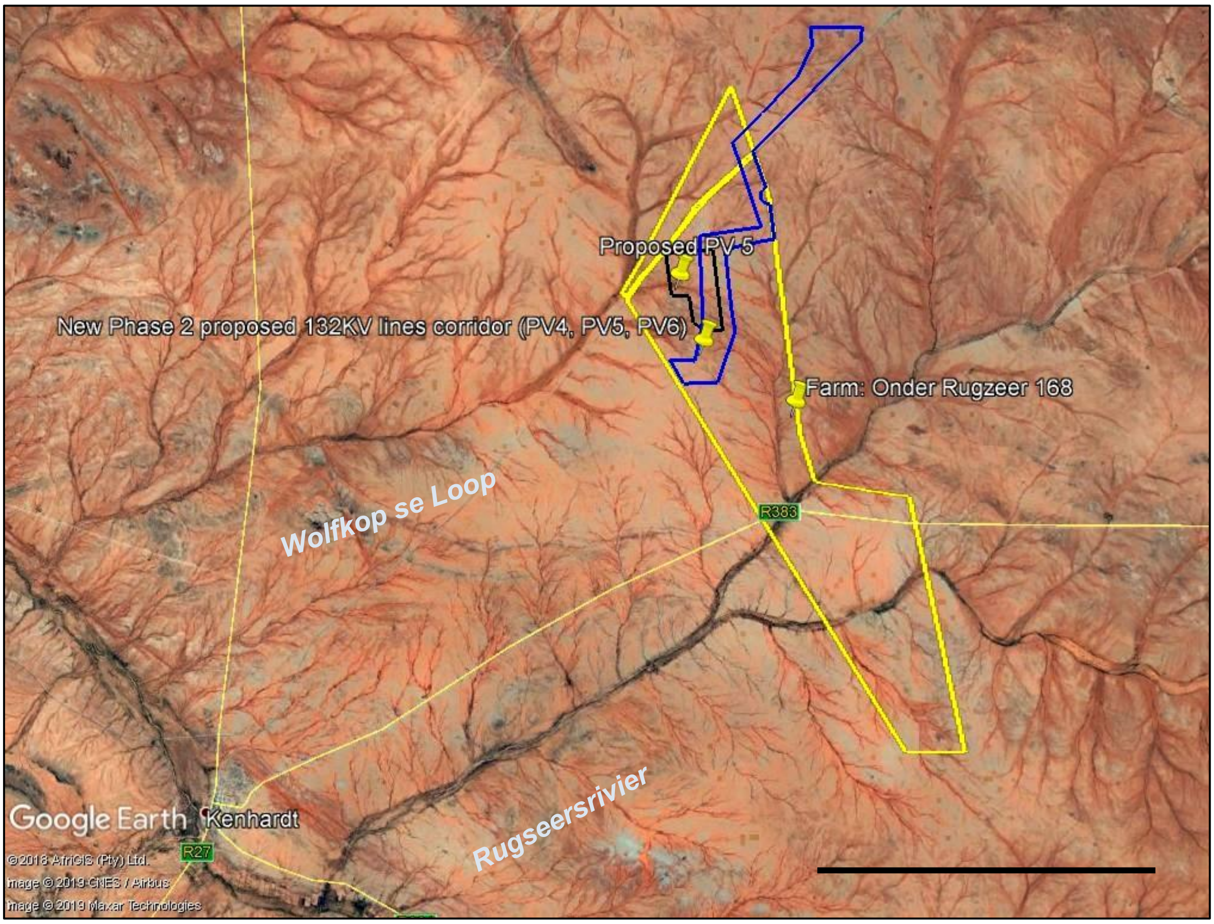

Figure 1. Google Earth© satellite image of the semi-arid Scatec Solar Phase 2 project area on Farm Onder Rugzeer 168, located *c*. 20 km NE of Kenhardt, Northern Cape (yellow polygon). The proposed PV5 site is shown in black and the associated 132 kV transmission line corridor to the existing Eskom Nieuwehoop substation is outlined in blue. Scale bar = 10 km. North towards the top of the image.

A large proportion of the basement rocks in the proposed project area are mantled by a range of superficial sediments of Late Caenozoic age, some of which are included within the **Kalahari Group**. These predominantly thin, unconsolidated deposits include small patches of calcretes (soil limestones), gravelly to sandy river alluvium, pan sediments along certain watercourses, surface gravels, colluvium (scree) as well as – especially – Quaternary to Recent aeolian (wind-blown) sands of the Gordonia Formation (Kalahari Group). The basement rocks in the PV5 study area, with the possible exception of a small outlier of Elsie se Gorra Granite towards the south, are largely mantled by aeolian sands of the **Gordonia Formation** ("Kalahari sands") as well as Late Caenozoic alluvial deposits. Small inliers of basement rocks mapped within the 132 kV transmission line corridor associated with the PV project include the Elsie se Gorra

Granite as well as the Sandnoute Formation gneisses but these are also largely covered by Kalahari aeolian sands.

The geology of the Late Cretaceous to Recent Kalahari Group is reviewed by Thomas (1981), Dingle *et al.* (1983), Thomas & Shaw (1991), Haddon (2000) and Partridge *et al.* (2006). The thickness of the unconsolidated Kalahari sands in the Bushmanland area is variable and often uncertain. The Gordonia Formation dune sands are considered to range in age from the Late Pliocene / Early Pleistocene to Recent, dated in part from enclosed Middle to Late Stone Age stone tools (Dingle *et al*., 1983, p. 291). The recent extension of the Pliocene - Pleistocene boundary from 1.8 Ma back to 2.588 Ma places the older Gordonia Formation sands entirely within the Pleistocene Epoch. A number of older Kalahari formations underlie the young wind-blown surface sands in the main Kalahari depository to the north of the study area. However, at the latitude of the study area near Kenhardt (*c*. 29° S) Gordonia Formation sands less than 30 m thick are likely to be the main or perhaps only Kalahari sediments present (*cf* isopach map of the Kalahari Group, Figure 6 *in* Partridge *et al*., 2006). These unconsolidated sands will be locally underlain by thin subsurface gravels along the buried palaeosurface and perhaps by calcretes of Pleistocene or younger age (*cf* Mokalanen Formation).

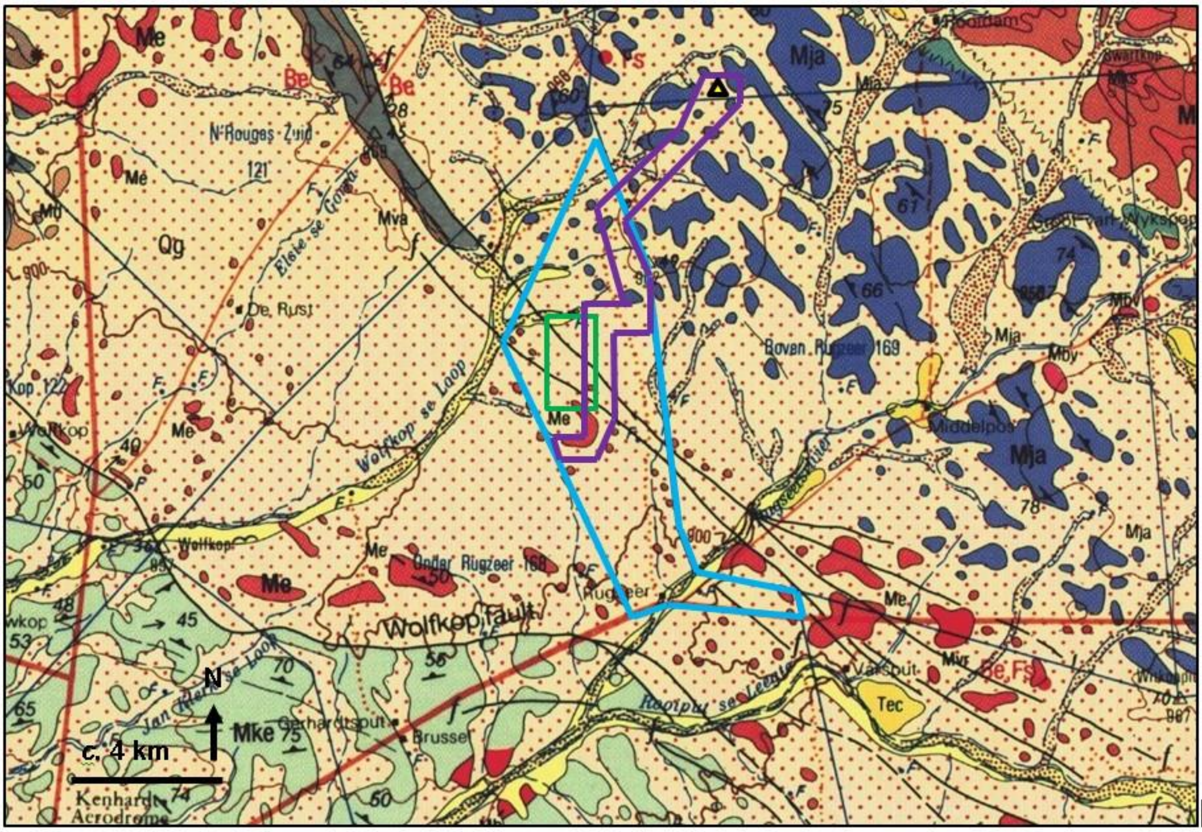

Figure 2. Extract from 1: 250 000 scale geological map sheet 2920 Kenhardt (Council for Geoscience, Pretoria) showing the geology of the Phase 2 Scatec Solar PV Facility project area on the northern sector of Farm Onder Rugzeer 168 (pale blue polygon) situated *c*. 20 km to the NE of Kenhardt, Northern Cape. The PV5 study site is *approximately* indicated by the green polygon while the associated 132 kV transmission line corridor to the existing Eskom Nieuwehoop Substation (yellow triangle) is shown by the purple polygon.

Linked to Figure 1 above, the main geological units represented within the broader Scatec Solar project area include:

PRECAMBRIAN BASEMENT ROCKS:

KEIMOES SUITE
- **Red (Me) = Elsie se Gorra Granite**

KORANNALAND SUPERGROUP:
- **Brown (Mva) = Valsvlei Formation, Biesje Poort Group**
- **Grey (Msa) = Sandputs Formation, Biesje Poort Group**
- **Blue (Mja) = Sandnoute Formation, Jacomyns Pan Group**

VYFBEKER METAMORPHIC SUITE:
- **Pale blue-green (Mke) = Kenhardt Migmatite**

LATE CAENOZOIC SUPERFICIAL SEDIMENTS:

- **Pale yellow with sparse red stipple (Qg) = aeolian sands of the Gordonia Formation (Kalahari Group)**
- **Pale yellow with dense red stipple = alluvial and pan sediments**
- **Dark yellow (Tec) = calcrete**

1.3.2. Palaeontological Heritage

The Precambrian basement rocks represented within the study area are igneous granitoids or high grade metamorphic rocks such as gneisses of the Namaqua-Natal Province that were last metamorphosed some 1 billion years ago and are entirely unfossiliferous. The sparse fossil record of Late Caenozoic superficial sediments in the Bushmanland region are briefly reviewed here (Refer also to Table 1 below). To the author's knowledge, there are no fossil records from the broader Scatec Solar project area itself and no palaeontological fieldwork has been undertaken here. The Scatec Solar PV project area lies within the Upington Renewable Energy Development Zone (REDZ7). The Kenhardt region in the south-western portion of REDZ7 was assessed as of low palaeontological sensitivity in the Strategic Environmental Assessment for Wind and Solar Photovoltaic Energy in South Africa (Almond *in* Fourie *et al.* 2014).

The disparate superficial deposits within the South African interior, including Bushmanland, have been comparatively neglected in palaeontological terms. However, sediments associated with ancient drainage systems, springs and pans may occasionally contain important fossil biotas, notably the bones, teeth and horn cores of mammals as well as remains of reptiles like tortoises (*e.g.* Skead 1980, Klein 1984, Brink 1987, Bousman *et al.* 1988, Bender & Brink 1992, Brink *et al.* 1995, MacRae 1999, Meadows & Watkeys 1999, Churchill *et al.* 2000, Partridge & Scott 2000, Brink & Rossouw 2000, Rossouw 2006, Almond *in* Macey *et al.* 2011). Other late Caenozoic fossil biotas that may occur within these superficial deposits include non-marine molluscs (bivalves, gastropods), ostrich egg shells, trace fossils (e.g. calcretised termitaria, coprolites, invertebrate burrows, rhizocretions), and plant material such as peats or palynomorphs (pollens) in organic-rich alluvial horizons (Scott 2000) and diatoms in pan sediments. In Quaternary deposits, fossil remains may be associated with human artefacts such as stone tools and are also of archaeological interest (*e.g*. Smith 1999 and references. therein). Ancient solution hollows within extensive calcrete hardpans may have acted as animal traps in the past. As with coastal and interior limestones, they might occasionally contain mammalian bones and teeth (perhaps associated with hyaena dens) or invertebrate remains such as snail shells.

Diverse fossils associated with the ancient Tertiary drainage systems of the Karoo and Bushmanland region have been summarized by Almond *in* Macey *et al.* (2011) (See also articles by Cooke 1949, Wells 1964, Butzer et al. 1973, Helgren 1977, Klein 1984, Macrae 1999). They include remains of fish, reptiles, mammals, freshwater molluscs, petrified wood and trace fossils (*e.g.* De Wit 1990, 1993, De Wit & Bamford 1993, Bamford 2000, Bamford & De Wit 1993, Senut *et al.* 1996).

In the Brandvlei area to the southwest of Kenhardt lies the north-south trending Geelvloer Palaeo-valley, a Mid Tertiary palaeodrainage system that links up with the Commissioners Pan – Koa Valley system to the northwest. Here calcretised basal alluvial facies contain bones of hippopotamus-like artiodactyls called anthracotherids indicating a Miocene age (De Wit 1993, 1999, De Wit *et al.* 2000). Anthracotherids are an extinct group of amphibious mammalian herbivores only distantly related to true hippos that were widespread in the Miocene of Africa (Schneider & Marais 2004). Early to Mid-Miocene silicified woods from Brandvlei are referable to a number of extant tree families, including the Dipterocarpaceae that mainly inhabit tropical forests in Africa and Asia today. The fossil woods and associated sediments indicate that warm, tropical to subtropical climates prevailed in the Mid-Miocene and that perennial, low-sinuosity braided river systems supported lush riparian forests (De Wit & Bamford 1993, Bamford & De Wit 1993, Bamford 2000). Wet, weakly seasonal climates are suggested by the structure (indistinct growth rings) and dimensions (trunk diameters of over 50 cm) of the fossil woods (Bamford 2000).

Abraded Plio-Pleistocene fossil woods from relict alluvial terraces of the Sak River just north of Brandvlei include members of the Family Polygalaceae and also indicate humid growth conditions (Bamford & De Wit 1993). These terraces were formed by meandering rivers during intermittent pluvial (i.e. wetter), but still semi-arid, episodes following the onset of generally arid conditions in the western portion of southern Africa towards the end of the Miocene. So far fossils have not been recorded from the Sakrivier system closer to Kenhardt.

Pan sediments in Bushmanland have also recently yielded interesting Pleistocene mammalian faunas in association with age-diagnostic archaeological material. Important fossil mammalian remains assigned to the Florisian Mammal Age (*c*. 300 000 – 12 000 BP; MacRae 1999) have recently been documented from stratigraphic units designated Group 4 to Group 6 (i.e. calcrete hardpan and below) at Bundu Pan, some 22 km northwest of Copperton (Kiberd 2006 and references therein). These are among very few Middle Pleistocene faunal records from stratified deposits in the southern Africa region (Klein 1980, 1984a, 1984b, 2000) and are therefore of high palaeontological significance. Characteristic extinct Pleistocene species recorded at Bundu Pan are the giant Cape Horse or Zebra (*Equus capensis*) and the Giant Hartebeest (*Megalotragus priscus*). Other extant to extinct taxa include species of warthog, blesbok, black wildebeest, springbok and baboon. There is additionally trace fossil evidence for hyaenids (tooth marks) as well as ostrich egg shell. Preliminary dating and the inferred ecology of the fossil taxa present suggests the presence of standing water within a grassy savanna setting during the 200 - 300 000 BP interval when the Bundu Pan faunal assemblage accumulated. A sequence of Earlier, Middle and Later Stone Age (ESA, MSA and LSA, respectively) artefact assemblages is also recorded from this site. Stratigraphic Groups 4 to 6 (*i.e.* calcrete hardpan and below) contain a Final Acheulian or transitional ESA/MSA artefact assemblage, while Groups 2 - 3 above the calcrete horizon contain a MSA artefact assemblage. Orton (2012) recorded a single fossil equid tooth associated with a rich MSA artefact assemblage from gravels overlying a calcrete hardpan on the farm Hoekplaas near Copperton. This horizon is probably equivalent to Group 3 of Kiberd's stratigraphy at Bundu Pan, and therefore somewhat younger than the Florisian mammal fauna reported there.

The fossil record of the Kalahari Group as a whole is generally sparse and low in diversity; no fossils are recorded here in the Kenhardt geology sheet explanation by Slabbert *et al.* (1999). The Gordonia Formation dune sands were mainly active during cold, drier intervals of the Pleistocene Epoch that were inimical to most forms of life, apart from hardy, desert-adapted species. Porous dune sands are not generally conducive to fossil preservation. However, mummification of soft tissues may play a role here and migrating lime-rich groundwaters derived from underlying lime-rich bedrocks may lead to the rapid calcretisation of organic structures such as burrows and root casts. Occasional terrestrial fossil remains that might be expected within this unit include calcretized rhizoliths (root casts) and termitaria (*e.g. Hodotermes*, the harvester termite), ostrich egg shells (*Struthio*), tortoise remains and shells of land snails (*e.g. Trigonephrus*) (Almond in Macey *et al.* 2011, Almond & Pether 2008). Other fossil groups such as freshwater bivalves and gastropods (*e.g. Corbula, Unio*), ostracods (seed shrimps), charophytes (stonewort algae), diatoms (microscopic algae within siliceous shells) and stromatolites (laminated microbial limestones) are associated with local watercourses and pans. Microfossils such as diatoms may be blown by wind into nearby dune sands (Du Toit 1954, Dingle *et al.,* 1983). These Kalahari fossils (or subfossils) can be expected to occur sporadically but widely, and the overall palaeontological sensitivity of the Gordonia Formation is therefore considered to be low. Underlying calcretes might also contain trace fossils such as rhizoliths, termite and other insect burrows, or even mammalian trackways. Mammalian bones, teeth and horn cores (also tortoise remains, and fish, amphibian or even crocodiles in wetter depositional settings) may be expected occasionally expected within Kalahari Group sediments and calcretes, notably those associated with ancient alluvial gravels (See Koa River Valley above). The younger (Pleistocene to Recent) fluvial and alluvial sands and gravels within the proposed development area are unlikely to contain many, if any, substantial fossil or subfossil remains.

Table 1.1: Fossil heritage recorded from the major rock units that are represented within the broader Scatec Solar study area near Kenhardt

GEOLOGICAL UNIT	ROCK TYPES AND AGE	FOSSIL HERITAGE	PALAEONT-OLOGICAL SENSITIVITY
LATE CAENOZOIC SUPERFICIAL SEDIMENTS, **especially** **ALLUVIAL AND PAN SEDIMENTS**	**fluvial, pan, lake and terrestrial sediments, including diatomite (diatom deposits), pedocretes (*e.g.* calcrete), colluvium (slope deposits such as scree), aeolian sands (Gordonia Formation, Kalahari Group)** **LATE TERTIARY, PLEISTOCENE TO RECENT**	**bones and teeth of wide range of mammals (*e.g.* mastodont proboscideans, rhinos, bovids, horses, micromammals), fish, reptiles (crocodiles, tortoises), ostrich egg shells, fish, freshwater and terrestrial molluscs (unionid bivalves, gastropods), crabs, trace fossils (*e.g.* calcretised termitaria, horizontal invertebrate burrows, stone artefacts), petrified wood, leaves, rhizoliths, stromatolites, diatom floras, peats and palynomorphs.**	**GENERALLY LOW BUT LOCALLY HIGH** **(*e.g.* Tertiary alluvium associated with old river courses)**
Basement granites and gneisses **NAMAQUA-NATAL PROVINCE**	**Highly-metamorphosed sediments, intrusive granites** **MID-PROTEROZOIC (*c.*1-2 billion years old)**	**None**	**ZERO**

1.4. APPLICABLE LEGISLATION AND PERMIT REQUIREMENTS

All South African fossil heritage, including palaeontological sites and specimens, is protected by law (National Heritage Resources Act (Act 25 of 1999) and fossils cannot be collected, damaged, destroyed or disturbed without a permit from SAHRA or the relevant Provincial Heritage Resources Agency.

As mentioned previously, where palaeontological mitigation of a development project is required, the palaeontologist concerned with mitigation work would need a valid fossil collection permit from SAHRA and any material collected would have to be curated in an approved depository (*e.g.* museum or university collection). All palaeontological specialist work should conform to international best practice for palaeontological fieldwork and the study (*e.g.* data recording fossil collection and curation, final report) should adhere as far as possible to the minimum standards for Phase 2 palaeontological studies recently developed by SAHRA (2013).

The present palaeontological heritage assessment falls under Sections 35 and 38 (Heritage Resources Management) of the National Heritage Resources Act (Act 25 of 1999), and it will also inform the Environmental Management Programme for this project. The various categories of heritage resources recognised as part of the National Estate in Section 3 of the National Heritage Resources Act include, among others:

- geological sites of scientific or cultural importance;
- palaeontological sites; and
- palaeontological objects and material, meteorites and rare geological specimens.

According to Section 35 of the National Heritage Resources Act (Act 25 of 1999), dealing with archaeology, palaeontology and meteorites:

1) The protection of archaeological and palaeontological sites and material and meteorites is the responsibility of a provincial heritage resources authority.
2) All archaeological objects, palaeontological material and meteorites are the property of the State.
3) Any person who discovers archaeological or palaeontological objects or material or a meteorite in the course of development or agricultural activity must immediately report the find to the responsible heritage resources authority, or to the nearest local authority offices or museum, which must immediately notify such heritage resources authority.
4) No person may, without a permit issued by the responsible heritage resources authority—
    i. destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or any meteorite;
    ii. destroy, damage, excavate, remove from its original position, collect or own any archaeological or palaeontological material or object or any meteorite;
    iii. trade in, sell for private gain, export or attempt to export from the Republic any category of archaeological or palaeontological material or object, or any meteorite; or
    iv. bring onto or use at an archaeological or palaeontological site any excavation equipment or any equipment which assist in the detection or recovery of metals or archaeological and palaeontological material or objects, or use such equipment for the recovery of meteorites.
5) When the responsible heritage resources authority has reasonable cause to believe that any activity or development which will destroy, damage or alter any archaeological or palaeontological site is under way, and where no application for a permit has been submitted and no heritage resources management procedure in terms of section 38 has been followed, it may—
    a) serve on the owner or occupier of the site or on the person undertaking such development an order for the development to cease immediately for such period as is specified in the order;

b) carry out an investigation for the purpose of obtaining information on whether or not an archaeological or palaeontological site exists and whether mitigation is necessary;
c) if mitigation is deemed by the heritage resources authority to be necessary, assist the person on whom the order has been served under paragraph (a) to apply for a permit as required in subsection (4); and
d) recover the costs of such investigation from the owner or occupier of the land on which it is believed an archaeological or palaeontological site is located or from the person proposing to undertake the development if no application for a permit is received within two weeks of the order being served.

1.5. IDENTIFICATION OF KEY ISSUES

1.5.1. Key Issues Identified

The only key issue identified by the specialist is the potential loss of palaeontological heritage resources (fossils, fossil sites including their geological context) through surface clearance and excavations into sedimentary rocks during the construction phase of the project.

1.5.2. Identification of Potential Impacts

The potential impacts identified are:

1.5.3. Construction Phase

Potential loss of palaeontological heritage resources through disturbance, damage or destruction of fossils and fossil sites (including associated geological contextual data) through surface clearance and excavation activities during the construction phase.

1.5.4. Operational Phase

No significant impacts on palaeontological heritage are anticipated during the operational phase of the development.

1.5.5. Decommissioning Phase

No significant impacts on palaeontological heritage are anticipated during the operational phase of the development.

1.5.6. Cumulative Impacts

Potential cumulative loss of palaeontological heritage resources through disturbance, damage or destruction of fossils and fossil sites (including associated geological contextual data) through surface clearance and excavation activities during the construction phase of several alternative energy facilities within the broader Kenhardt region and other key electrical infrastructure developments within a 30 km radius of the proposed project site.

1.6. ASSESSMENT OF IMPACTS AND IDENTIFICATION OF MANAGEMENT ACTIONS

In this section of the report potential impacts of the construction, operational and decommissioning phases of the proposed PV solar facility development on palaeontological heritage are outlined and recommendations for any necessary monitoring or mitigation are provided. Possible cumulative impacts in the light of other alternative energy development proposals in the Kenhardt region are also evaluated

1.6.1. *Potential Impact 1: Construction Phase*

The construction phase of the proposed solar energy facility will entail substantial surface clearance and shallow excavations into the superficial sediment cover (aeolian sands, surface gravels, stream alluvium *etc.*), which may contain fossil remains, and in some cases also into the underlying unfossiliferous bedrock. These include, for example, surface clearance operations, excavations and foundations (which will likely be drilled and concreted into the ground) for the solar array footings, underground cables, access and internal gravel roads, 132 kV transmission line towers, on-site substation, laydown areas, stormwater channels, water pipelines and foundations for buildings (offices, operational control centre, warehouse/workshop). As a result, fossils at the ground surface or buried beneath it may be disturbed, damaged, destroyed or sealed-in while their scientifically informative sedimentary context will also be disturbed or destroyed.

Desktop analysis of the fossil records of the various rock units underlying the proposed project area indicates that the majority of these units are of zero to low palaeontological sensitivity (as discussed in Section 1.3.2 and Table 1 of this chapter). The basement rocks are entirely unfossiliferous while the overlying Late Caenozoic superficial sediments (wind-blown sands, alluvium, gravels *etc.*) are of low to very low palaeontological sensitivity. Construction of the solar panel arrays, overhead power lines, buildings and associated infrastructure is therefore unlikely to entail significant impacts on local fossil heritage resources.

The inferred impact of the proposed solar facility development on local fossil heritage is assessed in Table 2.2 below. This assessment applies only to the construction phase of the development since further impacts on fossil heritage during the operational and decommissioning phases of the solar energy facility are not anticipated.

The destruction, damage or disturbance out of context of fossils and fossil sites preserved at the ground surface or below ground represents a *direct negative* impact that is confined to the development footprint (*site specific*). Such impacts are made only during the construction period, and can usually be partially mitigated but cannot be fully rectified; *i.e.* they are *non-reversible* and of *permanent* duration. Since several of the sedimentary units represented within the study area do contain fossils of some sort, some level impact on fossil heritage is probable (*likely*). However, because of the generally very sparse occurrence of well-preserved, scientifically-valuable fossils within the superficial sediments, and because most of the fossils encountered are likely to be of widespread occurrence (*low irreplaceability*) the consequence of these impacts is rated as *slight*.

No previously recorded areas or sites of exceptional fossil heritage sensitivity or significance have been identified within the proposed project area as a whole. Due to the inferred scarcity of exceptional fossil remains within the study area, the overall impact significance of the construction phase of the proposed solar energy project is assessed as *VERY LOW* (*negative*) (without mitigation). Due to the paucity of palaeontological field studies within this part of Bushmanland, confidence levels for this desktop palaeontological heritage assessment are only moderate (*medium*).

Specialist palaeontological monitoring and mitigation for this project are not recommended, pending the potential discovery of new fossil sites during development, given its low impact significance. The Environmental Control Officer responsible for the construction phase of the project should be aware of the necessity of conserving fossils and should monitor all substantial excavations into sedimentary rocks for fossil remains. Proposed mitigation of chance fossil finds during the construction phase involves safeguarding of the fossils (preferably *in situ*) by the responsible Environmental Control Officer, reporting of finds to the SAHRA and, where appropriate, judicious sampling and recording of fossil material and associated geological data by a qualified palaeontologist (as discussed in Section 1.7 of this chapter). Should these recommended mitigation measures be fully implemented, the impact significance of the development would remain *VERY LOW* but small residual negative impacts (*e.g.* loss of undetected fossils) would remain. However, these negative impacts would be partially offset through the improved scientific understanding of local palaeontological heritage in a hitherto poorly-studied region of South Africa which would be considered as a significant *positive* outcome.There are no fatal flaws in the proposed development proposal as far as fossil heritage is concerned.

1.6.2. Potential Impacts (Operational and Decommissioning Phases)

No significant impacts on fossil heritage resources are anticipated during the operational and decommissioning phases of the proposed solar energy facility.

1.6.3. Cumulative Impacts

The palaeontological heritage impact significance of all three Phase 2 solar energy developments and associated electrical infrastructure proposed by Scatec Solar, as well as several other authorized solar facilities and electrical infrastructure near Kenhardt - within a 30 km radius of the proposed project - are rated equally as very low (See Figure 3 and desktop palaeontological assessment reports for all these projects listed in Section 1.9). The potentially fossiliferous sedimentary rock units represented within the broader project area are of widespread occurrence and this is also likely to apply to most of the fossils they contain. It is concluded that the cumulative impact on fossil heritage resources posed by the proposed solar facilities and associated electrical infrastructure to the northeast of Kenhardt is of a very low significance, both before and after mitigation (Table 2.3).

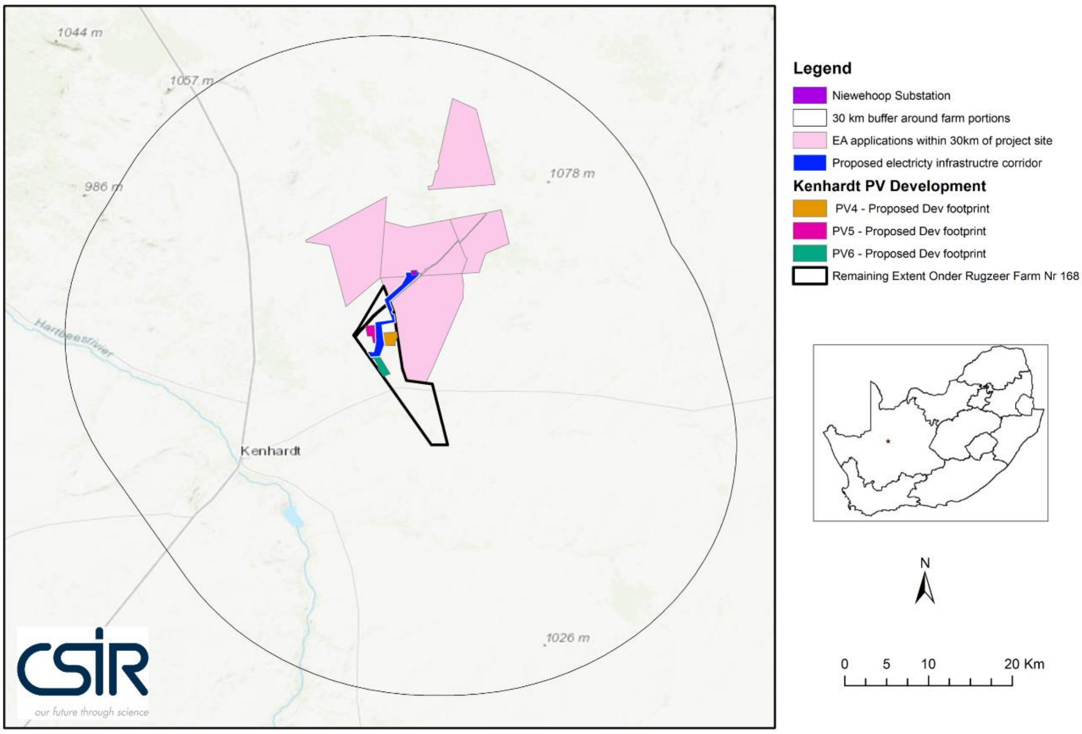

Figure 3. Map showing location of potential solar projects in immediate vicinity of the Scatec Kenhardt Phase 2 solar PV projects (Image provided by CSIR) (See Table 2). Desktop palaeontological heritage assessments for these projects have been compiled by the author (See References).

Table 2.1: Renewable energy projects and associated powerlines identified within 30km of the Scatec Phase 2 project

DEFF REF NO	PROJECT TITLE	DATE APPLICATION RECIEVED	APPLICANT	EAP	LOCAL MUNICIPALITY	TECHNOLOGY	MW	EA STATUS
14/12/16/3/3/2/1072	75 MW AMDA Charlie PV SEF north of Kenhardt within the Kai !Garib Local Municipality in the Northern Cape Province	2018/09/12	AMDA Charlie (Pty) Ltd	Cape Environmental Assessment Practitioners (Pty) Ltd	Kai !Garib Local Municipality	Solar PV	75	Approved
14/12/16/3/3/2/1073	75 MW AMDA Alpha PV SEF north of Kenhardt within the Kai !Garib Local Municipality in the Northern Cape Province	2018/09/11	AMDA Charlie (Pty) Ltd	Cape Environmental Assessment Practitioners (Pty) Ltd	!Kheis Local Municipality	Solar PV	75	Approved
14/12/16/3/3/2/847	75mw Solar Photovoltaic Facility (Boven 4) on the Remaining Extent of Boven Rugzeer Farm 169, North East of Kenhradt in the Northern Cape Province	2015/10/18	Boven Solar PV4 (Pty) Ltd	CSIR	!Kheis Local Municipality	Solar PV	75	Approved
14/12/16/3/3/2/842	75MW solar energy facility (Gemsbok PV4) on Portion 3 of Gemsbok Bult farm 120 near Kenhardt within the Kheis Local Municipality in the Northern cape province	2015/10/28	Gemsbok Solar PV3 (Pty) Ltd	CSIR	!Kheis Local Municipality	Solar PV	75	Approved
14/12/16/3/3/2/843	75MW solar energy facility (Gemsbok PV5) on Portion 8 of Gemsbok Bult farm 120 near Kenhardt within the Kheis Local Municipality in the Northern cape province	2015/10/28	Gemsbok Solar PV3 (Pty) Ltd	CSIR	!Kheis Local Municipality	Solar PV	75	Approved
14/12/16/3/3/2/1035	The 100MW Skeerhok 3 PV SEF north-east of Kenhardt within the Kheis Local Municipality, Northern Cape Province	2017/09/19	Juwi Renewable Energies (Pty) Ltd	Juwi Renewable Energies (Pty) Ltd	!Kheis Local Municipality	Solar PV	100	Approved
14/12/16/3/3/2/710	Proposed construction of Gemsbok PV1 75MW in Kenhardt, Northern Cape	2014/05/01	To review	CSIR	!Kheis Local Municipality	Solar PV	0	In process
14/12/16/3/3/2/711	Proposed construction of Gemsbok PV2 75MW in Kenhardt, Northern Cape	2014/05/01	To review	CSIR	!Kheis Local Municipality	Solar PV	0	In process
14/12/16/3/3/2/712	Proposed construction of the Boven PV1 75MW in Kenhardt, Northern Cape	2014/05/01	To review	CSIR	!Kheis Local Municipality	Solar PV	0	In process

1.6.4. Impact assessment summary

The assessment of impacts on palaeontological heritage resources as well as recommended mitigation and monitoring measures for the Kenhardt Solar PV project and associated 132 kV transmission line, as discussed above, are collated in Tables 2-2 and 2-3 below.

The no-go option (no solar developments) will have a neutral impact on local palaeontological heritage resources. Longer-term preservation of fossils within the project area without development would be offset against ongoing background destruction of fossil material exposed at the ground surface due to natural erosion and weathering as well as the loss of any potential new palaeontological data that might have resulted from professional mitigation of the PV project.

Given the generally low palaeontological sensitivity of the basement and overlying sedimentary rocks in the broader eastern Bushmanland region, significant cumulative impacts on fossil heritage are not anticipated here as a result of the various alternative energy and other infrastructure developments that have been proposed here (Table 2.3).

Table 2-2 Impact assessment summary table for the Construction Phase

Aspect/ Impact pathway	Nature of potential impact/risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confidence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
CONSTRUCTION PHASE													
Surface clearance and excavations into superficial sediments	Loss of fossil heritage and contextual data at or beneath ground surface	Negative	Site	Permanent	Slight	Likely	Non-reversible	Low	• Undertake monitoring of all substantial excavations into sedimentary rocks for fossil remains and safeguard any finds in situ. • Appoint a professional palaeontologist to record and sample any chance fossil finds	Very low	Very low	5	Medium

Table 2-3 Cumulative impact assessment summary table

Aspect/ Impact pathway	Nature of potential impact/risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confidence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
CONSTRUCTION PHASE													
Surface clearance and excavations into superficial sediments	Loss of fossil heritage and contextual data at or beneath ground surface	Negative	Site	Permanent	Slight	Likely	Non-reversible	Low	• Undertake monitoring of all substantial excavations into sedimentary rocks for fossil remains and safeguard any finds in situ. • Appoint a professional palaeontologist to record and sample any chance fossil finds	Very low	Very low	5	Medium

1.7. INPUT TO THE ENVIRONMENTAL MANAGEMENT PROGRAMME

Given the low palaeontological sensitivity of the proposed Scatec Solar PV project area, as determined from desktop analysis, as well as the inferred very low impact significance of the alternative energy project in terms of fossil heritage conservation, no specialist palaeontological monitoring or mitigation is recommended here, pending the discovery of substantial new fossil remains during construction.

During the construction phase of the PV and transmission line all substantial bedrock excavations should be monitored for fossil material by the responsible Environmental Control Officer. Should significant fossil remains - such as vertebrate bones and teeth, plant-rich fossil lenses, petrified wood or dense fossil burrow assemblages - be exposed during construction, the responsible Environmental Control Officer should safeguard these, preferably *in situ*. The South African Heritage Resources Agency (SAHRA) should be alerted as soon as possible (Contact details: SAHRA, 111 Harrington Street, Cape Town. P.O. Box 4637, Cape Town 8000, South Africa. Phone: +27 (0)21 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za). This is so that appropriate action can be taken by a professional palaeontologist, at the developer's expense. Mitigation would normally involve the scientific recording and judicious sampling or collection of fossil material as well as associated geological data (*e.g.* stratigraphy, sedimentology, taphonomy) by a professional palaeontologist.

The palaeontologist concerned with mitigation work will need a valid fossil collection permit from SAHRA and any material collected would have to be curated in an approved depository (*e.g.* museum or university collection). All palaeontological specialist work should conform to international best practice for palaeontological fieldwork and the study (*e.g.* data recording fossil collection and curation, final report) should adhere as far as possible to the minimum standards for Phase 2 palaeontological studies recently developed by SAHRA (2013).

No monitoring or mitigation is required during the operational and decommissioning phases of the development.

These mitigation recommendations should be incorporated into the Environmental Management Programme for the Solar PV energy facility as well as the associated electrical infrastructure (132 kV transmission line, on-site substation).

1.8. CONCLUSION AND RECOMMENDATIONS

The project areas for the proposed Kenhardt PV5 facility and the associated 132 kV transmission line corridor are underlain at depth by Precambrian basement rocks (*c*. 1-2 billion years old) assigned to the Namaqua-Natal Province. These ancient igneous and high-grade metamorphic rocks - mainly granites and gneisses of the Keimoes Suite and Jacomynspan Group - crop out at surface in small areas and are entirely unfossiliferous. A large proportion of the basement rocks are mantled by a range of superficial sediments of Late Caenozoic age that may contain sparse fossil remains. These predominantly thin, unconsolidated deposits include small patches of calcretes, gravelly to sandy river alluvium, pan sediments, surface gravels, colluvium (scree) as well as Pleistocene to Recent wind-blown sands of the Gordonia Formation (Kalahari Group). Most of these younger rock units are of widespread occurrence and low palaeontological sensitivity. Scientifically important vertebrate fossil remains (*e.g.* Pleistocene mammalian bones and teeth) have been recorded within older stratified pan and river sediments elsewhere in the Bushmanland region where they are often associated with stone artefacts, while a limited range of trace fossils (*e.g.* plant root casts, termitaria and other invertebrate burrows) may be found within calcrete horizons. The Kenhardt region in the south-western portion of REDZ7 was assessed as of low sensitivity in the Strategic Environmental Assessment for Wind and Solar Photovoltaic Energy in South Africa (Almond *in* Fourie *et al.* 2014).

No previously recorded areas or sites of exceptional fossil heritage sensitivity or significance have been identified within the Scatec Solar project area as a whole. Due to the inferred scarcity of scientifically important fossil remains within the Kenhardt PV5 study area, the overall impact significance of the construction phase of the proposed solar energy project is assessed as VERY LOW (before and after mitigation). No significant impacts on fossil heritage are anticipated during the operational and decommissioning phases of the proposed solar energy facility. The potentially fossiliferous sedimentary rock units represented within the study area (*e.g.* Gordonia sands, calcrete) are of widespread occurrence and this is also likely to apply to most of the fossils they contain. It is concluded that the cumulative impacts on fossil heritage resources posed by the known alternative energy and other infrastructural developments in the region – including the two other proposed Scatec Solar PV projects on Onder Rugzeer Farm 168 - is of very low significance. There are no fatal flaws in the proposed solar facility development, nor are there objections to its authorisation as far as fossil heritage conservation is concerned, since significant impacts on scientifically valuable fossils or fossil sites are not anticipated here. The only proposed condition to accompany environmental authorisation is that the recommendations for construction phase monitoring and mitigation included in the EMPr are fully complied with. The no-go option (no solar developments) will have a neutral impact on local palaeontological heritage resources.

Given the generally low palaeontological sensitivity of the eastern Bushmanland region, as determined from desktop and field-based studies, as well as the inferred very low impact significance of the Kenhardt PV5 100MW Solar PV Facility and associated electrical infrastructure for fossil heritage conservation. There are no objections on palaeontological heritage grounds to authorisation of the project and no specialist palaeontological monitoring or mitigation is recommended here, pending the discovery of substantial new fossil remains during construction. Mitigation measures and monitoring recommendations for inclusion in the EMPr for the PV facility and the associated electrical infrastructure (132 kV transmission line, substation) are discussed in Sections 1.6 and 1.7 of this report.

In this report the entire site for the proposed Kenhardt PV5 100MW Solar Photovoltaic (PV) Facility on Onder Rugzeer Farm 168 has been assessed based on the worst case scenario. From a palaeontological heritage impact point of view, the applicant can select any 250 ha area within the surveyed area to build the PV plant, provided that the recommended mitigation measures are implemented as applicable.

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BIRD IMPACT ASSESSMENT: KENHARDT PV5

Basic Assessments for the proposed construction of three Solar Photovoltaic (PV) Facilities (i.e. Kenhardt PV4, Kenhardt PV5 and Kenhardt PV6) and associated electrical infrastructure, near Kenhardt, in the Northern Cape.

Report prepared for:
CSIR – Environmental Management Services
P O Box 320
Stellenbosch
7599
South Africa

Report prepared by:
Chris van Rooyen Consulting

December 2019

Specialist Expertise

Curriculum vitae: Chris van Rooyen

Profession/Specialisation	:	Avifaunal Specialist
Highest Qualification	:	LLB
Nationality	:	South African
Years of experience	:	22 years

Key Experience

Chris van Rooyen has twenty two years' experience in the assessment of avifaunal interactions with industrial infrastructure. He was employed by the Endangered Wildlife Trust as head of the Eskom-EWT Strategic Partnership from 1996 to 2007, which has received international acclaim as a model of co-operative management between industry and natural resource conservation. He is an acknowledged global expert in this field and has consulted in South Africa, Namibia, Botswana, Lesotho, New Zealand, Texas, New Mexico and Florida. He also has extensive project management experience and he has received several management awards from Eskom for his work in the Eskom-EWT Strategic Partnership. He is the author and/or co-author of 17 conference papers, co-author of two book chapters, several research reports and the current best practice guidelines for avifaunal monitoring at wind farm sites. He has completed around 130 power line assessments; and has to date been employed as specialist avifaunal consultant on more than 50 renewable energy generation projects. He has also conducted numerous risk assessments on existing power lines infrastructure. He also works outside the electricity industry and he has done a wide range of bird impact assessment studies associated with various residential and industrial developments. He serves on the Birds and Wind Energy Specialist Group which was formed in 2011 to serve as a liaison body between the ornithological community and the wind industry.

Professional affiliations

I work under the supervision of and in association with Albert Froneman (MSc Conservation Biology) (SACNASP Zoological Science Registration number 400177/09) as stipulated by the Natural Scientific Professions Act 27 of 2003.

Curriculum vitae: Albert Froneman

Profession/Specialisation	:	Avifaunal Specialist
Highest Qualification	:	MSc (Conservation Biology)
Nationality	:	South African
Years of experience	:	20 years

Key Qualifications

Albert Froneman (Pr.Sci.Nat) has more than 20 years' experience in the management of avifaunal interactions with industrial infrastructure. He holds a M.Sc. degree in Conservation Biology from the University of Cape Town. He managed the Airports Company South Africa (ACSA) – Endangered Wildlife Trust Strategic Partnership from 1999 to 2008 which has been internationally recognized for its achievements in addressing airport wildlife hazards in an environmentally sensitive manner at ACSA's airports across South Africa. Albert is recognized worldwide as an expert in the field of bird hazard management on airports and has worked in South Africa, Swaziland, Botswana, Namibia, Kenya, Israel, and the USA. He has served as the vice chairman of the International Bird Strike Committee and has presented various papers at international conferences and workshops. At present, he is consulting to ACSA with wildlife hazard management on all their airports. He also an accomplished specialist ornithological consultant outside the aviation industry and has completed a wide range of bird impact assessment studies. He has co-authored many avifaunal specialist studies and pre-construction monitoring reports for proposed renewable energy developments across South Africa. He also has vast experience in using Geographic Information Systems to analyse and interpret avifaunal data spatially and derive meaningful conclusions. Since 2009 Albert has been a registered Professional Natural Scientist (Registration Number 400177/09) with The South African Council for Natural Scientific Professions, specialising in Zoological Science.

Specialist Declaration

I, Chris van Rooyen, as the appointed independent specialist, in terms of the 2014 EIA Regulations, hereby declare that I:

- I act as the independent specialist in this application;
- I 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;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct, and do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 and any specific environmental management Act;
- 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 not, and will not engage in, conflicting interests in the undertaking of the activity;
- I have no vested interest in the proposed activity proceeding;
- 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;
- I have ensured that the comments of all interested and affected parties on the specialist input/study were considered, recorded and submitted to the competent authority in respect of the application;
- all the particulars furnished by me in this specialist input/study are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Name of Specialist: Chris van Rooyen

Signature of the specialist: ______________________________

Date: 17 December 2019

Executive Summary

It is estimated that a total of 149 bird species could potentially occur in the broader area – Appendix 2 provides a comprehensive list of all the species, including those recorded during the pre-construction monitoring. Of the priority species potentially occurring in the broader area, 24 could potentially occur in the combined area, i.e. within the footprint of the PV facility and the grid connection corridor. Nine of these are South African Red Data species, and three are globally Red listed.

The proposed project will have the following potential impacts on avifauna:

- Displacement due to disturbance associated with the construction of the solar PV plant, associated infrastructure and the 132kV grid connection.
- Displacement due to habitat transformation associated with the construction of the solar PV plant and associated infrastructure
- Collisions with the solar panels
- Entrapment in perimeter fences
- Collisions with the associated power lines
- Electrocutions on the associated power lines
- Displacement due to disturbance associated with the decommissioning of the solar PV plant and associated infrastructure

1. Displacement due to disturbance associated with the construction of the solar PV plant, associated infrastructure and the 132kV grid connection.

The construction activities associated with the construction of the solar PV plant, associated infrastructure and the 132kV grid connection impact on birds through disturbance; this could lead to breeding failure if the disturbance happens during a critical part of the breeding cycle. Construction activities in close proximity to breeding locations could be a source of disturbance and could lead to temporary displacement. Priority species that might be temporarily displaced due to disturbance associated with the construction of the proposed grid connection are the following: Black-eared Sparrowlark, Black-headed Canary, Fiscal Flycatcher, Karoo Prinia, Lanner Falcon, **Large-billed Lark, Lesser Kestrel, Pygmy Falcon, Red Lark, Sclater's Lark and Sickle-winged Chat. The impact is assessed to be Moderate before mitigation, and Low after mitigation**. Suggested mitigation measures are (a) activity should as far as possible be restricted to the footprint of the infrastructure, (b) measures to control noise and dust should be applied according to current best practice in the industry (c) maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum as far as practical (d) access to the rest of the property must be restricted (e) the recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the construction footprint is concerned, and (f) water troughs should be relocated at least 200m outside the combined area.

2. Displacement due to habitat transformation associated with the construction of the solar PV plant and associated infrastructure

Indications are that the PV facility matrix is permeable to most species. However, key environmental features, including available habitat and vegetation quality are most likely the overriding factors influencing species' occurrence and their relative density within the development footprint. The most significant aspect is that the distribution of birds in the landscape could change, from a shrubland to open country and grassland bird community, in response to changes in the distribution and abundance of habitat resources such as food, water and nesting sites. Shrubland specialists appear to be negatively affected by the presence of the PV facility. In contrast, open country/grassland and generalist species, are favoured by its development (Visser et al. 2019). Species that could be affected by displacement due to habitat transformation are Black-eared Sparrowlark, Black-headed Canary, Burchell's Courser, Fiscal Flycatcher, Karoo Korhaan, Karoo Prinia, Kori Bustard, Large-billed Lark, Ludwig's Bustard, Red Lark, Sclater's Lark, Sickle-winged Chat, Southern Pale Chanting Goshawk and Spotted Eagle-Owl. **The impact is assessed to be High before mitigation, and Moderate after mitigation.** The recommendations of the botanical specialist must be strictly implemented, especially as far as limiting the vegetation clearance to what is absolutely necessary, and rehabilitation of transformed areas are concerned. Other than that, not much can be done to limit this unavoidable impact on the avifauna.

3. Collisions with the solar panels

The results of the available literature lack compelling evidence of collisions as a cause of large-scale mortality among birds at PV facilities. However, it is clear that the lack of systematic and standardised data collection is a major problem in the assessment of the causes and extent of avian mortality at all types of solar facilities, regardless of the technology employed. Until statistically tested results emerge from existing compliance programmes and more dedicated scientific research, conclusions will inevitably be largely speculative and based on professional opinion. It is not foreseen that collisions with the solar panels at the PV facility will be a significant impact. The priority species which would most likely be potentially affected by this impact are mostly small birds which forage between the solar panels, and possibly raptors which prey on them: Black-eared Sparrowlark, Black-headed Canary, Fiscal Flycatcher, Karoo Prinia, Lanner Falcon, Large-billed Lark, Lesser Kestrel, Pygmy Falcon, Red Lark, Sclater's Lark and Sickle-winged Chat. **The risk is assessed to be Very Low.** No mitigation is required due to the very low expected magnitude.

4. Entrapment in perimeter fences

Visser *et al.* (2019) recorded a fence-line fatality resulting from the bird being trapped between the inner and outer perimeter fence of a solar facility. This was further supported by observations of large-bodied birds unable to escape from between the two fences (Visser *et al.* 2019). It is not foreseen that entrapment in perimeter fences will be a significant impact. The priority species which could potentially be affected by this impact are most likely medium to large terrestrial species: Karoo Korhaan, Kori Bustard and Ludwig's Bustard. **The risk is assessed to be Low, but it can be reduced to Very Low through the application of mitigation measures**. Suggested mitigation is that a single perimeter fence should be used or, alternatively, the two fences should be at least 4 metres apart to allow medium to large birds enough space to take off.

5. Collisions with the associated power lines

Collision mortality is the biggest threat posed by transmission lines to birds in southern Africa (Van Rooyen 2004). Most heavily impacted upon are bustards, storks, cranes and various species of waterbirds. These species are mostly heavy-bodied birds with limited manoeuvrability, which makes it difficult for them to take the necessary evasive action to avoid colliding with transmission lines (Van Rooyen 2004, Anderson 2001). Species most at risk of powerline collisions at the PV facility are large terrestrial birds and a number of raptors (in specific circumstances): Karoo Korhaan, Kori Bustard, Lanner Falcon, Ludwig's Bustard, Martial Eagle, Spotted Eagle-Owl. **The impact is assessed to be High before mitigation, and Very Low after mitigation.** Suggested mitigation are (a) all 33kV powerlines should be buried (b) If there are sections where the 33kV powerlines cannot be buried due to technical constraints, the spans must be marked with Eskom approved bird flight diverters, on the conductors, staggered 5m apart, alternating black and white/yellow (c) the entire 132kV grid connection should be marked with Eskom approved bird flight diverters, on the earthwire, 5m apart, alternating black and white/yellow and (d) water troughs should be relocated at least 200m outside the combined area..

6. Electrocutions on the associated power lines

Electrocution refers to the scenario where a bird is perched or attempts to perch on the 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 2004). The electrocution risk is largely determined by the design of the electrical hardware. It is currently not clear whether the internal 33kV electrical powerlines will be buried, or above ground. If the lines are above ground, several raptor species might be at risk of electrocution on the medium voltage lines: Booted Eagle, Greater Kestrel, Lanner Falcon, Lesser Kestrel, Martial Eagle, Rock Kestrel, Southern Pale Chanting Goshawk, Spotted Eagle-Owl and Verreaux's Eagle. **The impact is assessed to be High before mitigation, and Low after mitigation.** Suggested mitigation measures are (a) all 33kV powerlines should be buried and (b) if there sections where the 33kV powerlines cannot be buried due to technical constraints, a bird-friendly design must be employed after an appropriately qualified and experienced avifaunal specialist have signed-off on the final design. Species that could be impacted are Booted Eagle, Greater Kestrel, Lanner Falcon, Lesser Kestrel, Martial Eagle, Rock Kestrel, Southern Pale Chanting Goshawk, Spotted Eagle-Owl and Verreaux's Eagle.

7. Displacement due to disturbance associated with the decommissioning of the solar PV plant, associated infrastructure and the 132kV grid connection.

The activities associated with the decommissioning of the solar PV plant, associated infrastructure and the 132kV grid connection will impact on birds through disturbance; this could lead to breeding failure if the disturbance happens during a critical part of the breeding cycle. Activities in close proximity to breeding locations could be a source of disturbance and could lead to temporary displacement. Priority species that might be temporarily displaced are the following: Black-eared Sparrowlark, Black-headed Canary, Fiscal Flycatcher, Karoo Prinia, Lanner Falcon, Large-billed Lark, Lesser Kestrel, Pygmy Falcon, Red Lark, Sclater's Lark and Sickle-winged Chat. **The impact is assessed to be Moderate before mitigation, and Low after mitigation.** Suggested mitigation measures are (a) activity should as far as possible be restricted to the footprint of the infrastructure, (b) measures to control noise and dust should be applied according to current best practice in the industry (c) maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum as far as practical (d) access to the rest of the property must be restricted (e) the recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the activity footprint is concerned and (f) water troughs should be relocated at least 200m outside the combined area..

8. Cumulative impacts

The total combined size of the land parcels taken up by solar energy projects including the three Scatec Kenhardt Phase 2 projects, equates to about 31 500ha, which is just over 10% of the available land in the 30km radius. However, the actual footprint of the solar facilities will be much smaller that the land parcel area, between 20 - 40% of the land parcel area. The total area to be taken up by renewable energy developments will therefore comprise less than 10% of the land surface within the 30km radius around the proposed Kenhardt Phase 2 projects. The cumulative impact of the habitat transformation which will come about as a result of the three proposed PV project should therefore be low. The three Scatec Kenhardt Phase 2 projects will add another approximately 12km of sub-transmission line. This translates into a 6 - 8% increase in the length of existing and proposed high voltage line within the 30km radius around the proposed projects. The most significant potential impact of high voltage lines within the aforesaid 30km radius is bird collisions with the earth wires of the lines. A 6 - 8% increase in line length should represent a low increase in cumulative risk. **The risk of cumulative impacts associated with the PV facility and the associated infrastructure and grid connection is assessed to be Low, but it can be reduced to Very Low through the application of the mitigation measures listed in**

this report. However, it should be noted that the collective cumulative impact on birds of **all** the additional high voltage lines associated with all the renewable energy projects in the 30km radius, is significant, resulting in an increase from a relatively low risk current scenario to a moderate risk scenario with the addition of all the new lines. Fortunately, the new lines are mostly concentrated around Nieuwehoop Substation, which limit their geographic impact.

Table 1 below provides a summary of the respective significance ratings, and an average overall rating before and after mitigation.

Impact	**Rating pre-mitigation**	**Rating post-mitigation**
Displacement due to disturbance associated with the construction of the solar PV plant, associated infrastructure and the 132kV grid connection.	Moderate (3)	Low (4)
Displacement due to habitat transformation associated with the construction of the solar PV plant and associated infrastructure[1]	High (2)	Moderate (3)
Collisions with the solar panels	Very Low (5)	Very Low (5)
Entrapment in perimeter fences	Low (4)	Very Low (5)
Collisions with the associated power lines	High (2)	Very Low (5)
Electrocutions on the associated power lines	High (2)	Low (4)
Displacement due to disturbance associated with the decommissioning of the solar PV plant and associated infrastructure	Moderate (3)	Low (4)
Cumulative impacts	Low (4)	Very Low (5)
Average:	**Moderate (3.1)**	**Low – Very Low (4.3)**

9. Final Specialist Statement and Authorisation Recommendation

In terms of an average, the pre-mitigation significance of all potential impacts identified in this specialist study is assessed as slightly above **Moderate**, leaning more towards Moderate (i.e. average of 3.1, as shown in Table 1 above) and the post-mitigation significance is assessed as Low to Very Low, leaning more towards **Low** (i.e. average of 4.3, as shown in Table 1 above). It is therefore recommended that the activity is authorised, on condition that the proposed mitigation measures as detailed in the EMPr (Appendix 4) are strictly implemented.

[1] Due to the nature of the habitat, displacement due to habitat destruction associated with the proposed grid connection is likely to be negligible, therefore this is not listed as an impact.

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List of Abbreviations

BA	Basic Assessment
BFD	Bird Flight Diverters
BLSA	BirdLife South Africa
DEFF	Department of Environmental Affairs and Forestry
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
EWT	Endangered Wildlife Trust
IBA	Important Bird Area
SABAP 2	Southern African Bird Atlas Project 2

Glossary

Definitions	
Broader area	The area covered by the 25 SABAP 2 pentads where the proposed development is located.
Combined area	The area covered by the proposed PV footprint and the grid corridor.
PV footprint	The PV footprint includes the solar fields, internal roads, lay-down area, building infrastructure, fencing
Priority species	▪ Priority solar species were defined as follows: o South African Red Data species; o South African endemics and near-endemics; o Raptors o Waterbirds ▪ Priority powerline species were defined as those species which could potentially be impacted by powerline collisions or electrocutions, based on morphology and/or behaviour.
Pentad Grid	A pentad grid cell covers 5 minutes of latitude by 5 minutes of longitude

COMPLIANCE WITH THE APPENDIX 6 OF THE 2014 EIA REGULATIONS (AS AMENDED)

Requirements of Appendix 6 – GN R982	**Addressed in the Specialist Report**
1. (1) A specialist report prepared in terms of these Regulations must contain- a) details of- i. the specialist who prepared the report; and ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	Pg. 2 - 3
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Pg.3
c) an indication of the scope of, and the purpose for which, the report was prepared;	Section 1 and 2
(cA) an indication of the quality and age of base data used for the specialist report;	Section 2
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 4 and Section 6
d) the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 2
e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 2
f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Section 4 and Appendix 4
g) an identification of any areas to be avoided, including buffers;	Section 4 and Appendix 4
h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Appendix 4
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 2
j) a description of the findings and potential implications of such findings on the impact of the proposed activity or activities;	Section 6 and Section 10
k) any mitigation measures for inclusion in the EMPr;	Appendix 4
l) any conditions for inclusion in the environmental authorisation;	Appendix 4
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Appendix 4
n) a reasoned opinion- i. whether the proposed activity, activities or portions thereof should be authorised; (iA) regarding the acceptability of the proposed activity or activities; and ii. if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Section 10 and Section 11
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	Section 2
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	n/a
q) any other information requested by the competent authority.	n/a
(2) Where a government notice by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	n/a

BIRD IMPACT ASSESSMENT

This report presents the Bird Impact Assessment that was prepared by Chris van Rooyen of Chris van Rooyen Consulting as part of the Basic Assessment (BA) Process for the proposed construction of the Scatec Solar Photovoltaic Facilities 4, 5 and 6, near Kenhardt in the Northern Cape Province.

This report deals specifically with Photovoltaic Facility 5 (PV5) and associated grid connection.

1. Introduction and Methodology

1.1. Scope, Purpose and Objectives of this Specialist Report

The objectives of the report are to investigate the potential impacts of the proposed PV5 site and associated grid connection, on avifauna in order to assess whether the project is fatally flawed from an avifaunal impact perspective and, if not, what mitigation measures should be implemented to reduce the potential impacts.

1.2. Terms of Reference

The terms of reference for this impact assessment report are as follows:

- Describe the affected environment from an avifaunal perspective;
- Discuss gaps in baseline data and other limitations;
- List and describe the expected impacts;
- Compile a sensitivity map for the project site;
- Assess and evaluate the potential impacts;
- Recommend mitigation measures to reduce the impact of the expected impacts; and
- Provide a reasoned opinion as to whether the proposed development should proceed or not.

1.3. Assessment Details

Type of Specialist Investigation	Bird Impact Assessment Study: Solar energy facilities
Date of Specialist Site Investigation	13 – 16 November 2019, 21 – 24 November 2019
Season	Early Summer
Relevance of Season	Start of the raining season is usually a time when birds are most active.

2. Approach and Methodology

Surveys were conducted according to the best practice guidelines for avifaunal impact studies at solar developments, compiled by BirdLife South Africa (BLSA) in 2017 (Jenkins *et al.* 2017).

- On-site surveys were conducted from 13 - 16 November and again from 21 - 24 November 2019 in the following manner:
    - Twelve walk transects were identified totalling 1km each, nine within the proposed PV footprints, and three control transects outside the proposed footprints.
    - An observer recorded all species on both sides of the walk transect. The observer stopped at regular intervals to scan the environment with binoculars.
    - Each transect was counted twice during each survey over a period of four days.
    - The following variables were recorded:
        - Species;
        - Number of birds;
        - Date;
        - Start time and end time;
        - Estimated distance from transect (m);

- Wind direction;
- Wind strength (estimated Beaufort scale 1 - 7);
- Weather (sunny; cloudy; partly cloudy; rain; mist);
- Temperature (cold; mild; warm; hot);
- Behaviour (flushed; flying-display; perched; perched-calling; perched-hunting; flying-foraging; flying-commute; foraging on the ground.

- All incidental sightings of priority species in and around the proposed PV development area were recorded.
- The section of the Aries - Nieuwehoop 400kV transmission line running west of the study area was inspected for evidence of breeding raptors on the towers.

See Appendix 1 for a map of the development site, showing the location of transects used for purposes of the surveys.

2.1. Information Sources

- Bird distribution data from the Southern African Bird Atlas Project 2 (SABAP 2) was obtained (http://sabap2.adu.org.za/), in order to ascertain which species occur in the pentad where the proposed development areas are located. A pentad grid cell covers 5 minutes of latitude by 5 minutes of longitude (5'× 5'). Each pentad is approximately 8 × 7.6 km. In order to get a more representative impression of the birdlife, a consolidated data set was obtained for a block of 25 pentads (40km x 38km), within which the proposed development is located, henceforth called the broader area[2]. The SABAP2 data covers the period 2007 to 2019.
- A classification of the vegetation types in the development area was obtained from the Atlas of Southern African Birds 1 (SABAP1) and the National Vegetation Map compiled by the South African National Biodiversity Institute (Mucina & Rutherford 2006).
- The national threatened status of all priority species was determined with the use of the most recent edition of the Red Data Book of Birds of South Africa, Lesotho and Swaziland (Taylor *et al.* 2015), and the latest authoritative summary of southern African bird biology (Hockey *et al.* 2005).
- The global threatened status of all priority species was determined by consulting the latest (2019.2) IUCN Red List of Threatened Species).
- The Important Bird and Biodiversity Areas of South Africa (Marnewick *et al.* 2015) was consulted for information on potentially relevant Important Bird Areas (IBAs).
- Satellite imagery (Google Earth © 2018) was used in order to view the broader area on a landscape level and to help identify bird habitat on the ground.
- The South African National Biodiversity BGIS map viewer was used to determine the locality of the proposed site relative to National Protected Areas, National Protected Areas Expansion Strategy (NPEAS) focus areas and Critical Biodiversity Areas in the Northern Cape.
- The DEFF National Screening Tool was used to determine the assigned avian sensitivity of the combined footprint of the site and the proposed grid connection.
- The Strategic Environmental Assessment for Wind and Solar Photovoltaic Energy in South Africa (Solar and Wind SEA) was consulted to determine what level of avifaunal sensitivity is assigned to the combined footprint of the site and the proposed grid connection (CSIR 2015).
- The avifaunal impact assessment studies for the Phase 2 Nieuwehoop Solar Park (Pachnoda Consulting 2015), and the Skeerhok PV1, PV2 and PV3 Solar Photovoltaic Facilities (WildSkies 2018) near Kenhardt provided background information of avifaunal assemblages in the broader area.

[2] The relevant pentads are 2900_2105, 2900_2110, 2900_2115, 2900_2120, 2905_2105, 2905_2110, 2905_2115, 2905_2120, 2905_2120, 2910_2105, 2910_2110, 2910_2115, 2910_2120, 2910_2125, 2915_2105, 2915_2110, 2915_2110, 2915_2115, 2915_2120, 2915_2125, 2920_2105, 2920_2110, 2920_2115, 2920_2120, 2920_2125.

2.2. Assumptions, Knowledge Gaps and Limitations

- A total of 77 SABAP 2 full protocol lists had been completed for the broader area where the proposed project is located (i.e. bird listing surveys lasting a minimum of two hours each). In addition, 43 ad hoc protocol lists (i.e. bird listing surveys lasting less than two hours but still giving useful data) and 249 incidental sightings were also recorded. The SABAP2 data was therefore regarded as a good indicator of the avifauna which could occur at the proposed development area, and it was further supplemented by data collected during the on-site surveys.
- The focus of the study is primarily on the potential impacts on priority solar and powerline species.
- Priority solar species were defined as follows:
    - South African Red Data species;
    - South African endemics and near-endemics;
    - Raptors
    - Waterbirds
- Priority powerline species were defined as those species which could potentially be impacted by powerline collisions or electrocutions, based on morphology and/or behaviour.
- The impact of solar installations on avifauna is a new field of study, with only one published scientific study on the impact of PV facilities on avifauna in South Africa (Visser *et al.* 2019). Strong reliance was therefore placed on expert opinion and data from existing monitoring programmes at solar facilities in the USA where monitoring has been ongoing since 2013. The pre-cautionary principle was applied throughout as the full extent of impacts on avifauna at solar facilities is not presently known.
- The assessment of impacts is based on the baseline environment as it currently exists at the proposed development area.
- Cumulative impacts include all proposed and existing renewable energy projects within a 30km radius around the proposed development areas[3].
- Conclusions in this study are based on experience of these and similar species in different parts of South Africa. Bird behaviour can never be entirely reduced to formulas that will be valid under all circumstances.
- The **broader area** is defined as the area encompassed by the 25 pentads where the project is located. The **combined area** is defined as the PV footprint and the powerline corridor. The **PV footprint** includes the solar fields, internal roads, lay-down area, building infrastructure, fencing (see Figure 1).

[3] The list of projects was provided by the CSIR.

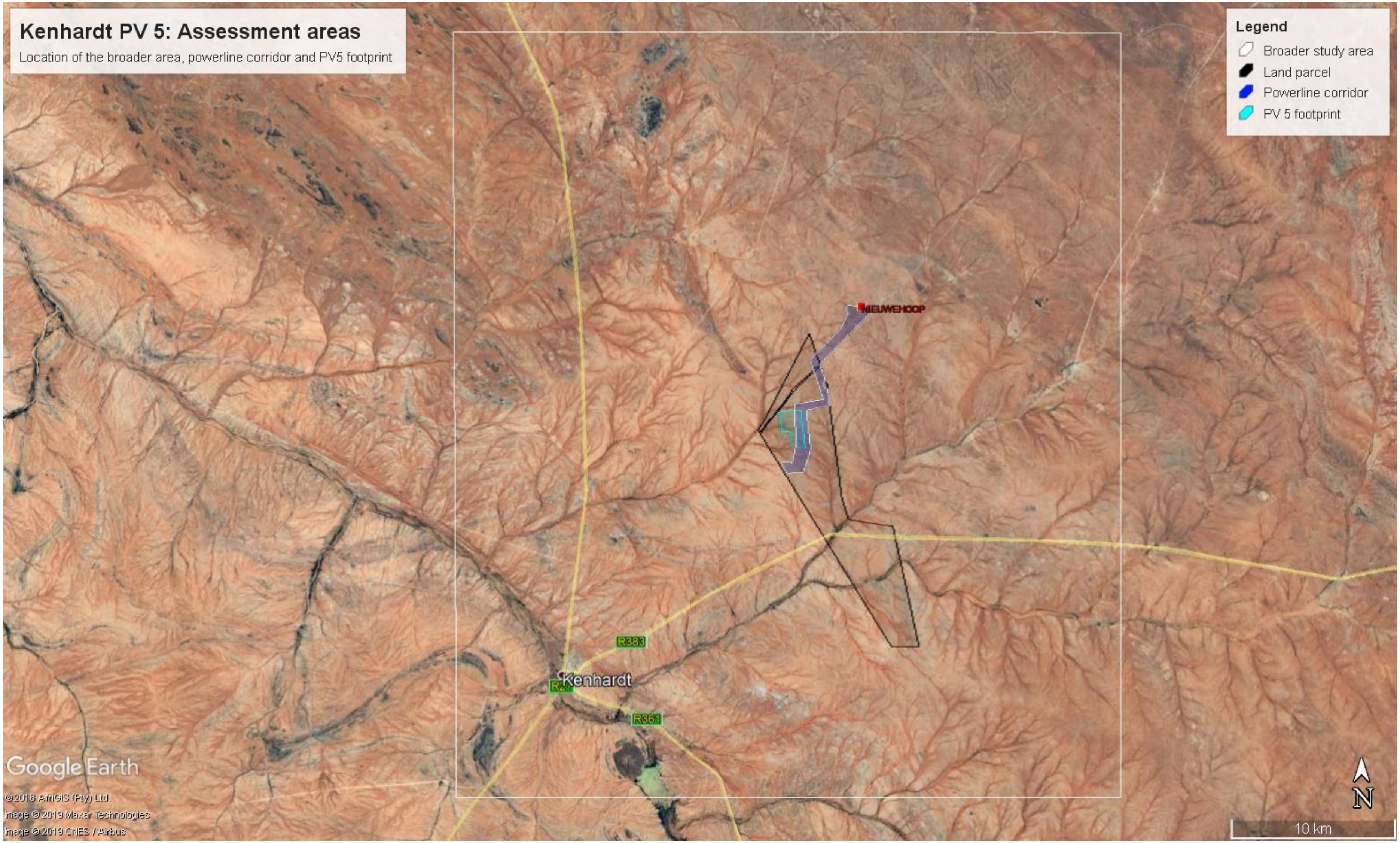

Figure 1: The location of the proposed Kenhardt PV5 solar facility and associated powerline.

2.3. Consultation Processes Undertaken

The landowner was consulted with regard to the birds occurring on the property.

3. Description of Project Aspects relevant to Avifaunal Impacts

The following aspects of the project is relevant to avifaunal impacts:

- Solar field, comprising solar arrays with a maximum height of 10m and maximum footprint of 250 hectares.
- Building Infrastructure (included in the PV5 footprint)
  - Offices (maximum height 7m and footprint of 1000 m^2);
  - Operational and maintenance control centre (maximum height 7m and footprint 500 m^2);
  - Warehouse/workshop (maximum height 7m and footprint 500 m^2);
  - Ablution facilities (maximum height 7m and footprint 50 m^2);
  - 24 converter/Inverter stations (height from 2.5m to 7m and footprint 2500 m^2);
  - On-site substation building (footprint 20 000 m^2).; and
  - Guard Houses (height 3m, footprint 40 m^2).
- Associated Infrastructure
  - 132 kV overhead transmission line to connect to the existing Eskom Nieuwehoop substation.
  - Internal 33 kV transmission lines/underground cables (either underground to maximum depth of 1m or above ground with height of 9m);
  - Access roads, maximum 8m wide.
  - Internal gravel roads (width of 4m);
  - Fencing at least 2.6 - 3m height.
  - Temporary work area during the construction phase (i.e. laydown area of maximum 5 ha).

4. Description of the Receiving Environment

4.1. Baseline Environmental Description

4.1.1 Important Bird Areas

There are no Important Bird Areas (IBA) within a 100km radius around the proposed development. It is therefore highly unlikely that the proposed development will have a negative impact on any IBA.

4.1.2 Critical Biodiversity Area (CBA)

The combined area is not classified as a CBA, but as Other Natural Areas.

4.1.3 DEFF National Screening Tool

The DEFF National Screening Tool classifies the combined area as medium sensitive from an avifaunal perspective.

4.1.4 National Protected Areas Expansion Strategy (NPEAS) focus areas

The combined area does not form part of an NPEAS focus area.

4.1.5 Strategic Environmental Assessment for Wind and Solar Photovoltaic Energy in South Africa (Solar and Wind SEA)

The combined area is classified as Low sensitivity for avifauna in the Solar and Wind SEA.

4.1.6 Habitat classes

Vegetation structure, rather than the actual plant species, is more significant for bird species distribution and abundance (Harrison *et al.* 1997). The description of the vegetation types occurring in the development area largely follows the classification system presented in the Atlas of southern African birds (Harrison *et al.* 1997). The criteria used to amalgamate botanically defined vegetation units, or to keep them separate were (1) the existence of clear differences in vegetation structure, likely to be relevant to birds, and (2) the results of published community studies on bird/vegetation associations. It is important to note that no new vegetation unit boundaries were created, with use being made only of previously published data. The description of vegetation presented in this study therefore concentrates on factors relevant to the bird species present and is not an exhaustive list of plant species present.

Whilst the distribution and abundance of the bird species in the combined area are mostly associated with natural vegetation, as this comprises virtually all the habitat, it is also necessary to examine external modifications to the environment that might have relevance for priority species. Anthropogenic avifaunal-relevant habitat modifications which could potentially influence the avifaunal community that were recorded in or close to the study area are water troughs, a dam, fences and a high voltage transmission line. These are discussed in more detail below.

- Biomes and vegetation types

The combined area is located in Nama Karoo Biome, and the Bushmanland Bioregion (Mucina & Rutherford 2006). It is situated on a vast, flat plain dominated by Bushmanland Arid Grassland, which consists of grassland dominated by white grasses (*Stipagrostis* species) giving this vegetation type the character of semidesert 'steppe' in years of high rainfall. In places low shrubs change the vegetation structure in areas, particularly in drainage lines. In years of abundant rainfall rich displays of annual herbs can be expected (Mucina & Rutherford, 2006). The combined area contains both sandy areas and calcrete gravelly plains. Due to the extensive ongoing drought in the area, the grass layer was completely depleted at when the surveys were conducted. The land-use in the region is predominantly livestock farming.

Figure 2: Shrubby vegetation in a drainage line at the combined area.

Figure 3: The combined area is situated on a vast, flat plain, with both sandy and calcrete gravelly areas.

The climate at Kenhardt is arid, with high summer temperatures and mild winters. Average rainfall is around 156mm per year. Table 1 below displays the average temperatures and rainfall for Kenhardt (climate-data.org).

Table 1: Annual temperatures and precipitation at Kenhardt (climate-data.org)

	January	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**
Avg. Temperature (°C)	27.1	26.4	24.1	19.8	14.9	11.8	10.7	13.5	16.3	20.6	23	26.2
Min. Temperature (°C)	18.8	18.3	16.2	12	6.7	3.3	2.2	4.4	7.3	11.7	14.4	17.6
Max. Temperature (°C)	35.5	34.5	32.1	27.7	23.2	20.4	19.3	22.7	25.4	29.5	31.7	34.9
Precipitation / Rainfall (mm)	19	27	31	20	9	5	3	4	4	8	12	14

- Surface water

Surface water is of specific importance to avifauna in this semi-arid environment. The combined area contains open water troughs that provide drinking water to livestock (see Figure 4). Open water troughs are important sources of surface water and could potentially be used extensively by various bird species, including large raptors, to drink and bath. There is also a small pan in the northernmost corner of the combined area, close to the Nieuwehoop Substation. The pan was dry when the surveys were conducted, but it could hold water after good rains, when it could be attractive to various bird species, including large raptors, to drink and bath. It could also serve as an attraction to waterbirds when it contains water. The PV5 footprint itself contains no surface water.


Figure 4: A water trough in the combined area.

- High voltage lines

High voltage lines are an important potential roosting and breeding substrate for large raptors in the area. Existing high-voltage lines are used extensively by large raptors in arid regions of South Africa e.g. in 2005 an aerial survey of the Ferrum – Garona 275kV line which starts at Kathu and terminates at Garona Substation approximately 16km north of Groblershoop, found a total of 19 Martial Eagle and 7 Tawny Eagle nests on transmission line towers (Van Rooyen 2007). High voltage lines therefore hold a special importance for large raptors, but also for Sociable Weavers which often construct their giant nests within the lattice work or cross-arms of high voltage structures. The combined area does not contain any high voltage lines, but the 1 Aries – Nieuwehoop 400kV line runs just north-west of the combined area, where it terminates in the Nieuwehoop Substation (see Figure 5). The line was inspected for potential raptor nesting activity during the field surveys, but no nests were recorded.


Figure 5: The 1 Aries – Nieuwehoop 400kV line where it terminates in the Nieuwehoop Substation.

- Fences

The combined area contains several fenced in grazing camps (see Figure 6). Farm fences provide important perching substrate for a wide range of birds in this treeless environment where natural perches are scarce, as a staging post for territorial displays by small birds and also for perch hunting for raptors such as Greater Kestrel, Rock Kestrel and Southern Pale Chanting Goshawk.

Figure 6: The combined area contains several fences.

4.2. Avifauna

4.2.1 Southern African Bird Atlas 2

The SABAP 2 data indicate that a total of 149 bird species could potentially occur in the broader area – Appendix 2 provides a comprehensive list of all the species, including those recorded during the pre-construction monitoring. Of the priority species potentially occurring in the broader area, 24 could potentially occur in the combined area (see Section 4 for definition of a priority species), 9 of these are South African Red Data species, and 3 are globally Red listed. The probability of a priority species occurring in the study area is indicated in Table 2.

Table 2 below lists all the priority species and the possible impact on the respective species by the proposed solar energy infrastructure. The following abbreviations and acronyms are used:

EN = Endangered
VU = Vulnerable
NT = Near-threatened
LC = Least concern

Table 2: Priority species which could potentially occur in the Kenhardt PV5 combined area. Red listed species are shaded in red.

										Habitat class						Potential impact						
Species	**Scientific name**	**SABAP2 Full protocol reporting rate**	**Endemic - Southern Africa**	**Red Data Global**	**Red Data SA**	**Endemic - South Africa**	**Class**	**Probability of occurrence**	**Recorded during on-site surveys**	**Sandy areas**	**Gravel plains**	**Drainage lines (shrubs)**	**Surface water**	**High voltage lines**	**Fences**	**PV panel collisions**	**Displacement: Disturbance PV**	**Displacement: Habitat loss PV**	**Displacement: Disturbance grid construction**	**Entrapment**	**Powerline collisions**	**Electrocutions**
Black-eared Sparrowlark	*Eremopterix australis*	6.5	Endemic			Near endemic	Other	High		x	x	x	x		x	x	x	x	x			
Black-headed Canary	*Serinus alario*	6.5	Endemic			Near endemic	Other	High		x	x	x	x		x	x	x	x	x			
Booted Eagle	*Hieraaetus pennatus*	1.3					Raptor	Medium		x	x	x	x	x								x
Burchell's Courser	*Cursorius rufus*	1.3	Near-endemic	LC	VU		Other	Medium			x						x	x	x			
Egyptian Goose	*Alopochen aegyptiaca*	11.7					Waterbird	High	x				x	x								
Fiscal Flycatcher	*Sigelus silens*	2.6	Endemic			Near endemic	Other	Medium				x			x	x	x	x	x			
Greater Kestrel	*Falco rupicoloides*	6.5					Raptor	High		x	x	x		x	x							x
Karoo Korhaan	*Eupodotis vigorsii*	50.6	Endemic	LC	NT		Other	High	x	x	x	x					x	x	x	x	x	
Karoo Prinia	*Prinia maculosa*	2.6	Endemic			Near endemic	Other	Medium				x				x	x	x	x			
Kori Bustard	*Ardeotis kori*	7.8		NT	NT		Other	Medium		x	x	x	x				x	x	x	x	x	
Lanner Falcon	*Falco biarmicus*	1.3		LC	VU		Raptor	Medium		x	x	x	x	x	x	x						x
Large-billed Lark	*Galerida magnirostris*	2.6	Endemic			Near endemic	Other	High				x			x	x	x	x	x			
Lesser Kestrel	*Falco naumanni*	3.9					Raptor	Medium		x	x	x		x	x	x						x
Ludwig's Bustard	*Neotis ludwigii*	16.9	Near-endemic	EN	EN		Other	High		x	x	x					x	x	x	x	x	
Martial Eagle	*Polemaetus bellicosus*	5.2		VU	EN		Raptor	High	x	x	x	x	x	x								x
Pygmy Falcon	*Polihierax semitorquatus*	18.2					Raptor	Medium		x		x			x	x						

										Habitat class						Potential impact						
Species	**Scientific name**	**SABAP2 Full protocol reporting rate**	**Endemic - Southern Africa**	**Red Data Global**	**Red Data SA**	**Endemic - South Africa**	**Class**	**Probability of occurrence**	**Recorded during on-site surveys**	**Sandy areas**	**Gravel plains**	**Drainage lines (shrubs)**	**Surface water**	**High voltage lines**	**Fences**	**PV panel collisions**	**Displacement: Disturbance PV**	**Displacement: Habitat loss PV**	**Displacement: Disturbance grid construction**	**Entrapment**	**Powerline collisions**	**Electrocutions**
Red Lark	*Calendulauda burra*	2.6	Endemic	VU	VU	Endemic	Other	Medium		x		x			x	x	x	x	x			
Rock Kestrel	*Falco rupicolus*	3.9					Raptor	High		x	x	x	x	x	x							x
Sclater's Lark	*Spizocorys sclateri*	5.2	Endemic	NT	NT	Near endemic	Other	High			x		x		x	x	x	x	x			
Sickle-winged Chat	*Cercomela sinuata*	7.8	Endemic			Near endemic	Other	High				x	x		x	x	x	x	x			
Southern Double-collared Sunbird	*Cinnyris chalybeus*	2.6	Endemic			Near endemic	Other	Low				x						x				
Southern Pale Chanting Goshawk	*Melierax canorus*	40.3	Near-endemic				Raptor	High	x	x	x	x	x	x	x		x					x
Spotted Eagle-Owl	*Bubo africanus*	7.8					Raptor	High	x	x	x	x		x	x		x	x	x		x	x
Verreaux's Eagle	*Aquila verreauxii*	6.5		LC	VU		Raptor	Low						x								x

4.2.2 *Pre-construction surveys*

On-site surveys were conducted from 13 - 16 November and again from 21 - 24 November 2019. Surveys were conducted according to the best practice guidelines for avifaunal impact studies at solar developments, compiled by BirdLife South Africa (BLSA) in 2017 (Jenkins *et al.* 2017). Please see Section 2 for details of the methodology used in the surveys.

- Species abundance

The abundance of priority species recorded during the walk transects two surveys in November 2019 are displayed in Tables 3 and 4.

Table 3: Index of kilometric abundance (IKA) for all species recorded by means of walk transects **during the two surveys in the proposed PV footprints, conducted in November 2019. Priority species are shaded, and Red listed species are indicated in red (incidental sightings excluded).**

Species	Priority species	Locality	IKA
Namaqua Sandgrouse	No	PV	12.1944
Spike-heeled Lark	No	PV	0.9167
Stark's Lark	No	PV	0.8056
Karoo Korhaan	Yes	PV	0.2500
Sabota Lark	No	PV	0.2500
Pink-billed Lark	No	PV	0.2222
Double-banded Courser	No	PV	0.1111
Pied Crow	No	PV	0.1111
Ant-eating Chat	No	PV	0.0556
Chat Flycatcher	No	PV	0.0556
Northern Black Korhaan	No	PV	0.0556
Yellow Canary	No	PV	0.0556
Yellow-bellied Eremomela	No	PV	0.0556
Martial Eagle	Yes	PV	0.0278

Table 4: Index of kilometric abundance (IKA) for all species recorded by means of walk transects **during the two surveys in the control area, conducted in November 2019. Priority species are shaded, and Red listed species are indicated in red (incidental sightings excluded).**

Species	Priority species	Locality	IKA
Namaqua Sandgrouse	No	Ctrl	1.7500
Sociable Weaver	No	Ctrl	0.5833
Spike-heeled Lark	No	Ctrl	0.5833
Pied Crow	No	Ctrl	0.4167
Martial Eagle	Yes	Ctrl	0.2500
Speckled Pigeon	No	Ctrl	0.2500
Karoo Korhaan	Yes	Ctrl	0.1667
Cape Sparrow	No	Ctrl	0.1667
Sabota Lark	No	Ctrl	0.1667
Yellow Canary	No	Ctrl	0.1667
Yellow-bellied Eremomela	No	Ctrl	0.1667
Acacia Pied Barbet	No	Ctrl	0.0833
Barn Swallow	No	Ctrl	0.0833
Cape Turtle-Dove	No	Ctrl	0.0833

Rufous-eared Warbler	No	Ctrl	0.0833

- Species variety

The total number of species recorded during the two surveys conducted in November 2019 are listed in Table 5 below.

Table 5: The total number of species recorded during the two surveys conducted in November 2019. Priority species are shaded, and South African Red listed species are indicated in red.

EN = Endangered, NT = Near threatened, VU = Vulnerable, LC = Least concern

Priority species	Scientific name	Class	Red Data SA	Red Data global	Transect - PV	Transect - Ctrl	Incidental
Egyptian Goose	*Alopochen aegyptiaca*	Waterbird	-	LC			*
Karoo Korhaan	*Eupodotis vigorsii*	Other	NT	LC	*	*	*
Martial Eagle	*Polemaetus bellicosus*	Raptor	EN	VU	*	*	
Southern Pale Chanting Goshawk	*Melierax canorus*	Raptor	-	LC			*
Spotted Eagle-Owl	*Bubo africanus*	Raptor	-	LC			*
5			*Priority species subtotal:*		2	2	4
Non-priority species	**Scientific name**		**Red Data SA**	**Red Data global**	**Transect - PV**	**Transect - Ctrl**	**Incidental**
Acacia Pied Barbet	*Tricholaema leucomelas*		-	LC		*	*
African Red-eyed Bulbul	*Pycnonotus nigricans*		-	LC			*
Ant-eating Chat	*Myrmecocichla formicivora*		-	LC	*		
Barn Swallow	*Hirundo rustica*		-	LC		*	*
Black-chested Prinia	*Prinia flavicans*		-	LC			*
Cape Glossy Starling	*Lamprotornis nitens*		-	LC			*
Cape Sparrow	*Passer melanurus*		-	LC		*	*
Cape Turtle-Dove	*Streptopelia capicola*		-	LC		*	*
Chat Flycatcher	*Bradornis infuscatus*		-	LC	*		*
Common Scimitarbill	*Rhinopomastus cyanomelas*		-	LC			*
Double-banded Courser	*Rhinoptilus africanus*		-	LC	*		
Dusky Sunbird	*Cinnyris fuscus*		-	LC			*
Familiar Chat	*Cercomela familiaris*		-	LC			*

Greater Striped Swallow	*Hirundo cucullata*		-	LC			*
Namaqua Sandgrouse	*Pterocles namaqua*		-	LC	*	*	
Northern Black Korhaan	*Afrotis afraoides*		-	LC	*		*
Pied Crow	*Corvus albus*		-	LC	*	*	
Pink-billed Lark	*Spizocorys conirostris*		-	LC	*		
Rock Martin	*Hirundo fuligula*		-	LC			*
Rufous-cheeked Nightjar	*Caprimulgus rufigena*		-	LC			*
Rufous-eared Warbler	*Malcorus pectoralis*		-	LC		*	*
Sabota Lark	*Calendulauda sabota*		-	LC	*	*	*
Sociable Weaver	*Philetairus socius*		-	LC		*	*
Southern Red Bishop	*Euplectes orix*		-	LC			*
Speckled Pigeon	*Columba guinea*		-	LC		*	*
Spike-heeled Lark	*Chersomanes albofasciata*		-	LC	*	*	*
Stark's Lark	*Spizocorys starki*		-	LC	*		*
Swallow-tailed Bee-eater	*Merops hirundineus*		-	LC			*
White-rumped Swift	*Apus caffer*		-	LC			*
Yellow Canary	*Crithagra flaviventris*		-	LC	*	*	*
Yellow-bellied Eremomela	*Eremomela icteropygialis*		-	LC	*	*	*
31			*Non-Priority species subtotal:*		12	13	26
			Grand Total:		14	15	30

4.2. Identification of Environmental Sensitivities

4.2.1 High sensitivity

Included are areas within 200m of water troughs. These areas are highly sensitive for the following reasons:

- Surface water in this arid habitat is crucially important for avifauna, including several Red Data species such as Martial Eagle, Verreaux's Eagle, Sclater's Lark, Lanner Falcon and Kori Bustard, and many non-Red Data species. The main source of surface water in the combined area is water troughs.
- The water troughs attract many species of birds which may put them at risk of collisions if there are powerlines in the vicinity of the surface water. Red Data species that could be impacted in this way are Martial Eagle, Verreaux's Eagle and Lanner Falcon, when descending to the water to drink and bath, or in the case of Lanner Falcon, also when hunting other birds at the water's edge. Several non-Red Data powerline sensitive species could also be attracted to surface water and be

at risk of collisions e.g. Egyptian Goose and Namaqua Sandgrouse – a flock of 374 birds were recorded arriving at water trough to drink in the morning.

- The water troughs often have trees growing in the immediate vicinity, which may serve as potential nesting substrate for a variety of birds, including Southern Pale Chanting Goshawk. These trees are also important daytime roosts for Spotted Eagle-Owls e.g. roosting owls were regularly encountered in trees at a water trough just outside the combined area.

4.2.2 Medium sensitivity

The entire land parcel can be classified as medium sensitive. The area is largely untransformed, and the natural habitat supports a number of Red Data powerline sensitive species, notably Ludwig's Bustard, Karoo Korhaan and Martial Eagle. Ludwig's Bustard in particular is known to be highly susceptible to powerline collisions, while Martial Eagles are highly susceptible to electrocutions. Martial Eagle was recorded during the site visits.

4.2.3 DEFF National Screening Tool

The DEFF National Screening Tool classifies the combined area as medium sensitive from an avifaunal perspective.

4.2.4 Strategic Environmental Assessment for Wind and Solar Photovoltaic Energy in South Africa (Solar and Wind SEA)

The combined area is classified as Low sensitivity for avifauna in the Solar and Wind SEA.

See Appendix 4 for a sensitivity map indicating the high sensitivity areas.

5. Issues, Risks and Impacts

5.1. Summary of Issues identified during the Project Notification Phase

No issues were raised pertaining to avifauna during the Project Notification Phase.

5.2. Identification of Potential Impacts/Risks

The potential impacts identified during the BA are:

5.2.1 Construction Phase

- Displacement due to disturbance associated with the construction of the solar PV plant and associated infrastructure
- Displacement due to disturbance associated with the construction of the 132kV grid connection

5.2.2 Operational Phase

- Displacement due to habitat transformation associated with the construction of the solar PV plant and associated infrastructure[4]
- Collisions with the solar panels
- Entrapment in perimeter fences

[4] Due to the nature of the habitat, displacement due to habitat destruction associated with the proposed grid connection is likely to be negligible, therefore this is not listed as an impact.

- Collisions with the associated power lines
- Electrocutions on the associated power lines

5.2.3 Decommissioning Phase

- Displacement due to disturbance associated with the decommissioning of the solar PV plant and associated infrastructure

5.2.4 Cumulative Impacts

- Displacement due to disturbance associated with the construction of the solar PV plant and associated infrastructure
- Displacement due to habitat transformation associated with the construction of the solar PV plant and associated infrastructure
- Collisions with the solar panels
- Entrapment in perimeter fences
- Collisions with the associated power lines
- Electrocutions on the associated power lines.

6. Impact Assessment

6.1 Introduction

Increasingly, human-induced climate change is recognized as a fundamental driver of biological processes and patterns. Historic climate change is known to have caused shifts in the geographic ranges of many plants and animals, and future climate change is expected to result in even greater redistributions of species (National Audubon Society 2015). In 2006 WWF Australia produced a report on the envisaged impact of climate change on birds worldwide (Wormworth, J. & Mallon, K. 2006). The report found that:

- Climate change now affects bird species' behaviour, ranges and population dynamics;
- Some bird species are already experiencing strong negative impacts from climate change;
- In future, subject to greenhouse gas emissions levels and climatic response, climate change will put large numbers bird species at risk of extinction, with estimates of extinction rates varying from 2 to 72%, depending on the region, climate scenario and potential for birds to shift to new habitat.

Using statistical models based on the North American Breeding Bird Survey and Audubon Christmas Bird Count datasets, the National Audubon Society assessed geographic range shifts through the end of the century for 588 North American bird species during both the summer and winter seasons under a range of future climate change scenarios (National Audubon Society 2015). Their analysis showed the following:

- 314 of 588 species modelled (53%) lose more than half of their current geographic range in all three modelled scenarios.
- For 126 species, loss occurs without accompanying range expansion.
- For 188 species, loss is coupled with the potential to colonize new areas.

Climate sensitivity is an important piece of information to incorporate into conservation planning and adaptive management strategies. The persistence of many birds will depend on their ability to colonize climatically suitable areas outside of current ranges and management actions that target climate change adaptation.

South Africa is among the world's top 10 developing countries required to significantly reduce their carbon emissions (Seymore *et al.* 2014), and the introduction of low-carbon technologies into the country's compliment of power generation will greatly assist with achieving this important objective (Walwyn & Brent 2015). Given that South Africa receives among the highest levels of solar radiation on earth (Fluri 2009; Munzhedi *et al.* 2009), it is clear that solar power generation should feature prominently in future efforts to convert to a more sustainable energy mix in order to combat climate change, also from an avifaunal impact perspective. However, while the expansion of solar power generation is undoubtedly a positive development for avifauna in the longer term in that it will help reduce the effect of climate change and thus habitat transformation, it must also be acknowledged that renewable energy facilities, including solar PV facilities, in themselves have some potential for negative impacts on avifauna.

A literature review reveals a scarcity of published, scientifically examined information regarding large-scale PV plants and birds. The reason for this is mainly that large-scale PV plants are a relatively recent phenomenon. The main source of information for these types of impacts are from compliance reports and a few government-sponsored studies relating to recently constructed solar plants in the south-west United States. In South Africa, only one published scientific study has been completed on the impacts of PV plants in a South African context (Visser *et al.* 2019).

6.2 Impacts associated with PV plants

6.2.1 Impact trauma (collisions)

This impact refers to collision-related fatality i.e. fatality resulting from the direct contact of the bird with a project structure(s). This type of fatality has been occasionally documented at solar projects of all technology types (McCrary *et al.* 1986; Hernandez *et al.* 2014; Kagan *et al.* 2014). In some instances, the bird is not killed outright by the collision impact, but succumbs to predation later, as it cannot avoid predators due to its injured state.

Sheet glass used in commercial and residential buildings has been well established as a hazard for birds. When the sky is reflected in the sheet glass, birds fail to see the building as an obstacle and attempt to fly through the glass, mistaking it for empty space (Loss *et al.* 2014). Although very few cases have been reported it is possible that the reflective surfaces of solar panels could constitute a similar risk to avifauna.

An extremely rare but potentially related problem is the so-called "lake effect" i.e. it seems possible that reflections from solar facilities' infrastructure, particularly large sheets of dark blue photovoltaic panels, may attract birds in flight across the open desert, who mistake the broad reflective surfaces for water (Kagan *et al.* 2014)[5]. The unusually high percentage of waterbird mortalities at the Desert Sunlight PV facility (44%) may support the "lake effect" hypothesis (West 2014). Although in the case of Desert Sunlight, the proximity of evaporation ponds may act as an additional risk increasing factor, in that birds are both attracted to the water feature and habituated to the presence of an accessible aquatic environment in the area. This may translate into the misinterpretation of diffusely reflected sky or horizontal polarised light source as a body of water. However, due to limited data it would be premature to make any general conclusions about the influence of the lake effect or other factors that contribute to fatality of water-dependent birds. The activity and abundance of water-dependent species near solar facilities may depend on other site-specific or regional factors, such as the surrounding landscape (Walston *et al.* 2015). However, until such time that enough scientific evidence has been collected to discount the "lake effect" hypothesis, it must be considered as a potential source of impacts.

[5] This could either result in birds colliding directly with the solar panels or getting stranded and unable to take off again because many aquatic bird species find it very difficult and sometimes impossible to take off from dry land e.g. grebes and cormorants. This exposes them to predation, even if they do not get injured through direct collisions with the panels.

Weekly mortality searches at 20% coverage were conducted at the 250MW, 1300ha California Valley Solar Ranch PV site (Harvey & Associates 2014a and 2014b). According to the information that could be sourced from the internet (two quarterly reports), 152 avian mortalities were reported for the period 16 November 2013 – 15 February 2014, and 54 for the period 16 February 2014 – 15 May 2014, of which approximately 90% were based on feather spots which precluded a finding on the cause of death. These figures give an estimated unadjusted 1 030 mortalities per year, which is obviously an underestimate as it does not include adjustments for carcasses removed by scavengers and missed by searchers. The authors stated clearly that these quarterly reports do not include the results of searcher efficiency trials, carcass removal trials, or data analyses, nor does it include detailed discussions.

In a report by the National Fish and Wildlife Forensic Laboratory (Kagan *et al.* 2014), the cause of avian mortalities was estimated based on opportunistic avian carcass collections at several solar facilities, including the 550MW, 1 600ha Desert Sunlight PV plant. Impact trauma emerged as the highest identifiable cause of avian mortality, but most mortality could not be traced to an identifiable cause.

Walston *et al.* (2015) conducted a comprehensive review of avian fatality data from large scale solar facilities (all technology types) in the USA. Collision as cause of death (19 birds) ranked second at Desert Sunlight PV plant and California Valley Solar Ranch (CVSR) PV plant, after unknown causes. Cause of death could not be determined for over 50% of the fatality observations and many carcasses included in these analyses consisted only of feather spots (feathers concentrated together in a small area) or partial carcasses, thus making determination of cause of death difficult. It is anticipated that some unknown fatalities were caused by predation or some other factor unrelated to the solar project. However, they found that the lack of systematic data collection and standardization was a major impediment in establishing the actual extent and causes of fatalities across all projects.

The only scientific investigation of potential avifaunal impacts that has been performed at a South African PV facility was completed in 2016 at the 96MW Jasper PV solar facility (28°17′53″S, 23°21′56″E) which is located on the Humansrus Farm, approximately 4 km south-east of Groenwater and 30km east of Postmasburg in the Northern Cape Province (Visser *et al.* 2019). The Jasper PV facility contains 325 360 solar panels over a footprint of 180 hectares with the capacity to deliver 180 000 MWh of renewable electricity annually. The solar panels face north at a fixed 20° angle, reaching a height of approximately 1.86 m relative to ground level with a distance of 3.11 m between successive rows of panels. Mortality surveys were conducted from the 14th of September 2015 until the 6th of December 2015, with a total of seven mortalities recorded among the solar panels which gives an average rate of 0.003 birds per hectare surveyed per month. All fatalities were inferred from feather spots. Extrapolated bird mortality within the solar field at the Jasper PV facility was 435 birds/yr (95% CI 133 - 805). The broad confidence intervals result from the small number of birds detected. The mortality estimate is likely conservative because detection probabilities were based on intact birds, and probably decrease for older carcasses and feather spots. The study concluded inter alia that the short study period, and lack of comparable results from other sources made it difficult to provide a meaningful assessment of avian mortality at PV facilities. It further stated that despite these limitations, the few bird fatalities that were recorded might suggest that there is no significant collision-related mortality at the study site. The conclusion was that to fully understand the risk of solar energy development on birds, further collation and analysis of data from solar energy facilities across spatial and temporal scales, based on scientifically rigorous research designs, is required (Visser *et al.* 2019).

The results of the available literature lack compelling evidence of collisions as a cause of large-scale mortality among birds at PV facilities. However, it is clear from this limited literature survey that the lack of systematic and standardised data collection is a major problem in the assessment of the causes and extent of avian mortality at all types of solar facilities, regardless of the technology employed. Until statistically tested results emerge from existing compliance programmes and more dedicated scientific research, conclusions will inevitably be largely speculative and based on professional opinion.

It is not foreseen that collisions with the solar panels at the PV facility will be a significant impact. The priority species which would most likely be potentially affected by this impact are mostly small birds which forage between the solar panels, and possibly raptors which prey on them:

- Black-eared Sparrowlark
- Black-headed Canary
- Fiscal Flycatcher
- Karoo Prinia
- Lanner Falcon
- Large-billed Lark
- Lesser Kestrel
- Pygmy Falcon
- Red Lark
- Sclater's Lark
- Sickle-winged Chat

6.2.2 Entrapment in perimeter fences

Visser *et al.* (2019) recorded a fence-line fatality (Orange River Francolin *Scleroptila gutturalis*) resulting from the bird being trapped between the inner and outer perimeter fence of the facility. This was further supported by observations of large-bodied birds unable to escape from between the two fences (e.g. Red-crested Korhaan *Lophotis ruficrista*) (Visser *et al.* 2019). Considering that one would expect the birds to be able to take off in the lengthwise direction (parallel to the fences), it seems possible that the birds panicked when they were approached by observers and thus flew into the fence.

It is not foreseen that entrapment in perimeter fences will be a significant impact. The priority species which could potentially be affected by this impact are most likely medium to large terrestrial species:

- Karoo Korhaan
- Kori Bustard
- Ludwig's Bustard

6.2.3 Displacement due to disturbance and habitat transformation associated with the construction of the solar PV facility

Ground-disturbing activities affect a variety of processes in arid areas, including soil density, water infiltration rate, vulnerability to erosion, secondary plant succession, invasion by exotic plant species, and stability of cryptobiotic soil crusts. These processes have the ability – individually and together – to alter habitat quality, often to the detriment of wildlife, including avifauna. Any disturbance and alteration to the desert landscape, including the construction and decommissioning of utility-scale solar energy facilities, has the potential to increase soil erosion. Erosion can physically and physiologically affect plant species and can thus adversely influence primary production and food availability for wildlife (Lovich & Ennen 2011).

Solar energy facilities require substantial site preparation (including the removal of vegetation) that alters topography and, thus, drainage patterns to divert the surface flow associated with rainfall away from facility infrastructure. Channelling runoff away from plant communities can have dramatic negative effects on water availability and habitat quality in arid areas. Areas deprived of runoff from sheet flow support less biomass of perennial and annual plants relative to adjacent areas with uninterrupted water-flow patterns (Lovich & Ennen 2011).

The activities listed below are typically associated with the construction and operation of solar facilities and could have direct impacts on avifauna (County of Merced 2014):

- Preparation of solar panel areas for installation, including vegetation clearing, grading, cut and fill;
- Excavation/trenching for water pipelines, cables, fibre-optic lines, and the septic system;
- Construction of piers and building foundations;
- Construction of new dirt or gravel roads and improvement of existing roads;
- Temporary stockpiling and side-casting of soil, construction materials, or other construction wastes;
- Soil compaction, dust, and water runoff from construction sites;
- Increased vehicle traffic;
- Short-term construction-related noise (from equipment) and visual disturbance;
- Degradation of water quality in drainages and other water bodies resulting from project runoff;
- Maintenance of fire breaks and roads; and
- Weed removal, brush clearing, and similar land management activities related to the ongoing operation of the project.

These activities could have an impact on birds breeding, foraging and roosting in or in close proximity through disturbance and transformation of habitat, which could result in temporary or permanent displacement.

In a study comparing the avifaunal habitat use in PV arrays with adjoining managed grassland at airports in the USA, DeVault *et al.* (2014) found that species diversity in PV arrays was reduced compared to the grasslands (37 vs 46), supporting the view that solar development is generally detrimental to wildlife on a local scale.

In order to identify functional and structural changes in bird communities in and around the development footprint, Visser *et al.* (2019) gathered bird transect data at the 180 hectares, 96MW Jasper PV solar facility in the Northern Cape, representing the solar development, boundary, and untransformed landscape. The study found both bird density and diversity per unit area was higher in the boundary and untransformed landscape, however, the extent therefore was not considered to be statistically significant. This indicates that the PV facility matrix is permeable to most species. However, key environmental features, including available habitat and vegetation quality are most likely the overriding factors influencing species' occurrence and their relative density within the development footprint. Her most significant finding was that the distribution of birds in the landscape changed, from a shrubland to open country and grassland bird community, in response to changes in the distribution and abundance of habitat resources such as food, water and nesting sites. These changes in resource availability patterns were detrimental to some bird species and beneficial to others. Shrubland specialists appeared to be negatively affected by the presence of the PV facility. In contrast, open country/grassland and generalist species, were favoured by its development (Visser *et al.* 2019).

It is highly likely that the same pattern of reduced avifaunal densities and possible changes in densities and composition favouring grassland species will manifest itself at the proposed PV facility. Species that are likely to be affected by displacement due to disturbance and habitat destruction are listed below:

- Black-eared Sparrowlark
- Black-headed Canary
- Burchell's Courser
- Fiscal Flycatcher
- Karoo Korhaan

- Karoo Prinia
- Kori Bustard
- Large-billed Lark
- Ludwig's Bustard
- Red Lark
- Sclater's Lark
- Sickle-winged Chat
- Southern Pale Chanting Goshawk
- Spotted Eagle-Owl

6.3 Impacts associated with powerlines

Negative impacts on birds by electricity infrastructure generally take two principal forms, namely electrocution and collisions (Ledger & Annegarn 1981; Ledger 1983; Ledger 1984; Hobbs and Ledger 1986a; Hobbs & Ledger 1986b; Ledger, Hobbs & Smith, 1992; Verdoorn 1996; Kruger & Van Rooyen 1998; Van Rooyen 1998; Kruger 1999; Van Rooyen 1999; Van Rooyen 2000; Van Rooyen 2004; Jenkins *et al.* 2010). Birds also impact on the infrastructure through nesting and streamers, which can cause interruptions in the electricity supply (Van Rooyen *et al.* 2002). During the construction phase of power lines and substations, displacement of birds can also happen due to disturbance and habitat transformation.

6.3.1 Electrocutions

Electrocution refers to the scenario where a bird is perched or attempts to perch on the 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 2004). The electrocution risk is largely determined by the design of the electrical hardware.

It is currently not clear whether the internal 33kV electrical powerlines will be buried, or above ground. If the lines are above ground, several raptor species might be at risk of electrocution on the medium voltage lines:

- Booted Eagle
- Greater Kestrel
- Lanner Falcon
- Lesser Kestrel
- Martial Eagle
- Rock Kestrel
- Southern Pale Chanting Goshawk
- Spotted Eagle-Owl
- Verreaux's Eagle

6.3.2 Collisions

Collision mortality is the biggest threat posed by transmission lines to birds in southern Africa (Van Rooyen 2004). Most heavily impacted upon are bustards, storks, cranes and various species of waterbirds. These species are mostly heavy-bodied birds with limited manoeuvrability, which makes it difficult for them to take the necessary evasive action to avoid colliding with transmission lines (Van Rooyen 2004, Anderson 2001). In her PhD study, Shaw (2013) provides a concise summary of the phenomenon of avian collisions with transmission lines:

"The collision risk posed by power lines is complex and problems are often localised. While any bird flying near a power line is at risk of collision, this risk varies greatly between different groups of birds, and depends on the interplay of a wide range of factors (APLIC 1994). Bevanger (1994) described these factors in four main groups – biological, topographical, meteorological and technical. Birds at highest risk are those that are both susceptible to collisions and frequently exposed to power lines, with waterbirds, gamebirds, rails, cranes and bustards usually the most numerous reported victims (Bevanger 1998, Rubolini et al. 2005, Jenkins et al. 2010).

The proliferation of man-made structures in the landscape is relatively recent, and birds are not evolved to avoid them. Body size and morphology are key predictive factors of collision risk, with large-bodied birds with high wing loadings (the ratio of body weight to wing area) most at risk (Bevanger 1998, Janss 2000). These birds must fly fast to remain airborne, and do not have sufficient manoeuvrability to avoid unexpected obstacles. Vision is another key biological factor, with many collision-prone birds principally using lateral vision to navigate in flight, when it is the lower-resolution, and often restricted, forward vision that is useful to detect obstacles (Martin & Shaw 2010, Martin 2011, Martin et al. 2012). Behaviour is important, with birds flying in flocks, at low levels and in crepuscular or nocturnal conditions at higher risk of collision (Bevanger 1994). Experience affects risk, with migratory and nomadic species that spend much of their time in unfamiliar locations also expected to collide more often (Anderson 1978, Anderson 2002). Juvenile birds have often been reported as being more collision-prone than adults (e.g. Brown et al. 1987, Henderson et al. 1996).

Topography and weather conditions affect how birds use the landscape. Power lines in sensitive bird areas (e.g. those that separate feeding and roosting areas, or cross flyways) can be very dangerous (APLIC 1994, Bevanger 1994). Lines crossing the prevailing wind conditions can pose a problem for large birds that use the wind to aid take-off and landing (Bevanger 1994). Inclement weather can disorient birds and reduce their flight altitude, and strong winds can result in birds colliding with power lines that they can see but do not have enough flight control to avoid (Brown et al. 1987, APLIC 2012). The technical aspects of power line design and siting also play a big part in collision risk. Grouping similar power lines on a common servitude, or locating them along other features such as tree lines, are both approaches thought to reduce risk (Bevanger 1994). In general, low lines with short span lengths (i.e. the distance between two adjacent pylons) and flat conductor configurations are thought to be the least dangerous (Bevanger 1994, Jenkins et al. 2010). On many higher voltage lines, there is a thin earth (or ground) wire above the conductors, protecting the system from lightning strikes. Earth wires are widely accepted to cause the majority of collisions on power lines with this configuration because they are difficult to see, and birds flaring to avoid hitting the conductors often put themselves directly in the path of these wires (Brown et al. 1987, Faanes 1987, Alonso et al. 1994a, Bevanger 1994)."

From incidental record keeping by the Endangered Wildlife Trust, it is possible to give a measure of what species are generally susceptible to power line collisions in South Africa (see Figure 7 below – EWT unpublished data).

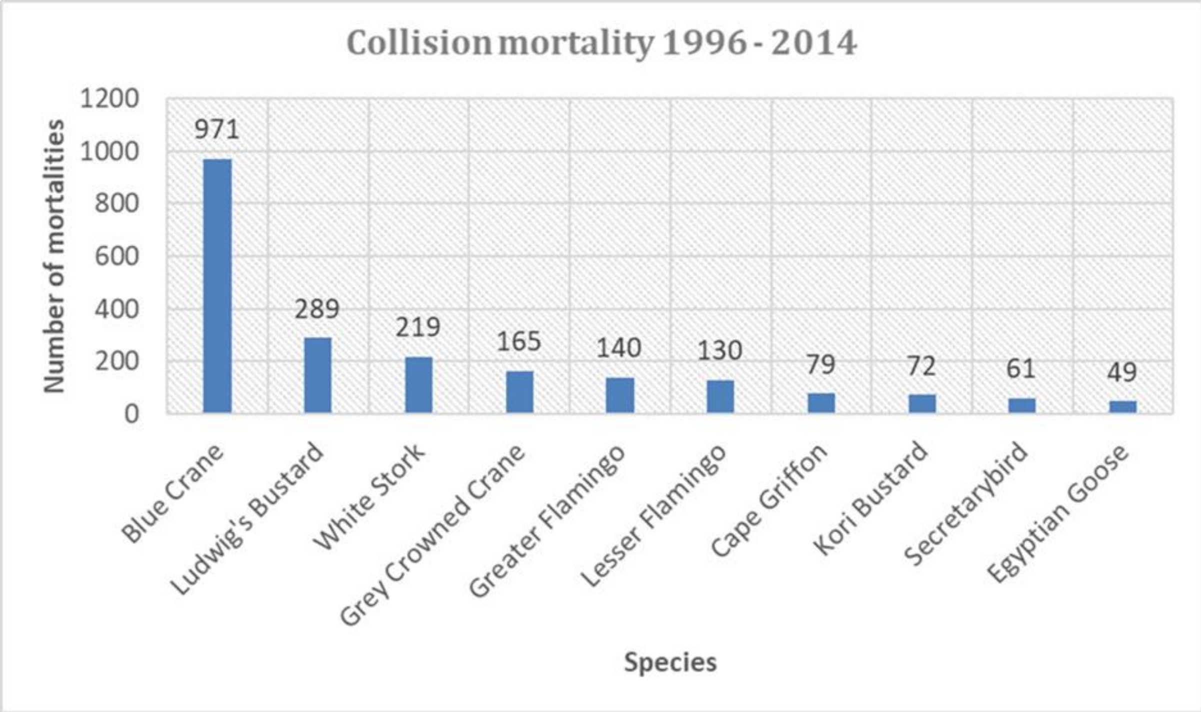

Figure 7: The top 10 collision prone bird species in South Africa, in terms of reported incidents contained in the Eskom/EWT Strategic Partnership central incident register 1996 - 2014 (EWT unpublished data).

Power line collisions are generally accepted as a key threat to bustards (Raab *et al.* 2009; Raab *et al.* 2010; Jenkins & Smallie 2009; Barrientos *et al.* 2012, Shaw 2013). In a comprehensive study, carcass surveys were performed under high voltage transmission lines in the Karoo for two years, and low voltage distribution lines for one year (Shaw 2013). Ludwig's Bustard was the most common collision victim (69% of carcasses), with bustards generally comprising 87% of mortalities recovered. Total annual mortality was estimated at 41% of the Ludwig's Bustard population, with Kori Bustards also dying in large numbers (at least 14% of the South African population killed in the Karoo alone). Karoo Korhaan was also recorded, but to a much lesser extent than Ludwig's Bustard. The reasons for the relatively low collision risk of this species probably include their smaller size (and hence greater agility in flight) as well as their more sedentary lifestyles, as local birds are familiar with their territory and are less likely to collide with power lines (Shaw 2013).

Several factors are thought to influence avian collisions, including the manoeuvrability of the bird, topography, weather conditions and power line configuration. An important additional factor that previously has received little attention is the visual capacity of birds; i.e. whether they are able to see obstacles such as power lines, and whether they are looking ahead to see obstacles with enough time to avoid a collision. In addition to helping explain the susceptibility of some species to collision, this factor is key to planning effective mitigation measures. Recent research provides the first evidence that birds can render themselves blind in the direction of travel during flight through voluntary head movements (Martin & Shaw 2010). Visual fields were determined in three bird species representative of families known to be subject to high levels of mortality associated with power lines i.e. Kori Bustards, Blue Cranes *Anthropoides paradiseus* and White Storks *Ciconia ciconia*. In all species the frontal visual fields showed narrow and vertically long binocular fields typical of birds that take food items directly in the bill under visual guidance. However, these species differed markedly in the vertical extent of their binocular fields and in the extent of the blind areas which project above and below the binocular fields in the forward-facing hemisphere. The importance of these blind areas is that when in flight, head movements in the vertical plane (pitching the head to look downwards) will render the bird blind in the direction of travel. Such movements may frequently occur when birds are scanning below them (for foraging or roost sites, or for conspecifics). In bustards and cranes pitch movements of only 25° and 35°, respectively, are sufficient to render the birds blind in the direction of travel; in storks, head movements of 55° are necessary. That flying birds can render themselves blind in the direction of travel has not been previously recognised and has important implications for the effective mitigation of collisions with human artefacts including wind turbines and power lines. These findings have applicability to species outside of these families especially raptors (Accipitridae) which are known to have small binocular fields and large blind areas similar to those of bustards and cranes, and are also known to be vulnerable to power line collisions.

Despite doubts about the efficacy of line marking to reduce the collision risk for bustards (Jenkins *et al.* 2010; Martin *et al.* 2010), there are numerous studies which prove that marking a line with PVC spiral type Bird Flight Diverters (BFDs) generally reduce mortality rates (e.g. Bernardino *et al.* 2019; Sporer *et al.* 2013; Barrientos *et al.* 2011; Jenkins *et al.* 2010; Alonso & Alonso 1999; Koops & De Jong 1982), including to some extent for bustards (Barrientos *et al.* 2012; Hoogstad 2018 pers.comm). Beaulaurier (1981) summarised the results of 17 studies that involved the marking of earth wires and found an average reduction in mortality of 45%. Barrientos *et al.* (2011) reviewed the results of 15 wire marking experiments in which transmission or distribution wires were marked to examine the effectiveness of flight diverters in reducing bird mortality. The presence of flight diverters was associated with a decrease of 55–94% in bird mortalities. Koops and De Jong (1982) found that the spacing of the BFDs was critical in reducing the mortality rates - mortality rates are reduced up to 86% with a spacing of 5m, whereas using the same devices at 10m intervals only reduces the mortality by 57%. Barrientos *et al.* (2012) found that larger BFDs were more effective in reducing Great Bustard collisions than smaller ones. Line markers should be as large as possible, and highly contrasting with the background. Colour is probably less important as during the day the background will be brighter than the obstacle with the reverse true at lower light levels (e.g. at twilight, or during overcast conditions). Black and white interspersed patterns are likely to maximise the probability of detection (Martin *et al.* 2010).

The use of BFDs to reduce collision mortality on powerlines in South Africa has also been tested scientifically. Using a controlled experiment spanning a period of nearly eight years (2008 to 2016), the effectiveness of two types of line markers, namely the EBM Bird Flapper and EBM helical BFD in reducing power line collision mortalities of large birds were tested on three 400kV transmission lines near Hydra substation in the Karoo. Marking was highly effective for Blue Cranes, resulting in a 92% reduction in mortality. Large birds in general also benefited from the marking, with a 56% reduction in mortality. Unfortunately, the marking did not prove to be effective for Ludwig's Bustard. The two different marking devices were approximately equally effective (Shaw *et al.* 2017).

Species most at risk of powerline collisions at the PV facility are large terrestrial birds and a number of raptors:

- Karoo Korhaan
- Kori Bustard
- Lanner Falcon
- Ludwig's Bustard
- Martial Eagle
- Spotted Eagle-Owl
- Verreaux's Eagle

6.3.3 Displacement due to disturbance associated with the construction of the 132kV grid connection

During the construction phase and maintenance of power lines and substations, some habitat destruction and transformation inevitably takes place. This happens with the construction of access roads, the clearing of servitudes and the levelling of substation yards. These activities have an impact on birds breeding, foraging and roosting in or in close proximity of the substation and power line servitudes through transformation of habitat, which could result in temporary or permanent displacement.

Apart from direct habitat destruction, the above-mentioned construction and maintenance activities also impact on birds through disturbance; this could lead to breeding failure if the disturbance happens during a critical part of the breeding cycle. Construction activities in close proximity to breeding locations could be a source of disturbance and could lead to temporary breeding failure or even permanent abandonment of nests.

Due the habitat at the proposed PV facility, it is not envisaged that habitat transformation will be significant, as there is a virtual absence of trees, except at the water troughs and a few isolated *Aloidendron dichotomum* (quiver trees) elsewhere. Extensive clearing of the powerline servitude will therefore not be required, which means displacement due to habitat transformation should not be a factor. Species that might be temporarily displaced due to disturbance associated with the construction of the proposed grid connection are the following:

- Black-eared Sparrowlark
- Black-headed Canary
- Burchell's Courser
- Fiscal Flycatcher
- Karoo Korhaan
- Karoo Prinia
- Kori Bustard
- Large-billed Lark
- Ludwig's Bustard
- Red Lark
- Sclater's Lark
- Sickle-winged Chat
- Spotted Eagle-Owl

6.4 Cumulative impacts

Cumulative effects are commonly understood to be impacts from different projects that combine to result in significant change, which could be larger than the sum of all the individual impacts. The assessment of cumulative effects therefore needs to consider all renewable energy developments (wind and solar) within at least a 30km radius of the proposed site. The 9 renewable projects which are planned or authorised are displayed in Figure 8 and Appendix 3.

6.4.1 PV sites

In the case of solar energy projects, the potentially most significant impact from an avifaunal perspective is the transformation of the natural habitat. The total land parcel area taken up by existing and proposed solar energy projects are approximately 25 000ha. The three Scatec Kenhardt Phase 2 projects will add another approximately 6 000ha of land parcel to these. The total area of the 30km radius around the proposed projects equates to about 285 000ha of very similar habitat. The total combined size of the land parcels taken up by solar energy projects including the three Scatec Kenhardt Phase 2 projects, equates to about 31 500ha, which is just over 10% of the available land in the 30km radius. However, the actual footprint of the solar facilities will be much smaller that the land parcel area, between 20 - 40% of the land parcel area. The total area to be taken up by renewable energy developments will therefore comprise less than 10% of the land surface within the 30km radius around the proposed

Kenhardt Phase 2 projects. The cumulative impact of the habitat transformation which will come about as a result of the three proposed PV project should therefore be **low**.

6.4.2 Grid connection

In the case of the grid connections, the existing Eskom high voltage grid (66 - 400kV) in the 30km radius around the proposed Kenhardt Phase 2 projects comes to about 86km. It is not known how many kilometres of high voltage lines will be added to this by the nine currently proposed renewable energy projects, but it is likely to be at least 50 - 100km. The three Scatec Kenhardt Phase 2 projects will add another approximately 12km of sub-transmission line. This translates into a 6 - 8% increase in the length of existing and proposed high voltage line within the 30km radius around the proposed projects. The most significant potential impact of high voltage lines within the aforesaid 30km radius is bird collisions with the earth wires of the lines. A 6 - 8% increase in line length should represent a **low** increase in cumulative risk. However, it should be noted that the collective cumulative impact on birds of **all** the additional high voltage lines associated with all the renewable energy projects in the 30km radius, is significant, resulting in an increase from a relatively low risk current scenario to a moderate risk scenario with the addition of all the new lines. Fortunately, the new lines are mostly concentrated around Nieuwehoop Substation, which limit their geographic impact.

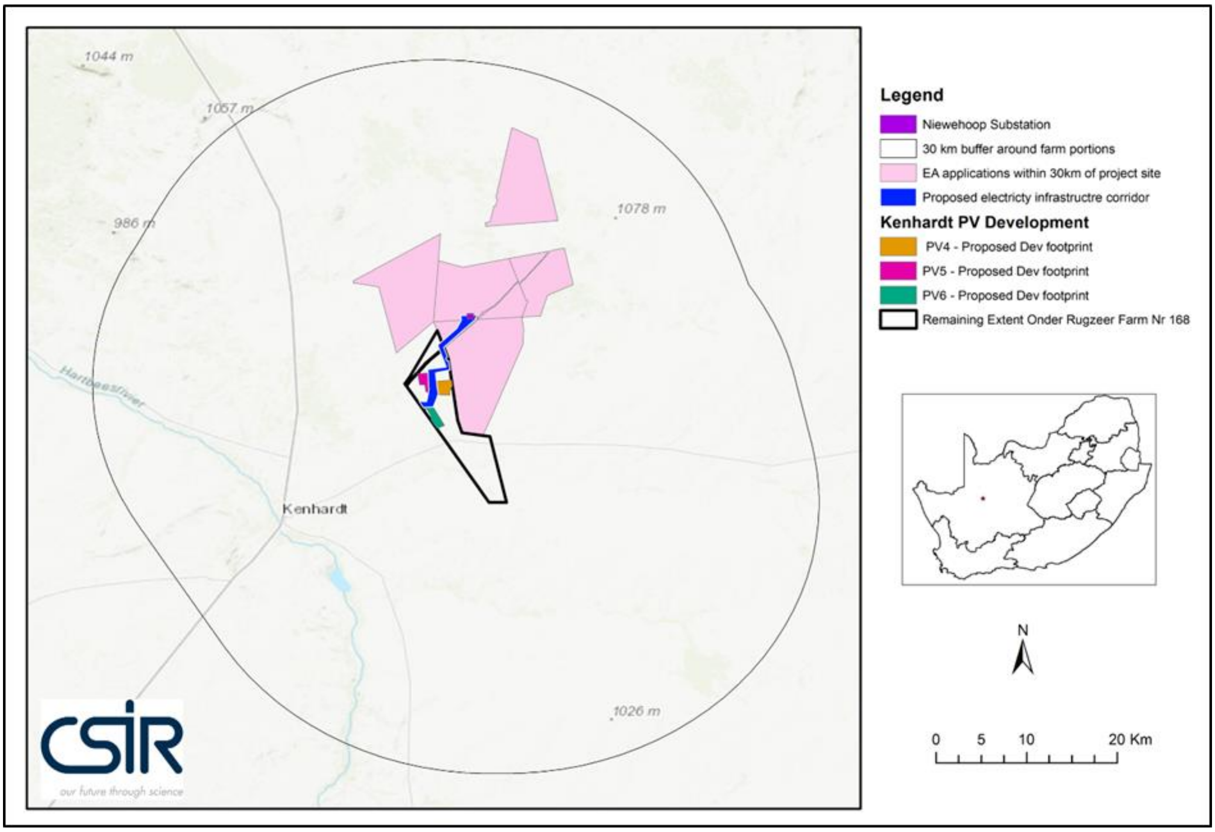

Figure 8: Map showing location of potential solar projects in immediate vicinity of the Scatec Kenhardt Phase 2 solar PV projects.

6.5 No-go option

The no-go option will result in no additional impacts on avifauna and will result in the ecological status quo being maintained (as described in Section 4 of this report), which will be to the advantage of the avifauna.

6.6 Potential Impacts during the Construction Phase

Aspect/Activity	Construction of the solar PV plant and associated infrastructure
Type of Impact (i.e. Impact Status)	Direct
Potential Impact	The noise and movement associated with the construction activities at the PV footprint will be a source of disturbance which would lead to the displacement of avifauna from the area. Priority species potentially affected are: - Black-eared Sparrowlark - Black-headed Canary - Fiscal Flycatcher - Karoo Prinia - Lanner Falcon - Large-billed Lark - Lesser Kestrel - Pygmy Falcon - Red Lark - Sclater's Lark - Sickle-winged Chat
Status	Negative
Mitigation Required	▪ Activity should as far as possible be restricted to the footprint of the infrastructure. ▪ Measures to control noise and dust should be applied according to current best practice in the industry. ▪ Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum as far as practical. ▪ Access to the rest of the property must be restricted. ▪ The recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the construction footprint is concerned. ▪ Water troughs should be relocated at least 200m outside the combined area.
Impact Significance (Pre-Mitigation)	Moderate (Level 3)
Impact Significance (Post-Mitigation)	Low (Level 4)
I&AP Concern	No

Aspect/Activity	Construction of the 132kV grid connection
Type of Impact (i.e. Impact Status)	Direct
Potential Impact	The noise and movement associated with the construction activities in the powerline corridor will be a source of disturbance which would lead to the displacement of avifauna from the area. Priority species potentially affected are: - Black-eared Sparrowlark - Black-headed Canary - Burchell's Courser - Fiscal Flycatcher - Karoo Korhaan - Karoo Prinia - Kori Bustard - Large-billed Lark - Ludwig's Bustard - Red Lark - Sclater's Lark - Sickle-winged Chat - Spotted Eagle-Owl
Status	Negative
Mitigation Required	▪ Activity should as far as possible be restricted to the footprint of the infrastructure. ▪ Measures to control noise and dust should be applied according to current best practice in the industry. ▪ Access to the rest of the property must be restricted.

	▪ Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum as far as practical. ▪ The recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the construction footprint is concerned. ▪ Water troughs should be relocated at least 200m outside the combined area.
Impact Significance (Pre-Mitigation)	Moderate (Level 3)
Impact Significance (Post-Mitigation)	Low (Level 4)
I&AP Concern	No

6.7 Potential Impacts during the Operational Phase

Aspect/Activity	The vegetation clearance and presence of the solar arrays and associated infrastructure amounts to habitat transformation in the PV footprint
Type of Impact (i.e. Impact Status)	Direct
Potential Impact	Total or partial displacement of avifauna due to habitat transformation associated with the vegetation clearance and the presence of the solar PV plant and associated infrastructure. Priority species potentially affected are the following: □ Black-eared Sparrowlark □ Black-headed Canary □ Burchell's Courser □ Fiscal Flycatcher □ Karoo Korhaan □ Karoo Prinia □ Kori Bustard □ Large-billed Lark □ Ludwig's Bustard □ Red Lark □ Sclater's Lark □ Sickle-winged Chat □ Southern Pale Chanting Goshawk □ Spotted Eagle-Owl
Status	Negative
Mitigation Required	The recommendations of the botanical specialist must be strictly implemented, especially as far as limiting the vegetation clearance to what is absolutely necessary, and rehabilitation of transformed areas are concerned.
Impact Significance (Pre-Mitigation)	High (Level 2)
Impact Significance (Post-Mitigation)	Moderate (Level 3)
I&AP Concern	No

Aspect/Activity	The presence of the PV solar arrays will lead to collisions with the reflective solar panels in the PV footprint
Type of Impact (i.e. Impact Status)	Direct
Potential Impact	Birds will get killed or injured through collisions with the solar panels. Priority species potentially affected are: □ Black-eared Sparrowlark □ Black-headed Canary □ Fiscal Flycatcher □ Karoo Prinia □ Lanner Falcon □ Large-billed Lark □ Lesser Kestrel □ Pygmy Falcon □ Red Lark

	Sclater's Lark Sickle-winged Chat
Status	Negative
Mitigation Required	No mitigation is required due to the very low expected magnitude.
Impact Significance (Pre-Mitigation)	Very Low (Level 5)
Impact Significance (Post-Mitigation)	Very Low (Level 5)
I&AP Concern	No

Aspect/Activity	The presence of a double perimeter fence could lead to entrapment of birds between the fences
Type of Impact (i.e. Impact Status)	Direct
Potential Impact	Entrapment of medium and large terrestrial birds between the perimeter fences, leading to mortality. Priority species that could potentially be affected are: Karoo Korhaan Kori Bustard Ludwig's Bustard
Status	Negative
Mitigation Required	A single perimeter fence should be used. Alternatively, the two fences should be at least 4 metres apart to allow medium to large birds enough space to take off.
Impact Significance (Pre-Mitigation)	Low (Level 4)
Impact Significance (Post-Mitigation)	Very Low (Level 5)
I&AP Concern	No

Aspect/Activity	33kV Overhead powerlines
Type of Impact (i.e. Impact Status)	Direct
Potential Impact	Electrocution of raptors. Potential priority species which could be affected are: Booted Eagle Greater Kestrel Lanner Falcon Lesser Kestrel Martial Eagle Rock Kestrel Southern Pale Chanting Goshawk Spotted Eagle-Owl Verreaux's Eagle
Status	Negative
Mitigation Required	▪ All 33kV powerlines should be buried. ▪ If there sections where the 33kV powerlines cannot be buried due to technical constraints, a bird-friendly design must be employed. An appropriately qualified and experienced avifaunal specialist must sign-off on the final design.
Impact Significance (Pre-Mitigation)	High (Level 2)
Impact Significance (Post-Mitigation)	Very Low (Level 5)
I&AP Concern	No

Aspect/Activity	33kV Overhead powerlines and 132kV grid connection
Type of Impact (i.e. Impact Status)	Direct
Potential Impact	Mortality of birds due to collisions with the powerlines. Species that could be affected are: Karoo Korhaan Kori Bustard Lanner Falcon Ludwig's Bustard

	- Martial Eagle - Spotted Eagle-Owl - Verreaux's Eagle
Status	Negative
Mitigation Required	▪ All 33kV powerlines should be buried. ▪ If there sections where the 33kV powerlines cannot be buried due to technical constraints, the spans must be marked with Eskom approved bird flight diverters, on the conductors, staggered 5m apart, alternating black and white/yellow. ▪ The entire 132kV grid connection should be marked with Eskom approved bird flight diverters, on the earthwire, 5m apart, alternating black and white/yellow. ▪ Water troughs should be relocated at least 200m outside the combined area.
Impact Significance (Pre-Mitigation)	High (Level 2)
Impact Significance (Post-Mitigation)	Low (Level 4)
I&AP Concern	No

6.8 Potential Impacts during the Decommissioning Phase

Aspect/Activity	Decommissioning of the solar PV plant and associated infrastructure, and 132kV grid connection
Type of Impact (i.e. Impact Status)	Direct
Potential Impact	The noise and movement associated with the activities at the combined area will be a source of disturbance which would lead to the displacement of avifauna from the area. Priority species potentially affected are: - Black-eared Sparrowlark - Black-headed Canary - Fiscal Flycatcher - Karoo Prinia - Lanner Falcon - Large-billed Lark - Lesser Kestrel - Pygmy Falcon - Red Lark - Sclater's Lark - Sickle-winged Chat
Status	Negative
Mitigation Required	▪ Activity should as far as possible be restricted to the footprint of the infrastructure. ▪ Measures to control noise and dust should be applied according to current best practice in the industry. ▪ Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum as far as practical. ▪ Access to the rest of the property must be restricted. ▪ The recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the activity footprint is concerned. ▪ Water troughs should be relocated at least 200m outside the combined area.
Impact Significance (Pre-Mitigation)	Moderate (Level 3)
Impact Significance (Post-Mitigation)	Low (Level 4)
I&AP Concern	No

6.9 Cumulative Impacts

Aspect/Activity	The incremental impact of the proposed PV facility and grid connection on priority avifauna, added to the impacts of other past, present or reasonably foreseeable future activities.
Type of Impact (i.e. Impact Status)	Direct

Potential Impact	▪ Displacement due to disturbance associated with the construction of the solar PV plant and associated infrastructure ▪ Displacement due to habitat transformation associated with the construction of the solar PV plant and associated infrastructure ▪ Collisions with the solar panels ▪ Entrapment in perimeter fences ▪ Collisions with the associated power lines ▪ Electrocutions on the associated power lines.
Status	Negative
Mitigation Required	Please refer to all the proposed mitigation measures as listed in the preceding tables in Section 6 for all the impacts and all the phases
Impact Significance (Pre-Mitigation)	Low (4)
Impact Significance (Post-Mitigation)	Very Low (5)
I&AP Concern	None to date

7. Impact Assessment Tables

The assessment of impacts and recommendation of mitigation measures as discussed above are collated in Tables 1 to 4 below.

Table 1: Impact Assessment Summary Table for the Construction Phase

Construction Phase												
Direct Impacts												
Aspect/ Impact Pathway	**Nature of Potential Impact/ Risk**	**Status**	**Spatial Extent**	**Duration**	**Consequence**	**Probability**	**Reversibility of Impact**	**Irreplaceability**	**Potential Mitigation Measures**	**Significance of Impact and Risk**		**Ranking of Residual Impact/ Risk**	**Confidence Level**
										Without Mitigation/ Management	**With Mitigation/ Management (Residual Impact/ Risk)**		
Construction of the solar PV plant and associated infrastructure.	The noise and movement associated with the construction activities at the PV footprint will be a source of disturbance which would lead to the displacement of avifauna from the area.	Negative	Site specific	Short term	Substantial	Very likely	high	Low	▪ Activity should as far as possible be restricted to the footprint of the infrastructure. ▪ Measures to control noise and dust should be applied according to current best practice in the industry. ▪ Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum as far as practical. ▪ Access to the rest of the property must be restricted. ▪ The recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the construction footprint is concerned. ▪ Water troughs should be relocated at least 200m outside the combined area.	Moderate (3)	Low (4)	Low (4)	High

Construction of the 132kV grid connection.	The noise and movement associated with the construction activities in the powerline corridor will be a source of disturbance which would lead to the displacement of avifauna from the area.	Negative	Site specific	Short term	Substantial	Very likely	high	Low	▪ Activity should as far as possible be restricted to the footprint of the infrastructure. ▪ Measures to control noise and dust should be applied according to current best practice in the industry. ▪ Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum as far as practical. ▪ The recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the construction footprint is concerned.	Moderate (3)	Low (4)	Low (4)	High

Table 2: Impact Assessment Summary Table for the Operational Phase

Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk: Without Mitigation/ Management	Significance of Impact and Risk: With Mitigation/ Management (Residual Impact/ Risk)	Ranking of Residual Impact/ Risk	Confidence Level
Operational Phase													
Direct Impacts													
The vegetation clearance and presence of the solar arrays and associated infrastructure amounts to habitat transformation in the PV footprint.	Total or partial displacement of avifauna due to habitat transformation associated with the presence of the solar PV plant and associated infrastructure.	Direct	Site specific	Long term	Severe	Very likely	High	Low	The recommendations of the botanical specialist must be strictly implemented, especially as far as limiting the vegetation clearance to what is absolutely necessary, and rehabilitation of transformed areas are concerned.	High (2)	Moderate (3)	Moderate (3)	Medium
The presence of the PV solar arrays will lead to collisions with the reflective solar panels in the PV footprint.	Birds will get killed or injured through collisions with the solar panels.	Direct	Site specific	Long term	Slight	Unlikely	High	Low	No mitigation is required due to the very low significance.	Very low (5)	Very low (5)	Very low (5)	Medium
The presence of a double perimeter fence could lead to entrapment of birds between the fences.	Entrapment of medium and large terrestrial birds between the perimeter fences, leading to mortality.	Direct	Site specific	Long term	Moderate	Likely	High	Low	A single perimeter fence should be used. Alternatively, the two fences should be at least 4 metres apart to allow medium to large birds enough space to take off.	Low (4)	Very low (5)	Very low (5)	High

33kV Overhead powerlines.	Electrocution of raptors.	Direct	Local	Long term	Severe	Likely	High	Low	▪ All 33kV powerlines should be buried. ▪ If there sections where the 33kV powerlines cannot be buried due to technical constraints, a bird-friendly design must be employed. An appropriately qualified and experienced avifaunal specialist must sign-off on the final design.	High (2)	Very low (5)	Very low (5)	High
33kV Overhead powerlines and 132kV grid connection.	Mortality of birds due to collisions with the powerlines.	Direct	Local	Long term	Severe	Likely	High	Low	▪ All 33kV powerlines should be buried. ▪ If there sections where the 33kV powerlines cannot be buried due to technical constraints, the spans must be marked with Eskom approved bird flight diverters, on the conductors, staggered 5m apart, alternating black and white/yellow. ▪ The entire 132kV grid connection should be marked with Eskom approved bird flight diverters, on the earthwire, 5m apart, alternating black and white/yellow. ▪ Water troughs should be relocated at least 200m outside the combined area.	High (2)	Low (4)	Low (4)	High

Table 3: Impact Assessment Summary Table for the Decommissioning Phase

Decommissioning Phase													
Direct Impacts													
Aspect/ Impact Pathway	**Nature of Potential Impact/ Risk**	**Status**	**Spatial Extent**	**Duration**	**Consequence**	**Probability**	**Reversibility of Impact**	**Irreplaceability**	**Potential Mitigation Measures**	**Significance of Impact and Risk**		**Ranking of Residual Impact/ Risk**	**Confidence Level**
										Without Mitigation/ Management	**With Mitigation/ Management (Residual Impact/ Risk)**		
Decommissioning of the solar PV plant and associated infrastructure, and 132kV grid connection.	The noise and movement associated with the activities at the combined area will be a source of disturbance which would lead to the displacement of avifauna from the area.	Direct	Site specific	Short term	Substantial	Very likely	High	Low	▪ Activity should as far as possible be restricted to the footprint of the infrastructure. ▪ Measures to control noise and dust should be applied according to current best practice in the industry. ▪ Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum as far as practical. ▪ The recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the activity footprint is concerned.	Moderate (3)	Low (4)	Very low (5)	High

Table 4: Cumulative Impact Assessment Summary Table

Cumulative Impacts (Construction, Operational and Decommissioning Phases)													
Direct Impacts													
Aspect/ Impact Pathway	**Nature of Potential Impact/ Risk**	**Status**	**Spatial**	**Duration**	**Consequence**	**Probability**	**Reversibility**	**Irreplaceability**	**Potential Mitigation Measures**	**Significance of Impact and Risk**		**Ranking of Residual Impact/ Risk**	**Confidence Level**
										Without Mitigation/ Management	**With Mitigation/ Management (Residual Impact/ Risk)**		
The incremental impact of the proposed PV facility and grid connection on priority avifauna, added to the impacts of other past, present or reasonably foreseeable future activities.	▪ Displacement due to disturbance associated with the construction of the solar PV plant and associated infrastructure ▪ Displacement due to habitat transformation associated with the construction of the solar PV plant and associated infrastructure ▪ Collisions with the solar panels ▪ Entrapment in perimeter fences ▪ Collisions with the associated power lines ▪ Electrocutions on the associated power lines.	Direct	Local	Long term	Substantial	Very likely	High	Low	See all the proposed mitigation measures as listed in the preceding tables in Section 6 for all the impacts and all the phases	Low (4)	Very low (5)	Very low (5)	Medium

7.1 Impact Assessment Summary

Table 6 below provides an indication of the overall impact significance with the implementation of mitigation measures for the various phases.

Table 6: Overall Impact Significance (Post Mitigation)

Phase	Overall Impact Significance
Construction	Low (Level 4)
Operational	Very Low (Level 5) to Moderate (Level 3)
Decommissioning	Low (Level 4)
Cumulative	Very Low (5)

8. Legislative and Permit Requirements

8.1 Legislative Framework

There is no legislation pertaining specifically to the impact of solar facilities and associated electrical infrastructure on avifauna. There are best practice guidelines available which were compiled under the auspices of Birdlife South Africa (BLSA) i.e. Jenkins, A.R., Ralston-Patton, Smit- Robinson, A.H. 2017. Guidelines for assessing and monitoring the impact of solar power generating facilities on birds in southern Africa. BirdLife South Africa.

8.1.1 Agreements and conventions

Table 7: International agreements and conventions which South Africa is party to and which is relevant to the conservation of avifauna.

Convention name	Description	Geographic scope
African-Eurasian Waterbird Agreement (AEWA)	The Agreement on the Conservation of AEWA is an intergovernmental treaty dedicated to the conservation of migratory waterbirds and their habitats across Africa, Europe, the Middle East, Central Asia, Greenland and the Canadian Archipelago. Developed under the framework of the Convention on Migratory Species (CMS) and administered by the United Nations Environment Programme (UNEP), AEWA brings together countries and the wider international conservation community in an effort to establish coordinated conservation and management of migratory waterbirds throughout their entire migratory range.	Regional
Convention on Biological Diversity (CBD), Nairobi, 1992	The Convention on Biological Diversity (CBD) entered into force on 29 December 1993. It has 3 main objectives: The conservation of biological diversity; The sustainable use of the components of biological diversity; and The fair and equitable sharing of the benefits arising out of the utilization of genetic resources.	Global
Convention on the Conservation of Migratory Species of Wild Animals, (CMS), Bonn, 1979	As an environmental treaty under the aegis of the UNEP, CMS provides a global platform for the conservation and sustainable use of migratory animals and their habitats. CMS brings together the States through which migratory animals pass, the Range States, and lays the legal foundation for internationally coordinated conservation measures throughout a migratory range.	Global

Convention name	Description	Geographic scope
Convention on the International Trade in Endangered Species of Wild Flora and Fauna, (CITES), Washington DC, 1973	CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora) is an international agreement between governments. Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival.	Global
Ramsar Convention on Wetlands of International Importance, Ramsar, 1971	The Convention on Wetlands, called the Ramsar Convention, is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources.	Global
Memorandum of Understanding on the Conservation of Migratory Birds of Prey in Africa and Eurasia	The Signatories will aim to take co-ordinated measures to achieve and maintain the favourable conservation status of birds of prey throughout their range and to reverse their decline when and where appropriate.	Regional

8.1.2 National legislation

8.1.2.1 Constitution of the Republic of South Africa, 1996

The Constitution of the Republic of South Africa provides in the Bill of Rights that: Everyone has the right –

(a) to an environment that is not harmful to their health or well-being; and
(b) to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that –
    (i) prevent pollution and ecological degradation;
    (ii) promote conservation; and
    (iii) secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.

8.1.2.2 The National Environmental Management Act 107 of 1998

The National Environmental Management Act 107 of 1998 (as amended) (NEMA) creates the legislative framework for environmental protection in South Africa, and is aimed at giving effect to the environmental right in the Constitution. It sets out a number of guiding principles that apply to the actions of all organs of state that may significantly affect the environment. Sustainable development (socially, environmentally and economically) is one of the key principles, and internationally accepted principles of environmental management, such as the precautionary principle and the polluter pays principle, are also incorporated.

NEMA also provides that a wide variety of listed developmental activities (via the promulgation of the EIA Regulations (2014, as amended), which may significantly affect the environment, may be performed only after an EIA has been done and authorisation has been obtained from the relevant authority. Many of these listed activities can potentially have negative impacts on bird populations in a variety of ways. The clearance of natural vegetation, for instance, can lead to a loss of habitat and may depress prey populations, while erecting structures needed for generating and distributing energy, communication, and so forth can cause mortalities by collision or electrocution.

8.1.2.3 The National Environmental Management: Biodiversity Act 10 of 2004 and the Threatened or Protected Species Regulations, February 2007

The most prominent statute containing provisions directly aimed at the conservation of birds is the National Environmental Management: Biodiversity Act (Act 10 of 2004, as amended) read with the Threatened or Protected Species Regulations, February 2007 (TOPS Regulations). Chapter 1 sets out the objectives of the Act, and they are aligned with the objectives of the Convention on Biological Diversity, which are the conservation of biodiversity, the sustainable use of its components, and the fair and equitable sharing of the benefits of the use of genetic resources. The Act also gives effect to CITES, the Ramsar Convention, and the Bonn Convention on Migratory Species of Wild Animals (as noted in Table 7 above). The State is endowed with the trusteeship of biodiversity and has the responsibility to manage, conserve and sustain the biodiversity of South Africa.

9. Environmental Management Programme Inputs

Refer to Appendix 4 for the EMPr inputs. It is important to note that a comprehensive EMPr is included in the BA Report, which includes input from all specialists in this regard.

10. Conclusion and Recommendations

It is estimated that a total of 149 bird species could potentially occur in the broader area – Appendix 2 provides a comprehensive list of all the species, including those recorded during the pre-construction monitoring. Of the priority species potentially occurring in the broader area, 24 could potentially occur in the combined area, i.e. within the footprint of the PV facility and the grid connection corridor. Nine of these are South African Red Data species, and three are globally Red listed.

The proposed project will have the following potential impacts on avifauna:

- Displacement due to disturbance associated with the construction of the solar PV plant, associated infrastructure and the 132kV grid connection.
- Displacement due to habitat transformation associated with the construction of the solar PV plant and associated infrastructure
- Collisions with the solar panels
- Entrapment in perimeter fences
- Collisions with the associated power lines
- Electrocutions on the associated power lines
- Displacement due to disturbance associated with the decommissioning of the solar PV plant and associated infrastructure

10.1 Displacement due to disturbance associated with the construction of the solar PV plant, associated infrastructure and the 132kV grid connection.

The construction activities associated with the construction of the solar PV plant, associated infrastructure and the 132kV grid connection impact on birds through disturbance; this could lead to breeding failure if the disturbance happens during a critical part of the breeding cycle. Construction activities in close proximity to breeding locations could be a source of disturbance and could lead to temporary displacement. Priority species that might be temporarily displaced due to disturbance associated with the construction of the proposed grid connection are the following: Black-eared Sparrowlark, Black-headed Canary, Fiscal Flycatcher, Karoo Prinia, Lanner Falcon, Large-billed Lark, Lesser Kestrel, Pygmy Falcon, Red Lark, Sclater's Lark and Sickle-winged Chat. **The impact is assessed to be Moderate before mitigation, and Low after mitigation**. Suggested mitigation measures are (a) activity should as far as possible be restricted to the footprint of the infrastructure, (b) measures to control noise and dust should be applied according to current best practice in the industry (c) maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum as far as practical (d) access to the rest of the property must be restricted (e) the recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the construction footprint is concerned and (f) water troughs should be relocated at least 200m outside the combined area.

10.2 Displacement due to habitat transformation associated with the construction of the solar PV plant and associated infrastructure

Indications are that the PV facility matrix is permeable to most species. However, key environmental features, including available habitat and vegetation quality are most likely the overriding factors influencing species' occurrence and their relative density within the development footprint. The most significant aspect is that the distribution of birds in the landscape could change, from a shrubland to open country and grassland bird community, in response to changes in the distribution and abundance of habitat resources such as food, water and nesting sites. Shrubland specialists appear to be negatively affected by the presence of the PV facility. In contrast, open country/grassland and generalist species, are favoured by its development (Visser et al. 2019). Species that could be affected by displacement due to habitat transformation are Black-eared Sparrowlark, Black-headed Canary, Burchell's Courser, Fiscal Flycatcher, Karoo Korhaan, Karoo Prinia, Kori Bustard, Large-billed Lark, Ludwig's Bustard, Red Lark, Sclater's Lark, Sickle-winged Chat, Southern Pale Chanting Goshawk and Spotted Eagle-Owl. **The impact is assessed to be High before mitigation, and Moderate after mitigation.** The recommendations of the botanical specialist must be strictly implemented, especially as far as limiting the vegetation clearance to what is absolutely necessary, and rehabilitation of transformed areas are concerned. Other than that, not much can be done to limit this unavoidable impact on the avifauna.

10.3 Collisions with the solar panels

The results of the available literature lack compelling evidence of collisions as a cause of large-scale mortality among birds at PV facilities. However, it is clear that the lack of systematic and standardised data collection is a major problem in the assessment of the causes and extent of avian mortality at all types of solar facilities, regardless of the technology employed. Until statistically tested results emerge from existing compliance programmes and more dedicated scientific research, conclusions will inevitably be largely speculative and based on professional opinion. It is not foreseen that collisions with the solar panels at the PV facility will be a significant impact. The priority species which would most likely be potentially affected by this impact are mostly small birds which forage between the solar panels, and possibly raptors which prey on them: Black-eared Sparrowlark, Black-headed Canary, Fiscal Flycatcher, Karoo Prinia, Lanner Falcon, Large-billed Lark, Lesser Kestrel, Pygmy Falcon, Red Lark, Sclater's Lark and Sickle-winged Chat. **The risk is assessed to be Very Low**. No mitigation is required due to the very low expected magnitude.

10.4 Entrapment in perimeter fences

Visser *et al.* (2019) recorded a fence-line fatality resulting from the bird being trapped between the inner and outer perimeter fence of the facility. This was further supported by observations of large-bodied birds unable to escape from between the two fences (Visser *et al.* 2019). It is not foreseen that entrapment in perimeter fences will be a significant impact. The priority species which could potentially be affected by this impact are most likely medium to large terrestrial species: Karoo Korhaan, Kori Bustard and Ludwig's Bustard. **The risk is assessed to be Low, but it can be reduced to Very Low through the application of mitigation measures**. Suggested mitigation is that a single perimeter fence should be used or, alternatively, the two fences should be at least 4 metres apart to allow medium to large birds enough space to take off.

10.5 Collisions with the associated power lines

Collision mortality is the biggest threat posed by transmission lines to birds in southern Africa (Van Rooyen 2004). Most heavily impacted upon are bustards, storks, cranes and various species of waterbirds. These species are mostly heavy-bodied birds with limited manoeuvrability, which makes it difficult for them to take the necessary evasive action to avoid colliding with transmission lines (Van Rooyen 2004, Anderson 2001). Species most at risk of powerline collisions at the PV facility are large terrestrial birds and a number of raptors (in specific circumstances): Karoo Korhaan, Kori Bustard, Lanner Falcon, Ludwig's Bustard, Martial Eagle, Spotted Eagle-Owl. **The impact is assessed to be High before mitigation, and Low after mitigation.** Suggested mitigation are (a) all 33kV powerlines should be buried (b) If there sections where the 33kV powerlines cannot be buried due to technical constraints, the spans must be marked with Eskom approved bird flight diverters, on the conductors, staggered 5m apart, alternating black and white/yellow (c) the entire 132kV grid connection should be marked with Eskom approved bird flight diverters, on the earthwire, 5m apart, alternating black and white/yellow and (d) water troughs should be relocated at least 200m outside the combined area..

10.5 Electrocutions on the associated power lines

Electrocution refers to the scenario where a bird is perched or attempts to perch on the 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 2004). The electrocution risk is largely determined by the design of the electrical hardware. It is currently not clear whether the internal 33kV electrical powerlines will be buried, or above ground. If the lines are above ground, several raptor species might be at risk of electrocution on the medium voltage lines: Booted Eagle, Greater Kestrel, Lanner Falcon, Lesser Kestrel, Martial Eagle, Rock Kestrel, Southern Pale Chanting Goshawk, Spotted Eagle-Owl and Verreaux's Eagle. **The impact is assessed to be High before mitigation, and Very Low after mitigation.** Suggested mitigation measures are (a) all 33kV powerlines should be buried and (b) if there sections where the 33kV powerlines cannot be buried due to technical constraints, a bird-friendly design must be employed after an appropriately qualified and experienced avifaunal specialist have signed-off on the final design. Species that could be impacted are Booted Eagle, Greater Kestrel, Lanner Falcon, Lesser Kestrel, Martial Eagle, Rock Kestrel, Southern Pale Chanting Goshawk, Spotted Eagle-Owl and Verreaux’s Eagle.

10.6 Displacement due to disturbance associated with the decommissioning of the solar PV plant, associated infrastructure and the 132kV grid connection.

The activities associated with the decommissioning of the solar PV plant, associated infrastructure and the 132kV grid connection will impact on birds through disturbance; this could lead to breeding failure if the disturbance happens during a critical part of the breeding cycle. Activities in close proximity to breeding locations could be a source of disturbance and could lead to temporary displacement. Priority species that might be temporarily displaced are the following: Black-eared Sparrowlark, Black-headed Canary, Fiscal Flycatcher, Karoo Prinia, Lanner Falcon, Large-billed Lark, Lesser Kestrel, Pygmy Falcon, Red Lark, Sclater's Lark and Sickle-winged Chat. **The impact is assessed to be Moderate before mitigation, and Low after mitigation.** Suggested mitigation measures are (a) activity should as far as possible be restricted to the footprint of the infrastructure, (b) measures to control noise and dust should be applied according to current best practice in the industry (c) maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum as far as practical (d) access to the rest of the property must be restricted (e) the recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the activity footprint is concerned and (f) water troughs should be relocated at least 200m outside the combined area..

10.5 Cumulative impacts

The total combined size of the land parcels taken up by solar energy projects including the three Scatec Kenhardt Phase 2 projects, equates to about 31 500ha, which is just over 10% of the available land in the 30km radius. However, the actual footprint of the solar facilities will be much smaller that the land parcel area, between 20 - 40% of the land parcel area. The total area to be taken up by renewable energy developments will therefore comprise less than 10% of the land surface within the 30km radius around the proposed Kenhardt Phase 2 projects. The cumulative impact of the habitat transformation which will come about as a result of the three proposed PV project should therefore be low. The three Scatec Kenhardt Phase 2 projects will add another approximately 12km of sub-transmission line. This translates into a 6 - 8% increase in the length of existing and proposed high voltage line within the 30km radius around the proposed projects. The most significant potential impact of high voltage lines within the aforesaid 30km radius is bird collisions with the earth wires of the lines. A 6 - 8% increase in line length should represent a low increase in cumulative risk. **The risk of cumulative impacts associated with the PV facility and the associated infrastructure and grid connection is assessed to be Low, but it can be reduced to Very Low through the application of the mitigation measures listed in this report.** However, it should be noted that the collective cumulative impact on birds of **all** the additional high voltage lines associated with all the renewable energy projects in the 30km radius, is significant, resulting in an increase from a relatively low risk current scenario to a moderate risk scenario with the addition of all the new lines. Fortunately, the new lines are mostly concentrated around Nieuwehoop Substation, which limit their geographic impact.

Table 8 below provides a summary of the respective significance ratings, and an average overall rating before and after mitigation.

Table 8: Overall impact significance rating

Impact	Rating pre-mitigation	Rating post-mitigation
Displacement due to disturbance associated with the construction of the solar PV plant, associated infrastructure and the 132kV grid connection.	Moderate (3)	Low (4)
Displacement due to habitat transformation associated with the construction of the solar PV plant and associated infrastructure[6]	High (2)	Moderate (3)
Collisions with the solar panels	Very Low (5)	Very Low (5)
Entrapment in perimeter fences	Low (4)	Very Low (5)
Collisions with the associated power lines	High (2)	Very Low (5)
Electrocutions on the associated power lines	High (2)	Low (4)
Displacement due to disturbance associated with the decommissioning of the solar PV plant and associated infrastructure	Moderate (3)	Low (4)
Cumulative impacts	Low (4)	Very Low (5)
Average:	**Moderate (3.1)**	**Low – Very Low (4.3)**

11. Final Specialist Statement and Authorisation Recommendation

[6] Due to the nature of the habitat, displacement due to habitat destruction associated with the proposed grid connection is likely to be negligible, therefore this is not listed as an impact.

In terms of an average, the pre-mitigation significance of all potential impacts identified in this specialist study is assessed as slightly above **Moderate**, leaning more towards Moderate (i.e. average of 3.1, as shown in Table 8 above) and the post-mitigation significance is assessed as Low to Very Low, leaning more towards **Low** (i.e. average of 4.3, as shown in Table 8 above). It is therefore recommended that the activity is authorised, on condition that the proposed mitigation measures as detailed in the EMPr (Appendix 4) are strictly implemented.

11.1. EA Condition Recommendations

The proposed mitigation measures are detailed in the EMPr (Appendix 4)

12. References

- ANIMAL DEMOGRAPHY UNIT. 2019. The southern African Bird Atlas Project 2. University of Cape Town. http://sabap2.adu.org.za.
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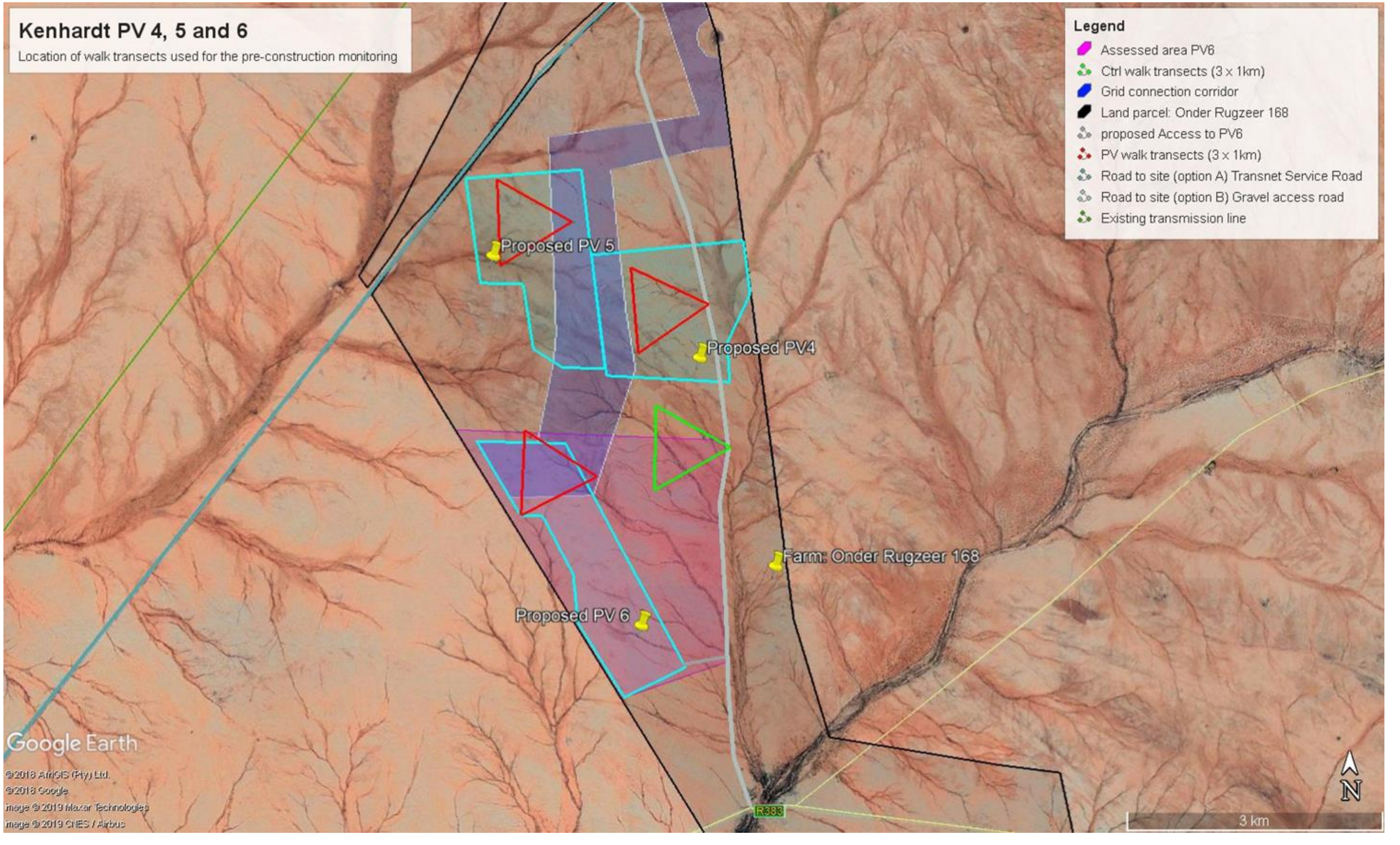
APPENDIX 1: PRE-CONSTRUCTION MONITORING



APPENDIX 2: SPECIES OCCURING IN THE BROADER AREA

Common group	Species	Taxonomic name	Full Protocol (Reporting rate %)	Ad hoc (Reporting rate %)	Incidental record	Recorded at site
Barbet	Acacia Pied Barbet	*Tricholaema leucomelas*	72.7	6.7	5	x
Fish-eagle	African Fish-eagle	*Haliaeetus vocifer*	1.3	0	0	
Harrier-Hawk	African Harrier-Hawk	*Polyboroides typus*	1.3	2.2	2	
Hoopoe	African Hoopoe	*Upupa africana*	1.3	0	1	
Palm-swift	African Palm-swift	*Cypsiurus parvus*	6.5	4.4	4	
Pipit	African Pipit	*Anthus cinnamomeus*	7.8	8.9	4	
Bulbul	African Red-eyed Bulbul	*Pycnonotus nigricans*	37.7	8.9	6	x
Reed-warbler	African Reed-warbler	*Acrocephalus baeticatus*	2.6	0	0	
Stonechat	African Stonechat	*Saxicola torquatus*	0	2.2	1	
Chat	Anteating Chat	*Myrmecocichla formicivora*	49.4	11.1	5	x
Tit	Ashy Tit	*Parus cinerascens*	11.7	0	0	
Owl	Barn Owl	*Tyto alba*	3.9	0	0	
Swallow	Barn Swallow	*Hirundo rustica*	14.3	2.2	0	x
Prinia	Black-chested Prinia	*Prinia flavicans*	79.2	6.7	5	
Sparrowlark	Black-eared Sparrowlark	*Eremopterix australis*	6.5	2.2	2	x
Waxbill	Black-faced Waxbill	*Estrilda erythronotos*	1.3	0	0	
Canary	Black-headed Canary	*Serinus alario*	6.5	0	0	
Grebe	Black-necked Grebe	*Podiceps nigricollis*	2.6	0	1	
Lapwing	Blacksmith Lapwing	*Vanellus armatus*	11.7	4.4	2	
Canary	Black-throated Canary	*Crithagra atrogularis*	11.7	2.2	1	
Stilt	Black-winged Stilt	*Himantopus himantopus*	2.6	0	0	
Bokmakierie	Bokmakierie	*Telophorus zeylonus*	58.4	11.1	6	
Eagle	Booted Eagle	*Aquila pennatus*	1.3	0	0	
Martin	Brown-throated Martin	*Riparia paludicola*	3.9	0	1	
Brubru	Brubru Brubru	*Nilaus afer*	14.3	0	1	
Courser	Burchell's Courser	*Cursorius rufus*	1.3	0	1	
Starling	Cape Glossy Starling	*Lamprotornis nitens*	29.9	2.2	6	x
Penduline-tit	Cape Penduline-tit	*Anthoscopus minutus*	10.4	2.2	2	
Robin-chat	Cape Robin-chat	*Cossypha caffra*	1.3	0	0	
Shoveler	Cape Shoveler	*Anas smithii*	1.3	0	1	
Sparrow	Cape Sparrow	*Passer melanurus*	79.2	15.6	9	x
Teal	Cape Teal	*Anas capensis*	9.1	0	1	
Turtle-dove	Cape Turtle-dove	*Streptopelia capicola*	58.4	13.3	6	x
Wagtail	Cape Wagtail	*Motacilla capensis*	16.9	8.9	5	
Wheatear	Capped Wheatear	*Oenanthe pileata*	9.1	4.4	1	
Woodpecker	Cardinal Woodpecker	*Dendropicos fuscescens*	6.5	0	2	
Flycatcher	Chat Flycatcher	*Bradornis infuscatus*	41.6	20	12	x
Tit-babbler	Chestnut-vented Tit-babbler	*Parisoma subcaeruleum*	42.9	2.2	3	
Bunting	Cinnamon-breasted Bunting	*Emberiza tahapisi*	1.3	0	0	
Fiscal	Common (Southern) Fiscal	*Lanius collaris*	59.7	13.3	9	

Common group	Species	Taxonomic name	Full Protocol (Reporting rate %)	Ad hoc (Reporting rate %)	Incidental record	Recorded at site
Greenshank	Common Greenshank	*Tringa nebularia*	2.6	0	0	
Ostrich	Common Ostrich	*Struthio camelus*	0	2.2	0	
Sandpiper	Common Sandpiper	*Actitis hypoleucos*	2.6	0	0	
Scimitarbill	Common Scimitarbill	*Rhinopomastus cyanomelas*	6.5	0	1	x
Starling	Common Starling	*Sturnus vulgaris*	2.6	0	0	
Shrike	Crimson-breasted Shrike	*Laniarius atrococcineus*	1.3	0	0	
Lapwing	Crowned Lapwing	*Vanellus coronatus*	9.1	4.4	2	
Sandpiper	Curlew Sandpiper	*Calidris ferruginea*	1.3	0	0	
Cisticola	Desert Cisticola	*Cisticola aridulus*	2.6	0	0	
Cuckoo	Diderick Cuckoo	*Chrysococcyx caprius*	2.6	0	0	
Courser	Double-banded Courser	*Rhinoptilus africanus*	13	4.4	2	x
Sunbird	Dusky Sunbird	*Cinnyris fuscus*	61	4.4	6	x
Lark	Eastern Clapper Lark	*Mirafra fasciolata*	15.6	2.2	1	
Goose	Egyptian Goose	*Alopochen aegyptiacus*	11.7	13.3	6	x
Bee-eater	European Bee-eater	*Merops apiaster*	2.6	0	0	
Chat	Familiar Chat	*Cercomela familiaris*	37.7	6.7	3	x
Lark	Fawn-coloured Lark	*Calendulauda africanoides*	26	0	1	
Flycatcher	Fiscal Flycatcher	*Sigelus silens*	2.6	2.2	1	
Drongo	Fork-tailed Drongo	*Dicrurus adsimilis*	15.6	0	2	
Kestrel	Greater Kestrel	*Falco rupicoloides*	6.5	2.2	2	
Swallow	Greater Striped Swallow	*Hirundo cucullata*	15.6	8.9	4	x
Heron	Grey Heron	*Ardea cinerea*	2.6	0	0	
Tit	Grey Tit	*Parus afer*	1.3	0	0	
Sparrowlark	Grey-backed Sparrowlark	*Eremopterix verticalis*	29.9	11.1	4	
Ibis	Hadeda Ibis	*Bostrychia hagedash*	11.7	2.2	2	
Sparrow	House Sparrow	*Passer domesticus*	19.5	11.1	6	
Scrub-robin	Kalahari Scrub-robin	*Cercotrichas paena*	11.7	4.4	3	
Chat	Karoo Chat	*Cercomela schlegelii*	7.8	2.2	0	
Korhaan	Karoo Korhaan	*Eupodotis vigorsii*	50.6	0	2	x
Lark	Karoo Long-billed Lark	*Certhilauda subcoronata*	26	11.1	6	
Prinia	Karoo Prinia	*Prinia maculosa*	2.6	0	0	
Scrub-robin	Karoo Scrub-robin	*Cercotrichas coryphoeus*	26	4.4	4	
Thrush	Karoo Thrush	*Turdus smithi*	10.4	2.2	1	
Plover	Kittlitz's Plover	*Charadrius pecuarius*	6.5	0	0	
Bustard	Kori Bustard	*Ardeotis kori*	7.8	6.7	3	
Falcon	Lanner Falcon	*Falco biarmicus*	1.3	6.7	2	
Lark	Large-billed Lark	*Galerida magnirostris*	2.6	6.7	3	
Bunting	Lark-like Bunting	*Emberiza impetuani*	74	11.1	5	
Dove	Laughing Dove	*Streptopelia senegalensis*	41.6	17.8	10	
Shrike	Lesser Grey Shrike	*Lanius minor*	1.3	0	0	
Kestrel	Lesser Kestrel	*Falco naumanni*	3.9	0	0	
Roller	Lilac-breasted Roller	*Coracias caudatus*	1.3	0	0	
Grebe	Little Grebe	*Tachybaptus ruficollis*	5.2	0	0	

Common group	Species	Taxonomic name	Full Protocol (Reporting rate %)	Ad hoc (Reporting rate %)	Incidental record	Recorded at site
Stint	Little Stint	*Calidris minuta*	5.2	0	0	
Swift	Little Swift	*Apus affinis*	37.7	20	11	
Crombec	Long-billed Crombec	*Sylvietta rufescens*	23.4	0	3	
Bustard	Ludwig's Bustard	*Neotis ludwigii*	16.9	2.2	2	
Flycatcher	Marico Flycatcher	*Bradornis mariquensis*	2.6	0	1	
Eagle	Martial Eagle	*Polemaetus bellicosus*	5.2	2.2	2	x
Wheatear	Mountain Wheatear	*Oenanthe monticola*	19.5	4.4	4	
Dove	Namaqua Dove	*Oena capensis*	35.1	13.3	5	
Sandgrouse	Namaqua Sandgrouse	*Pterocles namaqua*	45.5	22.2	9	x
Warbler	Namaqua Warbler	*Phragmacia substriata*	1.3	0	1	
Korhaan	Northern Black Korhaan	*Afrotis afraoides*	63.6	11.1	7	x
Thrush	Olive Thrush	*Turdus olivaceus*	0	2.2	0	
White-eye	Orange River White-eye	*Zosterops pallidus*	13	0	2	
Starling	Pale-winged Starling	*Onychognathus nabouroup*	9.1	8.9	5	
Swallow	Pearl-breasted Swallow	*Hirundo dimidiata*	1.3	0	1	
Avocet	Pied Avocet	*Recurvirostra avosetta*	1.3	0	0	
Crow	Pied Crow	*Corvus albus*	61	13.3	10	x
Lark	Pink-billed Lark	*Spizocorys conirostris*	0	0	0	x
Whydah	Pin-tailed Whydah	*Vidua macroura*	1.3	0	0	
Batis	Pririt Batis	*Batis pririt*	33.8	2.2	4	
Falcon	Pygmy Falcon	*Polihierax semitorquatus*	18.2	2.2	5	
Lark	Red Lark	*Calendulauda burra*	2.6	0	0	
Quelea	Red-billed Quelea	*Quelea quelea*	7.8	0	0	
Teal	Red-billed Teal	*Anas erythrorhyncha*	2.6	2.2	1	
Lark	Red-capped Lark	*Calandrella cinerea*	3.9	2.2	0	
Dove	Red-eyed Dove	*Streptopelia semitorquata*	5.2	0	2	
Mousebird	Red-faced Mousebird	*Urocolius indicus*	14.3	0	1	
Finch	Red-headed Finch	*Amadina erythrocephala*	5.2	0	0	
Coot	Red-knobbed Coot	*Fulica cristata*	2.6	0	0	
Cormorant	Reed Cormorant	*Phalacrocorax africanus*	1.3	0	0	
Dove	Rock Dove	*Columba livia*	2.6	0	1	
Kestrel	Rock Kestrel	*Falco rupicolus*	3.9	4.4	2	
Martin	Rock Martin	*Hirundo fuligula*	41.6	4.4	3	x
Lovebird	Rosy-faced Lovebird	*Agapornis roseicollis*	2.6	0	1	
Ruff	Ruff Ruff	*Philomachus pugnax*	1.3	0	0	
Nightjar	Rufous-cheeked Nightjar	*Caprimulgus rufigena*	5.2	0	0	x
Warbler	Rufous-eared Warbler	*Malcorus pectoralis*	40.3	15.6	8	x
Lark	Sabota Lark	*Calendulauda sabota*	53.2	17.8	9	x
Finch	Scaly-feathered Finch	*Sporopipes squamifrons*	57.1	11.1	5	
Lark	Sclater's Lark	*Spizocorys sclateri*	5.2	0	0	
Chat	Sickle-winged Chat	*Cercomela sinuata*	7.8	0	0	
Weaver	Sociable Weaver	*Philetairus socius*	89.6	40	19	x
Shelduck	South African Shelduck	*Tadorna cana*	11.7	2.2	3	

Common group	Species	Taxonomic name	Full Protocol (Reporting rate %)	Ad hoc (Reporting rate %)	Incidental record	Recorded at site
Sunbird	Southern Double-collared Sunbird	*Cinnyris chalybeus*	2.6	0	0	
Sparrow	Southern Grey-headed Sparrow	*Passer diffusus*	5.2	0	0	
Masked-weaver	Southern Masked-weaver	*Ploceus velatus*	39	8.9	5	
Goshawk	Southern Pale Chanting Goshawk	*Melierax canorus*	40.3	20	11	x
Bishop	Southern Red Bishop	*Euplectes orix*	7.8	2.2	0	x
Pigeon	Speckled Pigeon	*Columba guinea*	31.2	2.2	4	x
Lark	Spike-heeled Lark	*Chersomanes albofasciata*	57.1	22.2	11	x
Eagle-owl	Spotted Eagle-owl	*Bubo africanus*	7.8	2.2	1	x
Thick-knee	Spotted Thick-knee	*Burhinus capensis*	6.5	0	0	
Goose	Spur-winged Goose	*Plectropterus gambensis*	1.3	0	0	
Lark	Stark's Lark	*Spizocorys starki*	18.2	15.6	9	x
Bee-eater	Swallow-tailed Bee-eater	*Merops hirundineus*	2.6	2.2	1	x
Plover	Three-banded Plover	*Charadrius tricollaris*	10.4	2.2	3	
Chat	Tractrac Chat	*Cercomela tractrac*	2.6	2.2	0	
Eagle	Verreaux's Eagle	*Aquila verreauxii*	6.5	2.2	1	
Stork	White Stork	*Ciconia ciconia*	1.3	0	0	
Mousebird	White-backed Mousebird	*Colius colius*	23.4	11.1	9	
Cormorant	White-breasted Cormorant	*Phalacrocorax carbo*	1.3	0	0	
Sparrow-weaver	White-browed Sparrow-weaver	*Plocepasser mahali*	53.2	24.4	13	
Swift	White-rumped Swift	*Apus caffer*	9.1	6.7	1	x
Canary	White-throated Canary	*Crithagra albogularis*	29.9	4.4	4	
Warbler	Willow Warbler	*Phylloscopus trochilus*	1.3	0	0	
Canary	Yellow Canary	*Crithagra flaviventris*	57.1	13.3	7	x
Eremomela	Yellow-bellied Eremomela	*Eremomela icteropygialis*	36.4	2.2	2	x

APPENDIX 3: RENEWABLE ENERGY PROJECTS WITHIN A 30KM RADIUS AROUND The SCATEC PHASE 2 PROJECTS

DEFF REF NO	PROJECT TITLE	DATE APPLICATION RECIEVED	APPLICANT	EAP	LOCAL MUNICIPALITY	TECHNOLOGY	MW	EA STATUS
14/12/16/3/3/2/1072	THE 75 MW AMDA CHARLIE PV SEF NORTH OF KENHARDT WITHIN THE KAI! GARIB LM IN THE NORTHERN CAPE PROVINCE	2018/09/12	AMDA Charlie (Pty) Ltd	Cape Environmental Assessment Practitioners (Pty) Ltd	Kai !Garib Local Municipality	Solar PV	75	Approved
14/12/16/3/3/2/1073	THE 75 MW AMDA Alpha PV SEF NORTH OF KENHARDT WITHIN THE KAI! GARIB LM IN THE NORTHERN CAPE PROVINCE	2018/09/11	AMDA Charlie (Pty) Ltd	Cape Environmental Assessment Practitioners (Pty) Ltd	!Kheis Local Municipality	Solar PV	75	Approved
14/12/16/3/3/2/847	75mw Solar Photovoltaic Facility (Boven 4) on the remaining extent of Boven Rugzeer Farm 169, North East of Kenhradt in the Northern Cape Province	2015/10/18	Boven Solar PV4 (Pty) Ltd	CSIR	!Kheis Local Municipality	Solar PV	75	Approved
14/12/16/3/3/2/842	75MW solar energy facility (Gemsbok PV4) on Protion 3 of Gemsbok Bult farm 120 near Kenhardt within the Kheis Local Municipality in the Northern cape province	2015/10/28	Gemsbok Solar PV3 (Pty) Ltd	CSIR	!Kheis Local Municipality	Solar PV	75	Approved
14/12/16/3/3/2/843	75MW solar energy facility (Gemsbok PV5) on Protion 8 of Gemsbok Bult farm 120 near Kenhardt within the Kheis Local Municipality in the Northern cape province	2015/10/28	Gemsbok Solar PV3 (Pty) Ltd	CSIR	!Kheis Local Municipality	Solar PV	75	Approved
14/12/16/3/3/2/1035	The 100MW Skeerhok 3 PV SEF north-east of Kenhardt within the Kheis Local Municipality, Northern Cape Province	2017/09/19	Juwi Renewable Energies (Pty) Ltd	Juwi Renewable Energies (Pty) Ltd	!Kheis Local Municipality	Solar PV	100	Approved
14/12/16/3/3/2/710	Proposed construction of Gemsbok PV1 75MW in Kenhardt, Northern Cape	2014/05/01	To review	CSIR	!Kheis Local Municipality	Solar PV	0	In process

14/12/16/3/3/2/711	Proposed construction of Gemsbok PV2 75MW in Kenhardt, Northern Cape	2014/05/01	To review	CSIR	!Kheis Local Municipality	Solar PV	0	In process
14/12/16/3/3/2/712	Proposed construction of the Boven PV1 75MW in Kenhardt, Northern Cape	2014/05/01	To review	CSIR	!Kheis Local Municipality	Solar PV	0	In process

Management Plan for the Planning and Design Phase

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
Avifauna: Entrapment					
Entrapment of medium and large terrestrial birds between the perimeter fences, leading to mortality.	Prevent mortality of avifauna	1. A single perimeter fence should be used. 2. Alternatively, the two fences should be at least 4 metres apart to allow medium to large birds enough space to take off.	Design the facility with a single perimeter fence or with two fences at least 4 metres apart.	Once-off during the planning phase.	Project Developer
Avifauna: Electrocution					
Electrocution of raptors on the 33kV reticulation network.	Prevent mortality of avifauna	1. All 33kV powerlines should be buried. 2. If there sections where the 33kV powerlines cannot be buried due to technical constraints, a bird-friendly design must be employed.	1. Design the facility with underground electricity cables. 2. For those sections where overhead lines are required, appoint an appropriately qualified and experienced avifaunal specialist to sign-off on the final design. 3. The specialist must be provided with accurate information to make an informed	1. Once-off during the planning phase. 2. Before construction commences 3. Before construction commences	1. Project Developer 2. Avifaunal Specialist

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
			evaluation, preferably a 3D model of the type of structures to be employed.		
Avifauna: Powerline collisions					
Collisions of avifauna with overhead powerlines	Prevent mortality of avifauna	1. Water troughs should be relocated at least 200m outside the combined area.	1. Incorporate the re-location of water troughs into the design of the powerline.	1. Once-off during the planning phase.	Project Developer
Avifauna: Displacement due to disturbance					
The noise and movement associated with the construction activities at the PV and grid connection footprint will be a source of disturbance which would lead to the displacement of avifauna from the area	Prevent displacement of avifauna	1. Water troughs should be relocated at least 200m outside the combined area.	1. Incorporate the re-location of water troughs into the design of the PV.	1. Once-off during the planning phase.	Project Developer

Management Plan for the Construction Phase (Including pre- and post-construction activities)

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
Avifauna: Disturbance					
The noise and movement associated with the construction activities at the PV and grid connection footprint will be a source of disturbance which would lead to the displacement of avifauna from the area	Prevent unnecessary displacement of avifauna by ensuring that contractors are aware of the requirements of the Construction Environmental Management Programme (CEMPr.)	A site-specific CEMPr must be implemented, which gives appropriate and detailed description of how construction activities must be conducted. All contractors are to adhere to the CEMPr and should apply good environmental practice during construction. The CEMPr must specifically include the following: 1. No off-road driving; 2. Maximum use of existing roads; 3. Measures to control noise and dust according to latest best practice; 4. Restricted access to the rest of the property; 5. Strict application of all recommendations in the botanical specialist report pertaining to the limitation of the footprint.	1. Implementation of the CEMPr. Oversee activities to ensure that the CEMPr is implemented and enforced via site audits and inspections. Report and record any non-compliance. 2. Ensure that construction personnel are made aware of the impacts relating to off-road driving. 3. Construction access roads must be demarcated clearly. Undertake site inspections to verify. 4. Monitor the implementation of noise control mechanisms via site inspections and record and report non-compliance. 5. Ensure that the construction area	1. On a daily basis 2. Weekly 3. Weekly 4. Weekly 5. Weekly	1. Contractor and ECO 2. Contractor and ECO 3. Contractor and ECO 4. Contractor and ECO 5. Contractor and ECO

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
			is demarcated clearly and that construction personnel are made aware of these demarcations. Monitor via site inspections and report non-compliance.		
Avifauna: Powerline collisions					
Collisions of avifauna with overhead powerlines	Prevent mortality of avifauna	1. If there sections where the 33kV powerlines cannot be buried due to technical constraints, the spans must be marked with Eskom approved bird flight diverters, on the conductors, staggered 5m apart, alternating black and white/yellow. 2. The entire 132kV grid connection should be marked with Eskom approved bird flight diverters, on the earthwire, 5m apart, alternating black and white/yellow.	1. Sections of overhead lines must be identified beforehand. 2. The number of flappers to be fitted must be calculated. 3. The sections of line must be marked as soon as the line is strung.	1. Once-off	1. Project developer and contractor 2. Contractor 3. Contractor

Management Plan for the Operational Phase

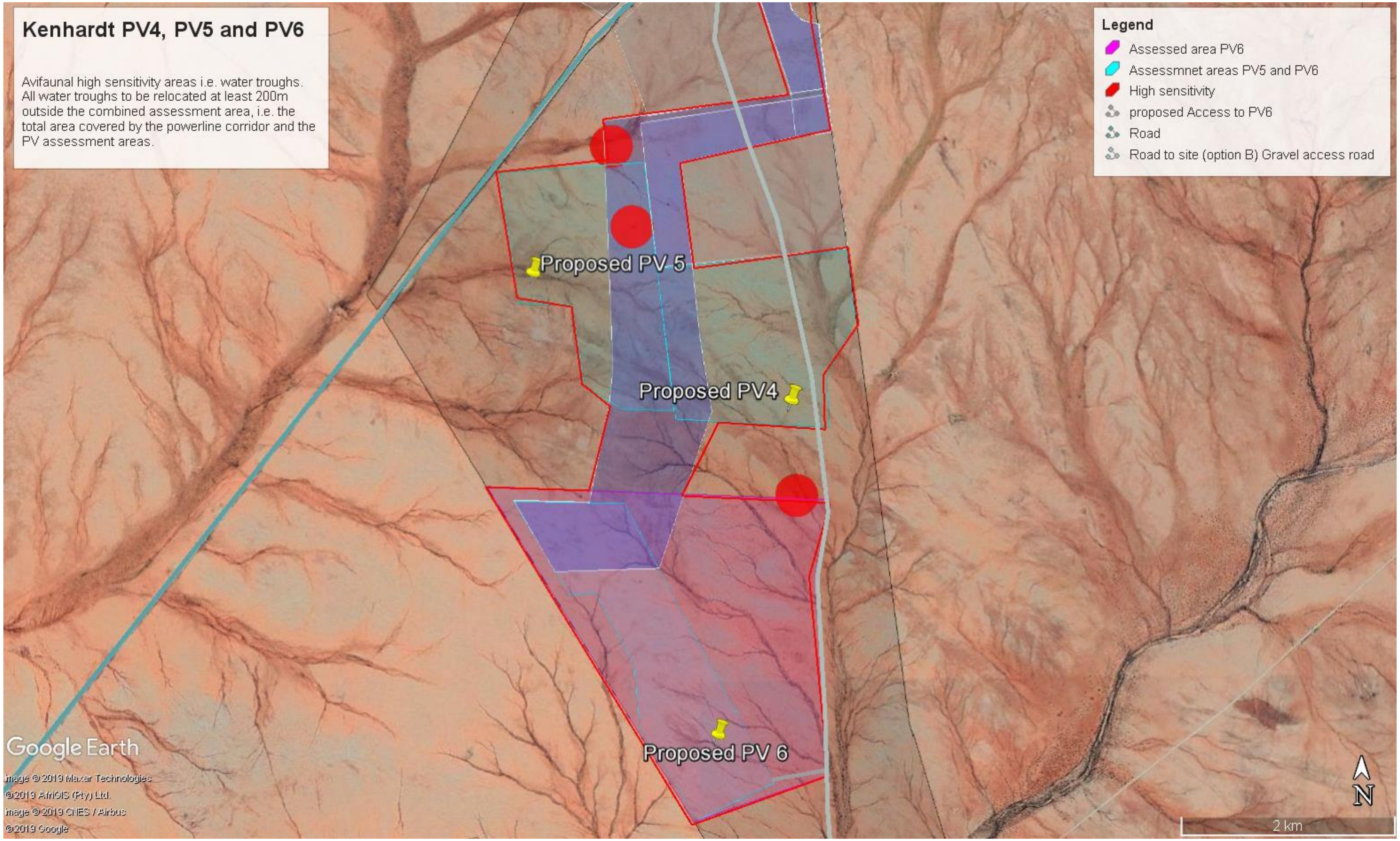
Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
Avifauna: Displacement due to habitat transformation					
Total or partial displacement of avifauna due to habitat transformation associated with the vegetation clearance and the presence of the solar PV plant and associated infrastructure.	Prevent unnecessary displacement of avifauna by ensuring that the rehabilitation of transformed areas is implemented by an appropriately qualified rehabilitation specialist, according to the recommendations of the botanical specialist study.	1. Develop a Habitat Restoration Plan (HRP) and ensure that it is approved. 2. Monitor rehabilitation via site audits and site inspections to ensure compliance. Record and report any non-compliance.	1. Appointment of rehabilitation specialist to develop Habitat Restoration Plan (HRP). 2. Site inspections to monitor progress of HRP. 3. Adaptive management to ensure HRP goals are met.	1. Once-off 2. Once a year 3. As and when required	1. Project developer 2. Facility Environmental Manager 3. Project developer and facility operational manager

Management Plan for the Decommissioning Phase

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
Avifauna: Displacement due to disturbance					
The noise and movement associated with the construction activities at the PV and grid connection footprint will be a source of disturbance which would lead to the displacement of avifauna from the area	Prevent unnecessary displacement of avifauna by ensuring that contractors are aware of the requirements of the CEMPr.	A site-specific CEMPr must be implemented, which gives appropriate and detailed description of how construction activities must be conducted. All contractors are to adhere to the CEMPr and should apply good environmental practice during construction. The CEMPr must specifically include the following: 1. No off-road driving; 2. Maximum use of existing roads; 3. Measures to control noise and dust according to latest best practice; 4. Restricted access to the rest of the property; 5. Strict application of all recommendations in the botanical specialist report pertaining to the limitation of the footprint.	1. Implementation of the CEMPr. Oversee activities to ensure that the CEMPr is implemented and enforced via site audits and inspections. Report and record any non-compliance. 2. Ensure that construction personnel are made aware of the impacts relating to off-road driving. 3. Construction access roads must be demarcated clearly. Undertake site inspections to verify. 4. Monitor the implementation of noise control mechanisms via site inspections and record and report non-compliance. 5. Ensure that the construction area	6. On a daily basis 7. Weekly 8. Weekly 9. Weekly 10. Weekly	1. Contractor and ECO 2. Contractor and ECO 3. Contractor and ECO 4. Contractor and ECO 5. Contractor and ECO

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
			is demarcated clearly and that construction personnel are made aware of these demarcations. Monitor via site inspections and report non-compliance.		

APPENDIX: SENSITIVITY MAP



ECOLOGICAL IMPACT ASSESSMENT REPORT:

Basic Assessments for the proposed construction of t Kenhardt PV5 Solar Photovoltaic (PV) Facilities and associated electrical infrastructure, near Kenhardt, in the Northern Cape.

Report prepared for:	*Report prepared by:*
CSIR – Environmental Management Services P O Box 320 Stellenbosch 7599 South Africa	S C Bundy BSc MSc (Pr.Sci.Nat) And L P Maingard BSc Hon (Cand.Sci.Nat)

3rd of December 2019.

Specialist Expertise

SIMON. COLIN. BUNDY

NAME Simon Colin Bundy. BSc. MSC Dip Proj Man

PROFESSION Ecologist / Environmental Assessment Practitioner

DATE OF BIRTH 7 September 1966

MEMBERSHIP OF PROFESSIONAL BODIES : South African Council of Natural Scientific Professionals No. 400093/06 – Professional Ecologist ; Southern African Association of Aquatic Scientists

KEY COMPETENCIES AND EXPERIENCE

Simon Bundy has been involved in environmental and development projects and programmes since 1991 at provincial, national and international level, with employment in the municipal, NGO and private sectors, providing a broad overview and understanding of the function of these sectors.

From a technical specialist perspective, Bundy focusses on coastal ecological systems in the near shore environment and is competent in a large number of ecological and analytical methods including multivariate analysis and canonical analysis. Bundy is competent in wetland delineation and has formulated ecological coastal set back methodologies for EKZN Wildlife and for the Department of Economic Development Tourism and Environmental Affairs. Bundy acts as botanical and environmental specialist for Eskom Eastern Region. Based in South Africa, he has engaged in projects in the Seychelles, Mozambique, Mauritius and Tanzania as well as Rwanda, Lesotho and Zambia. Within South Africa , Bundy has been involved in a number of large scale mega power projects as well as the development of residential estates, infrastructure and linear developments in KwaZulu Natal, Eastern Cape and Western Cape. In such projects Bundy has provided both technical support, as well as the undertaking of rehabilitation programmes.

SELECTED RELEVANT PROJECT EXPERIENCE

Ecological investigations Tongaat and Illovo Desalination Plants : CSIR – (2013 - 2016)
Review of eco-physiological state of the coastal environments in and around the proposed Illovo and Tongaat desalination plants for associated EIA process.

Ecological Review and Rehabilitation Planning : Sodwana Bay :iSimanagaliso Wetland Park Authority – (2014 - 2015)
Analysis and review of state of dune cordon in and around Sodwana Bay with modelling of the impacts of removing exotic trees from site to rejuvenate dune and beach dynamics

Ecological investigations for numerous renewable energy projects, including "Kalbult", "Dreunberg", "jUWI", "Kenhardt Pv1, 2 and 3", "Solar Capital" and "Lindes".

Ecological evaluation and monitoring: Plastic pellet (nurdles) clean-up MSC Susanna Marine Pollution Event : West of England Insurance, United Kingdom (2018 - 2019)
Location, evaluation and monitoring of plastic pellets within the coastal habitats between Durban and Richards Bay with Resolve Marine, AR Brink and Assocs and Drizit Environmental. Objective is to maintain a defendable but efficient level of pellet contamination across coastline.

PUBLICATIONS

Over a dozen scientific publications and numerous popular articles and contributions to books and documentaries

Luke. Patrick. Maingard

NAME Luke Patrick Maingard BSc (Hons)
PROFESSION BSc (Hons) Candidate Ecologist / Environmental Assessment Practitioner
DATE OF BIRTH 15 September 1993
MEMBERSHIP OF PROFESSIONAL BODIES: South African Council of Natural Scientific Professionals– Candidate Ecologist (registration number 116639)

KEY COMPETENCIES AND EXPERIENCE

Luke Maingard has been employed as an ecologist at SDP Ecological and Environmental Services since April 2016 to this present date, carrying out a number of ecological investigations as well as undertaking a number of Basic Assessment and Water Use License Processes. Maingard has a core competency in the delineation and assessments wetland environments as well as a focus on terrestrial environments, particularly coastal habitats. Throughout the past three years of employment, Maingard has compiled a number of ecological impact reports as well as providing mitigatory measure and insight on enviro-legal compliance matters with regards to a number of developments through out South Africa as well as Zambia.

SELECTED RELEVANT PROJECT EXPERIENCE

Environmental Control and Monitoring at the West Lunga PV facility, Lusaka, Zambia (2018)

Review and evaluation of the construction and operation of the aforementioned PV facility. With subsequent compilation of monthly reports detailing various mitigation measures to ensure compliance.

The evaluation of coastal erosion along the shoreline of Ballitoville, KwaZulu-Natal using geospatial techniques (2018)

Honours thesis. Such a study had been undertaken using GIS to assist coastal management initiatives.

Ecological Assessment of the dune habitat at Erf 206, Tinley Manor, KwaZulu-Natal (2017)

Assessment of the botanical community present within the dune cordon as well as a review of the coastal vulnerability of the site through an evaluation of coastal erosion.

Ecological assessment of the Umzimvubu river system, Swartberg, KwaZulu-Natal (2019)

Delineation of the riparian area as well as the assessment of the ambient water quality though water samples analysis, Bio-SASS as well as an itchy faunal assessment.

Specialist Declaration

I, ...Simon C Bundy, as the appointed independent specialist, in terms of the 2014 EIA Regulations (as amended), hereby declare that I:

- I act as the independent specialist in this application;
- I 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;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct, and do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 (as amended) and any specific environmental management Act;
- 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 have no vested interest in the proposed activity proceeding;
- 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;
- I have ensured that information containing all relevant facts in respect of the specialist input/study was distributed or made available to interested and affected parties and the public and that participation by interested and affected parties was facilitated in such a manner that all interested and affected parties were provided with a reasonable opportunity to participate and to provide comments on the specialist input/study;
- I have ensured that the comments of all interested and affected parties on the specialist input/study were considered, recorded and submitted to the competent authority in respect of the application;
- all the particulars furnished by me in this specialist input/study are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Name of Specialist: Simon C Bundy

Signature of the specialist:

Date: 3 December 2019

Executive Summary

The Kenhardt PV5 Solar Power facility is proposed to be established on the Farm Onder Rugzeer 168, located some 20 kilometres east of the town of Kenhardt. A basic assessment is being undertaken on the site and the applicant has appointed the CSIR as the environmental assessment practitioner. This ecological report provides an over view of the site and forecasts impacts that may be effected on site should the development proceed. The findings of this report will be incorporated into the basic assessment report to be submitted to the Department of Environmental Affairs for authorisation.

The evaluation of the site, some 240ha in extent, was undertaken in November 2019, during a period of intense drought and during the early summer period. The evaluation included the identification of drainage systems and their biophysical state, topographic features and a holistic review of all components within the ecological landscape. An evaluation of fauna or the potential presence of fauna on site, was included in the evaluation.

The proposed site of Kenhardt PV 5 was deemed to show little topographic variation, a factor deemed to be important in the provision of variable habitat and increased botanical and faunal diversity. The site comprised primarily of a level quartz and calcrete dominated environment with some sandy soils located to the north.

The primary impacts identified as a consequence of the development proceeding relate to, inter alia;

- Changes in the broader habitat as a consequence of variation in physical factors within the site (e.g. shading of vegetation, changes in surface water flow regime);
- Changes in the broader surface and possibly sub surface hydrology; and
- The ousting, and in some cases recruitment of species, with subsequent variation in populations in and around the development.

A number of other minor and more specific impacts were identified and are expanded upon in the report.

A proposed development footprint has been identified for the PV 5 solar facility, covering some 245ha and allowing for the maintenance of the major drainage channels serving the Wolfkopseloop drainage system.

Given the above, no impacts arising from the proposed development were identified as being of high significance, and most impacts can be considered to be of low to very low significance on a holistic evaluation. The project forms one of six relatively contiguous photovoltaic facilities that cover a combined area of more than 1500ha. As such cumulative impacts are likely to become more evident within each site, as the broader ecology changes in response to these developments and ecologically important habitats become more isolated. This cumulative level of impact should however be seen against the backdrop whereby impacts arising from the individual PV facilities will be concentrated and sequestered to a singular land unit within the region, thereby avoiding a state where these facilities are spatially scattered across the greater landscape.

Given the above, it is evident that the proposed solar park, Kenhardt PV 5 facility within the boundaries of the study area, cannot be precluded from the Farm Onder Rugseer on the grounds of ecological impact.

Contents

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List of Abbreviations

DEA	Department of Environmental Affairs
EIA	Environmental Impact Assessment
ELP	Electrical light pollution
NEMA	National Environmental Management Act
NEMBA	NEM Biodiversity Act

Glossary

Definitions	
Arid	Areas which receive low levels of rainfall or there is a moisture deficit.
Crepuscular	Fauna that is active at twilight
Dendrogram	A diagram showing relationships determined through a cluster analysis
Calcrete	A carbonate horizon formed in semi-arid regions. Also known as a caliche.
Dolerite	Form of igneous rock.
Drainage line	A geomorphological feature in which water may flow during periods of rainfall.
Eco morphology	Pertaining to the relationship between the geomorphology of an environment and the biotic components that are adapted to it.
Edaphic	Pertaining to soils.
Fossorial	Pertaining to burrowing animals or those which live underground
Geophyte	Plants with underground storage organs.
Graminoid	Grasses or grass-like. Also monocotyledonous plants.
Gully	An erosion line exceeding 30cm in depth where water flow is concentrated and erosion resulting from flow is clearly evident.
Hydrogeomorphological	The interaction of geomorphic processes, landforms and /or weathered materials with surface and sub-surface waters.
Hygrophilous	Plants growing in damp or wet conditions
Multivariate analysis	A statistical method of evaluating non linear relationships between groups of data.
Non perennial	Flow is intermittent and irregular
Rill	Shallow erosion lines less than 30cm deep
Xeric	A dry, as opposed to wet (hydric) or mesic (intermediate) environment.

COMPLIANCE WITH THE APPENDIX 6 OF THE 2014 EIA REGULATIONS (AS AMENDED)

Requirements of Appendix 6 – GN R982	**Addressed in the Specialist Report**
1. (1) A specialist report prepared in terms of these Regulations must contain- a) details of- i. the specialist who prepared the report; and ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	Pages 2- 4
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Page 4
c) an indication of the scope of, and the purpose for which, the report was prepared;	Page 10 - 11
(cA) an indication of the quality and age of base data used for the specialist report;	See section 2.1
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	See Section 7
d) the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	See section 1.3
e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	See section 2
f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	See section 3
g) an identification of any areas to be avoided, including buffers;	See section 3
h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	See Figure 6
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	See section 2.2
j) a description of the findings and potential implications of such findings on the impact of the proposed activity or activities;	See section 4
k) any mitigation measures for inclusion in the EMPr;	See section 9
l) any conditions for inclusion in the environmental authorisation;	See section 9
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	See section 9
n) a reasoned opinion- i. whether the proposed activity, activities or portions thereof should be authorised; (iA) regarding the acceptability of the proposed activity or activities; and ii. if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	See section 10

Requirements of Appendix 6 – GN R982	**Addressed in the Specialist Report**
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	See section 2.3
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	Not available at this time
q) any other information requested by the competent authority.	See section 8
(2) Where a government notice by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	See section 8

ECOLOGICAL IMPACT ASSESSMENT OF THE AREA IDENTIFIED AS 'PV 5'.

This report presents the Ecological Impact Assessment that was prepared by S C Bundy and L P Maingard of SDP Ecological and Environmental Services as part of the Basic Assessment (BA) Process for the proposed construction of the Scatec Solar Photovoltaic Facility 5, located near Kenhardt in the Northern Cape Province (Figure 1).

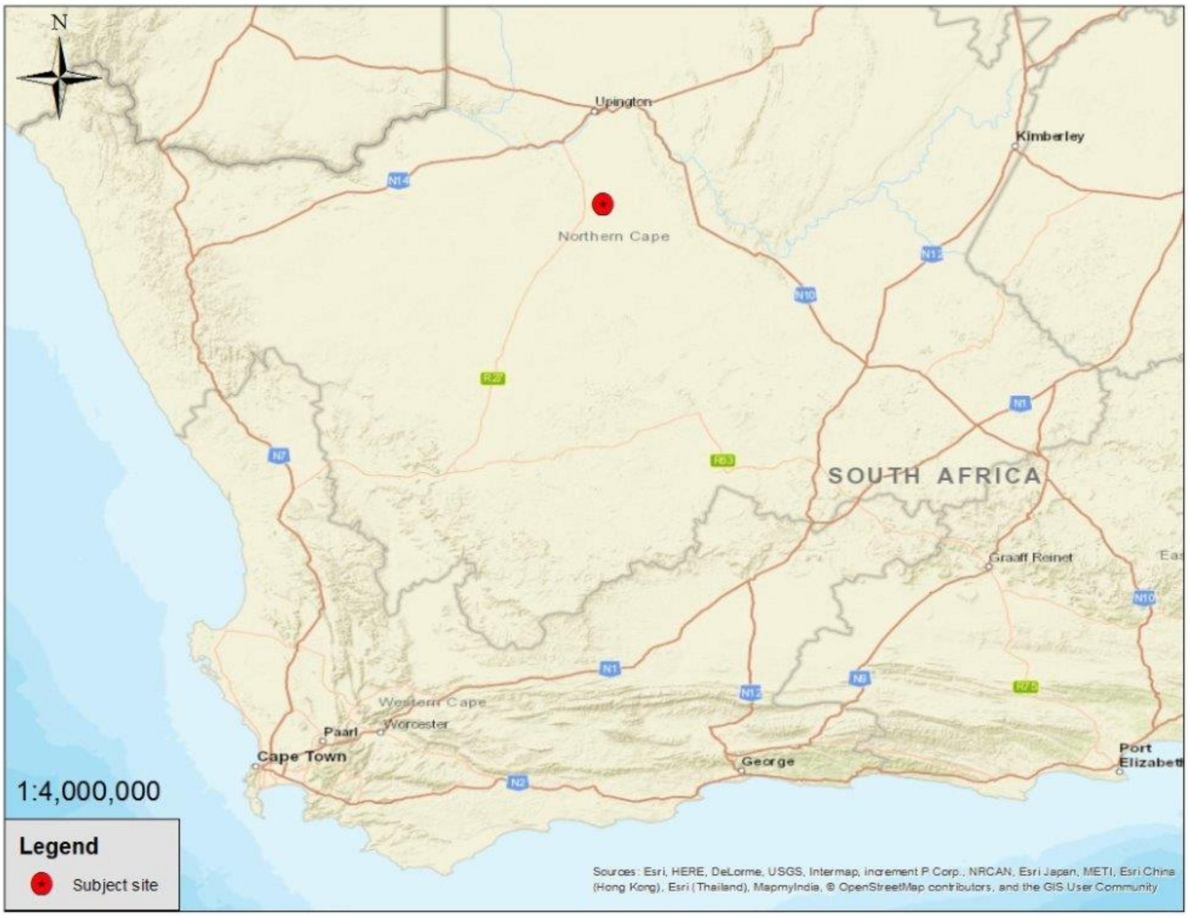

Figure 1. Map image detailing the location of the site a regional scale.

1. Introduction and Methodology

1.1. Scope, Purpose and Objectives of this Specialist Report

Scatec Solar Africa (Pty) Ltd are a renewable energy company with a significant footprint in South Africa. This footprint includes three approved projects in the Kenhardt Region (Kenhardt PV 1,2 and 3). Scatec Solar and their environmental assessment practitioners, the CSIR, are presently undertaking a Basic Assessment process on three additional sites within the Kenhardt Region, to be known as Kenhardt PV 4, Kenhardt PV 5 and Kenhardt PV 6. These proposed project sites lie almost contiguous with Kenhardt 3 and form a band of proposed photo voltaic power facilities that would serve the existing Nieuwehoop Sub station, located to the north of the Sishen – Saldanha Railway.

The objective of concentrating such facilities into a single, large and contiguous complex of PV parks aligns with the recommendations of the regional SEA for the region (CSIR 2015) and allows for the sharing of infrastructure, including roads and powerlines. The proponents are of the opinion that such concentration of facilities has both environmental and economic benefits. Proposed PV facilities PV4, PV5 and PV6 will be subject to individual consideration on a project – for – project basis, but with cognizance of the fact that more than one PV facility has been approved or may be approved for the region.

This ecological report has been compiled to provide an overview of the ecological state of the proposed PV5 subject area. Such information is to be incorporated into the Basic Assessment Report in order to provide a natural scientific overview of the nature of the proposed site and to determine or forecast the nature and significance of impacts that may arise on the site, should the proposed development be implemented. Options for the avoidance or mitigation of impacts are also presented.

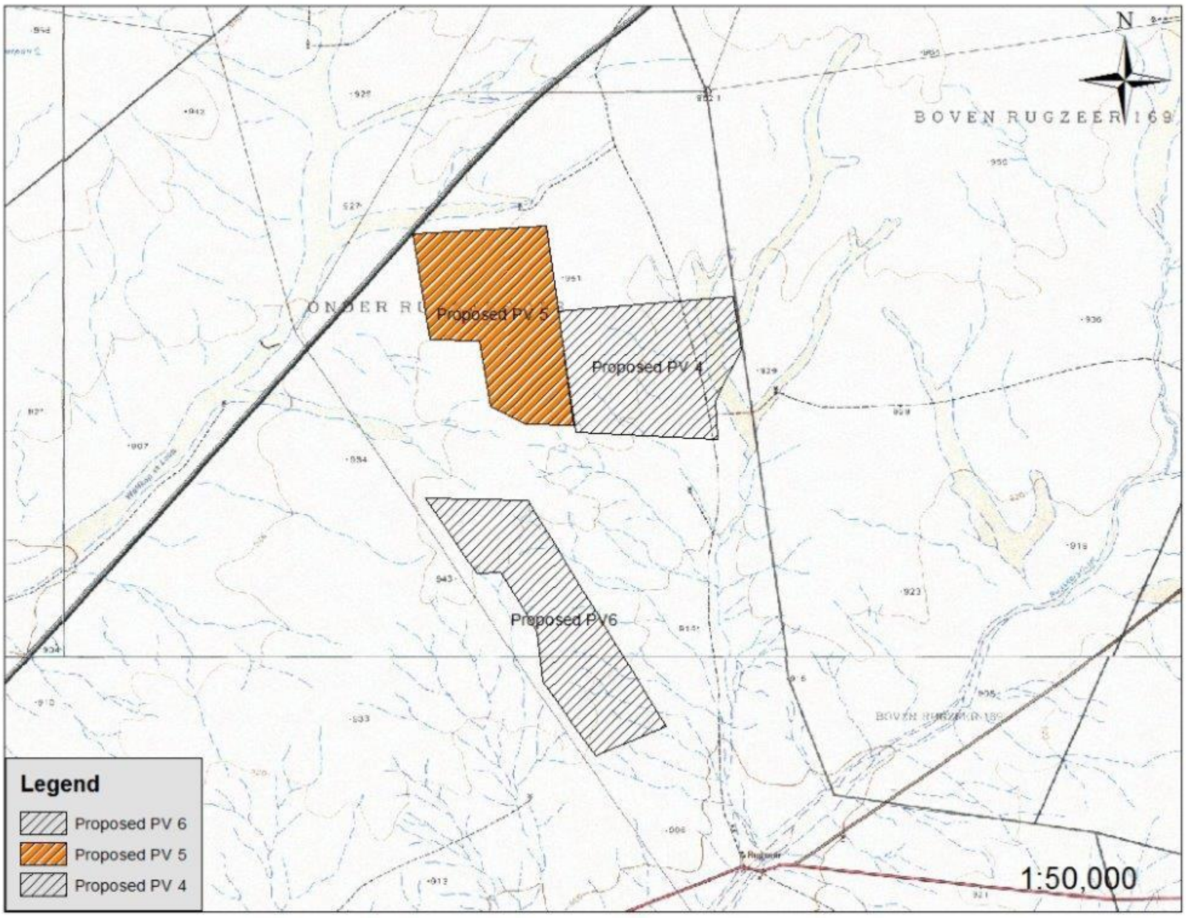

Figure 2. Map showing Kenhardt PV 5 in relation to two additional proposed sites, PV 4 and PV 6

This biophysical evaluation of the receiving environment, identified as portion of the Farm Onder Rugzeer 168, entailed both a literature review of ecological information pertaining to the region, as well as on site evaluations, during which specific primary data was collected and evaluated. The site reconnaissance was undertaken during the period 25 – 29 November 2019, during a period of severe drought in the subject region. The site reconnaissance entailed the identification of key ecological features on the property which were subject to evaluation.

All data collected in the field was evaluated and interpreted in order to provide an understanding of the nature of the prevailing environment at a landscape and localized habitat level, together with specific evaluation of data relating to habitat form and structure within the prevailing environment. The biophysical and ecological aspects have been considered in the evaluation of the impacts anticipated to be generated through the construction and operation of this proposed PV facility.

1.2. Terms of Reference

The overall objectives of the Ecological Impact Assessment are to:

- Identify and establish an understanding of the site under consideration at a landscape scale of evaluation with particular consideration being given to aquatic, riparian or important terrestrial habitats, as they may be identified.
- Provide an evaluation and status of habitat composition and significance within the site in order to evaluate the potential impact of the proposed development on the ecological function of the site.
- Assess the anticipated potential impacts arising from the proposed development on both the habitat and fauna within the study site. Such impacts may be directly applicable to the site and contained within the site boundaries, or may be indirect impacts, which may have ramifications outside of the site boundary, or may be of a cumulative nature in terms of impacts arising from similar developments or activities within the region.
- Provide guidance on the implementation of mitigation measures that may serve to moderate any negative impacts that may arise on site as a consequence of the development.

1.3. Assessment Details

Table 1. Details of assessment

Type of Specialist Investigation	Ecological Specialist Investigation
Date and Duration of Specialist Site Investigation	24/11/2019 to the 28/11/2019.
Season	Summer.
Relevance of Season	Seasonal (and extended drought state) have had an influence on the findings contained within this report. The following seasonal and climatic factors must be acknowledged. • While the Kenhardt region is considered to be a xeric or semi-xeric region, at the time of investigation the area was subject to a severe drought that had been in place since 2017. This situation, including the fact that rainfall, according to records, peaks in and around March, may influence the emergence of some geophytic plant species and may affect faunal populations within the region. The drought situation in the region is serious and comparison with findings undertaken during 2016 showed a significant change in habitat form with a generally depauperate environment. • During the site reconnaissance extreme and unseasonally high temperatures were experienced. (daily temperatures peaked at 42˚C), whereas the average temperature for November is noted as 23˚ (www.climate-data.org). Such extreme temperatures and evident water stress may serve to alter findings on site.

2. Approach and Methodology

The approach to assessing the ecological state of the potential site for Kenhardt PV5 entailed evaluation of existing data that was evident both in house and externally, and to corroborate such data as well as undertake an evaluation of the subject site at a finer scale of assessment through a site reconnaissance process undertaken between 25 and 29 November 2019.

The following activities were undertaken in the compilation of this assessment.

- Literature review and desktop analysis.

A preliminary review of the area in question was undertaken prior to the field investigation. The assessment utilized various literature and online sources as well as Geographic Information System data – as listed in section 2.1 below. Notably, an assessment associated with an application for authorization for PV facilities 1, 2 and 3 was undertaken by CSIR in 2016 and the findings of these assessments were useful in acting as baseline information for PV 5.

- Site reconnaissance:

Field reconnaissance was undertaken on the site which entailed the traversing of the site in a north-south and east- west direction. Sites of geomorphological or topographic variance were identified and subject to assessment which included the identification of the eco-morphology of the site. While consideration was given to the establishment of transects across the site, and such transects were undertaken over a 200m extent, this data proved to be indeterminate from a statistical perspective as the area was depauperate. As such only three species were recorded across the randomly selected transects and as such this data is not statistically sound. (This depauperate state is attributed to the severe drought that has been affecting the area since 2017). Use of the visual observation of species within the region was relied upon to develop an understanding of the habitat within the subject site, as well as the results of the 2016 investigation.

Fauna on site was identified during the walk over, while a Bushnell Trophy Cam was established at two sites over a period of 48 hours to assist with the identification of faunal species relevant to the area and the site. In addition, at selected topographically variable sites specific consideration was given to the presence of smaller fauna, in particular reptiles and invertebrates. The results of these searches are presented below.

- Wetland assessment

Using methods identified in the Department of Water Affairs' "A Practical Field Procedure for Identification of Wetlands and Riparian Areas" (2005), as well as the US Army Corp of Engineer's "A hydrogeomorphic classification for wetlands" (Brinson,1993), wetland and riparian areas were identified. Such evaluations utilised both geomorphological, geohydromorphic edaphic conditions and botanical indicators in order to identify such components. Where riparian and wetland systems are identified and lie within 500 m of the proposed development/activity, an application in terms of Section 21 c and i, of the National Water Act (1998) may be required to be submitted to the mandated authority.

- Data analysis

  1. Limited numeric data was garnered from the site for the above reasons and as such no statistical analysis of habitat form and or structure was undertaken.

  2. Give consideration to the overall structure of habitat within the subject site.

  3. Identify any habitat anomalies that may be identified in such analysis.

4. Allow for the interpretation of such data in order to prioritise and evaluate habitat form and structure within the study area

2.1. Information Sources

2.1.1 Literature resources

2.2

- Shearing, D. and Van Heerden, K., 1994. Karoo: South African wild flower guide 6. *Botanical Society of South Africa, Cape Town*.
- CSIR (2016) "Environmental Impact Assessment for the Proposed Development of a 75 MW Solar Photovoltaic Facility (KENHARDT PV 3) on the remaining extent of Onder Rugzeer Farm 168, north-east of Kenhardt, Northern Cape Province"
- DWAF (Department of Water Affairs and Forestry), 2005. A practical field procedure for identification and delineation of wetlands and riparian areas.

2.2.1 ARC GIS Version 10.4 - Geographic spatial data

- Critical Biodiversity Areas – BGIS (www.sanbi.org)
- National Fresh Water Ecological Priority Areas
- South African National Biodiversity Institute Vegetation data
- Google Earth Pro 2019 imagery

2.2.2 Online resources

- Meteoblue worldwide weather services https://www.meteoblue.com/en/weather/week

2.2. Assumptions, Knowledge Gaps and Limitations

The following assumptions and limitations apply:

➢ Seasonality and drought state

As indicated above, site reconnaissance was undertaken during the period of November 2019, a period of successive and unseasonably high temperatures and low rainfall (SA Weather Services, http://www.weathersa.co.za). A drought situation has also been evident since 2017. This state has given rise to a depauperate habitat across most of the subject region with recorded decreases in faunal populations and intensive grazing of areas by livestock. This situation is likely to have masked many floral forms and impacted upon faunal populations. This state has affected both site observation and data for the site and placed a significant reliance on earlier records (2016). In addition, statistical analysis of the site has provided scant information in terms of species diversity which has not allowed for the use of basic statistical tools to differentiate and compare habitats.

Figure 3. Comparative images of drainage channel on site in 2015 (left) and 2019 (right), showing depauperate sate of habitat due to drought. Note the extensive *Stipagrositis ciliata* growth in drainage lines which is absent in such features in 2019. Both images were taken in October/ November of the respective years.

- Assessment methodology:

The use of random sampling methods and the establishment of transects across site was undertaken, however data acquired is of limited statistical value and lacked sufficient variance to allow for the use of comparative and differentiate tools such as TWINSPAN and CANOCO. Significant reliance on visual eco-morphological observations, was made in order to derive an understanding of the state of the habitat within the subject site. This state may change under a different meteorological regime. .

- Cumulative impacts

In terms of the assessment of potential cumulative impacts included in this specialist study, these take into consideration certain developments that occur with a 20 km radius of the proposed project. This is an arbitrary extent determined by the authorities and is focused on allowing for the incorporation of similar projects known to be imminent within the area.

2.3. Consultation Processes Undertaken

Interaction was undertaken with the following persons in respect of the site:

- Mr S Strauss – local farmer and adjacent land owner
- Mannetjie – farm caretaker

3. Description of Project Aspects relevant to Ecological Impacts

The proposed PV5 development will see a land use change that differs significantly from the current, prevailing land use. Should the proposed development proceed, the prevailing ecology is expected to undergo notable change, primarily as a result of the construction stage of the project, as well as the long term operational stage. The development of the site for a photovoltaic facility will typically see the following activities arise:

- Cordoning and fencing of the site during both the construction and operational phases. This component of the project usually entails the establishment of an electrified fence which remains in situ for the lifetime of the project (i.e. for the operational phase). For the construction phase, the construction area and construction site camp may also be cordoned off with temporary fencing.

- Clearance or partial clearance of topographic features and significant vegetation where applicable during the construction phase.

- Establishment of roadways (i.e. internal gravel access roads) and hardpanning of surfaces, with minor stormwater management aspects being introduced during the construction and operational phases.

- Establishment of modular arrays with concomitant cabling and provision of invertors within the arrays.

- The footing of the module framework is founded into the ground using an earthscrew or similar methods.

- Cables are placed in trenches to a depth of approximately 1.0 m.

- Establishment of step up transformer and the on-site substation. This facility is expected to occupy an area of approximately 2 ha. It is fenced and isolated from the balance of the site.

- Establishment of offices and related infrastructure.

- A yard for storage and general operations will be set aside, adjacent to the built offices.

The commencement of construction on site will thus entail low to significant alteration of the prevailing habitat, depending upon the final design and layout of the PV facility. A general sequestering of the subject area, through the fencing of the site from the surrounding habitat forms will thus arise.

While the construction phase will see temporary disturbances and transformation to the environment, these impacts on the prevailing ecology are likely to be significant in terms of impact, but of short temporal extent as the construction project rolls out and a stability, albeit within a differing environment, arises on the subject site. It therefore follows that impacts on the ecology arising from this project can be divided into two aspects, namely: construction phase impacts and operational impacts. A brief list and description of the varying changes in the localised ecology of the site is presented under these two headings.

Construction phase impacts

- Change in localised topography on account of excavation and site establishment. Areas of elevation and depression are likely to be altered to establish infrastructure
- Change, both short and long term in localised hydrology – percolation rates, points of groundwater recharge, surface water flow will arise
- Clearance of vegetation to establish roadways and other infrastructure
- Isolation or cordoning of site through fencing, affecting the movement of fauna
- Dust – according to movement of traffic and other construction related factors will affect factors such as palatability of vegetation
- Electrical light pollution – primarily associated with work at night, will alter faunal ethos of some species
- Incidental pollution events, including the loss of solid waste, spillage of liquids such as hydrocarbons and other fuels as well as possible sewerage and other waste is likely to alter select points within the subject site, possibly affecting habitat form and other factors.
- General disturbance on account of pedestrian movement and activities on site

Operational phase impacts

- Altered topography within and adjacent to site will give rise to differing habitat regimen with variation in floral and faunal forms and ecology on site.
- Change in the localised hydrology will see variation in topography as surface run off establishes new primary drainage channels, structures alter flow and percolation rates across site
- Secondary vegetation will arise following a different seral process that will be driven by features including variation in solar irradiance (increased shade from modules), ongoing

disturbance (clearance of larger vegetation affecting modules) and plant communities will alter on account of changing hydrology and topography

- The isolation of the site by fence (perhaps electrified), will alter faunal ethos, while a changed habitat within the site may act to encourage faunal passage into the site. The fence may also alter predator – prey relationships both within and adjacent to the site, where prey is cordoned on account of the presence of fencing (e.g. jackals may use fencing to direct and run down prey).
- Electrical light pollution. Some points within the PV may be flood lit for security and other reasons. Such lighting or "ELP" may alter the ethos of fauna that are either attracted to lights or use light for predation. This may be a minor and generally latent impact, but is a likely state in the operational phase.
- Incidental pollution events are likely to continue throughout the operational stage. If tracking modules are utilised spills of hydraulic fluid may arise or other spillages may be evident. Small volumes of sewerage may be introduced into the localised environment from operational offices, while solid waste may arise within the site from time to time.
- General disturbance on account of pedestrian movement and activities on site

4. Description of the Receiving Environment

4.1. Baseline Environmental Description

The Kenhardt region in general, can be considered to have a low rainfall of less than 200 mm per annum (SA Weather Services, 2015) although the recorded average rainfall for the period 2000 to 2012 approximates 238 mm within an average of 51 rain days per year (www.worldweatheronline.com). As such the area has been described as a "semi-arid region" (Bailey 1979). Using the Koppen-Geiger climate classification method (www.koeppen-geiger.vu-wien.ac.at), the area is classified "BWh", which is indicative of an *arid hot environment*, this classification is supported by Esler *et. al.* (2006) who have defined areas with an annual rainfall of less than 200 mm as being "deserts". This *desert* status may be the case in the Kenhardt region under its lower rainfall periods. In addition, the highest annual temperatures for the region are recorded between January and February, with maximum temperatures being 37˚C (www.worldweatheronline.com) although more recent summer temperatures lie at approximately 42˚C.. Extreme temperatures thus coincide with the peak rainfall period. Such correlation may give rise to the low groundwater recharge rates projected for the region, this being estimated at approximately 0.03 mm / annum. (Musekiwa and Majola, 2011). With the above in mind, the most definitive physical drivers of the Bushmanland Arid Grassland veld type that lie within the study area, are meteorological in nature and will relate to surface and subsurface hydrology. Other physical drivers will include localised geologies and edaphics.

As indicated above, the region has been in an intensive drought, with 2016 showing the last significant rainfall period (https://www.worldweatheronline.com). Over the preceding 12 months only trace rainfall amounts have been recorded since May 2019 (Figure 4). This has resulted in a moribund state within the prevailing habitat with concomitant impacts on fauna.

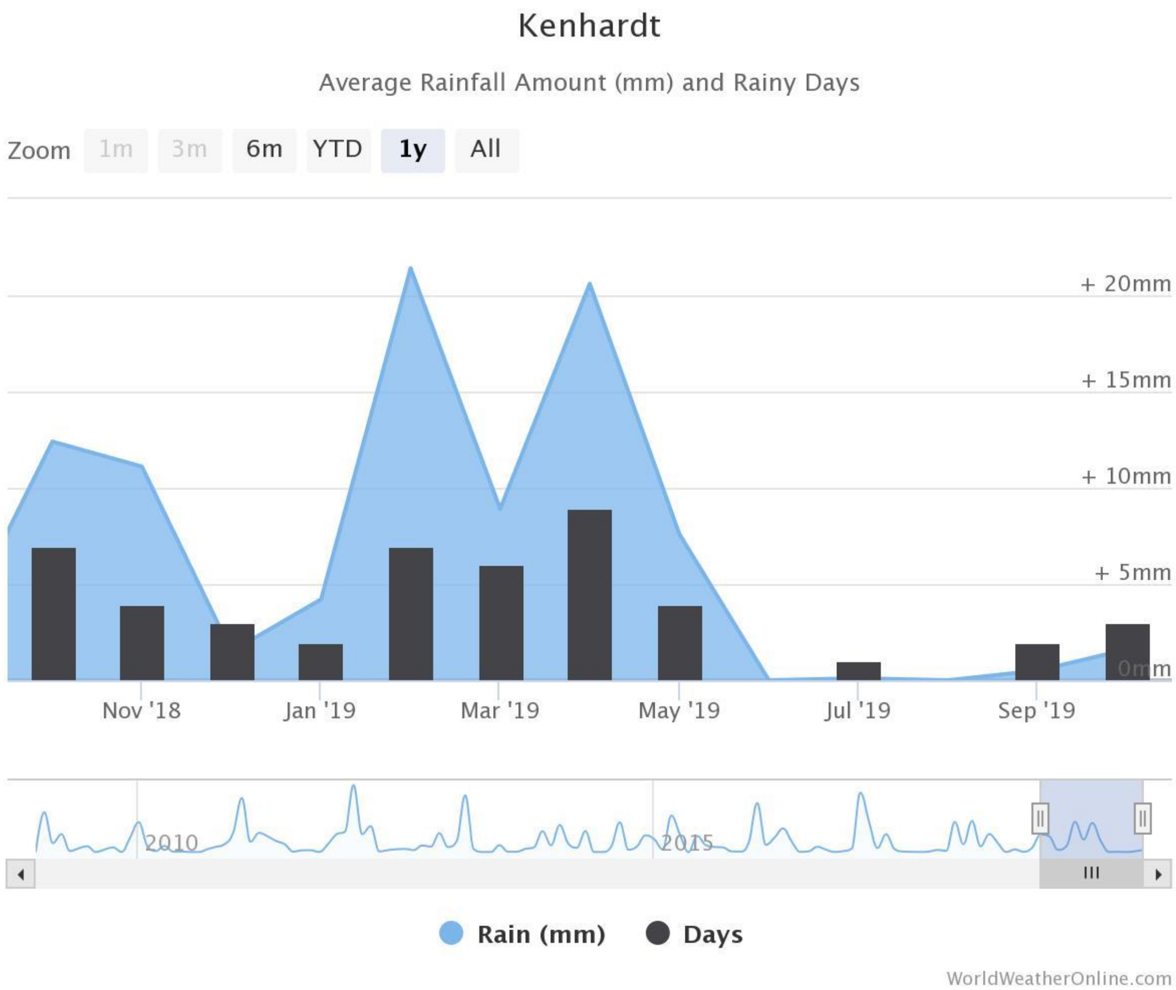

Figure 4. Rainfall data for the period November 2018 to November 2019 for Kenhardt (source www.worldweatheronline.com)

Kenhardt and those areas surrounding the town fall within the Bushmanland Arid Grassland veld type (NKb3) (Mucina and Rutherford, 2006). This veld type is located extensively south of the Orange River, but may include a number of smaller habitat forms within its broader extent.

The Kenhardt PV 5 study site can be described as a generally level portion of land. The site lies to the west of a watershed that divides the catchments of the Wolfsekopseloop water course and that of the Rugseersrivier. Both are ephemeral systems. Proposed PV 5 lies in its entirety to the west of the watershed and encompasses a number of minor dendritic drainage features that flow towards the Wolfsekopseloop drainage system which is a tributary of the Hartbees Rivier located to the north west of the town of Kenhardt. (Figure 5). To all intents and purposes these systems are minor drainage features, as discussed below.

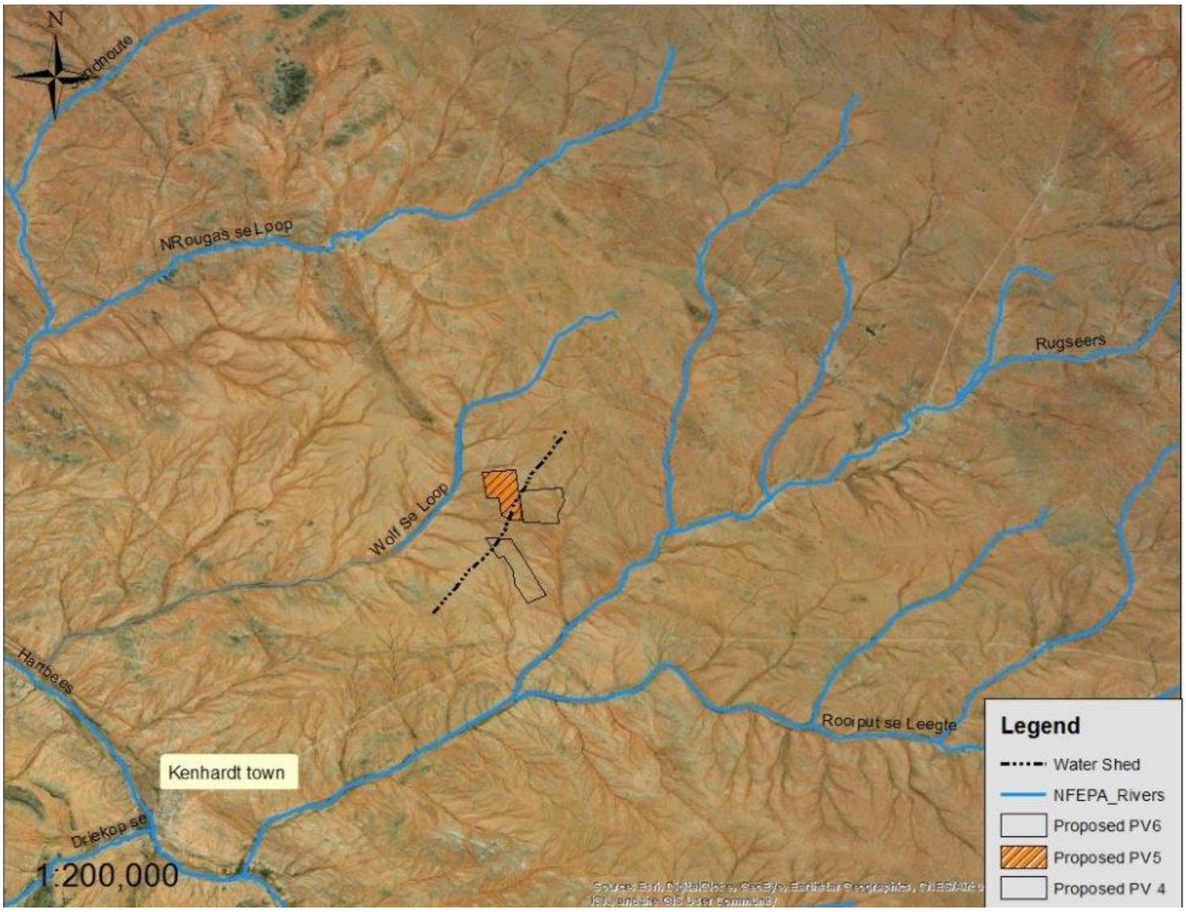

Figure 5: Map indicating drainage lines associated with Kenhardt PV5, including the two catchments of Wolfkopseloop and Rugseersrivier.

4.2 Habitat and Vegetation

The proposed Kenhardt PV 5 site is situated to the immediate south of the Sishen – Saldanha railway line. The railway has served to alter drainage from the site, perhaps retarding flow from the site and resulting in the placement of extensive areas of sandy soils for the north of the site. Occasional exposures of both dolerite and quartz at points are evident, however these are generally level, low lying features with limited topographic variation. PV 5 does not show the deeper sandy soils that are more common to the east of the Farm Onder Rugseer and evidently offers a slight variation in edaphics from that area. It is suggested that the more prevalent quartz geology associated with the western extent of the farm provides for limited sandy soil accumulation in this portion of the catchment.

Like the farm in general, PV 5 study site has been subject to extensive and significant grazing. The region in general has been subject to a significant drought which still prevails The dominant botanical species on site are *Lyceum horridus, Aristida ascenionis Rhigozum trichomotum* and *Stipagrostis ciliata*. A few individual specimens of *Aloe dichotoma* are present within neighbouring areas of the subject site, but no specimens were recorded from the site Two significant quartzite kopjies are however located to the south west and west of the subject area and these two features are considered to be ecologically important. Although lying within close proximity of the subject site they have however been excluded from the study area and a “buffer” or development exclusion zone with a diameter of 300m has been established. Using data collated from transects established at adjacent PV4 it was noted that over 3 x 200m, *L horridus* comprised 49% of the species encountered. *S ciliata* and a few forbs comprised the balance of species recorded. From this a depauperate state is evident, that which is further exacerbated by the effect of drought and the requirements of livestock has led to over-grazing o site. Three minor dendritic channels are evident within the property, each draining in a westerly direction into the Wolfkopseloop system. These drainage lines show little geomorphological characteristics but rather, are discerned by an increased density of vegetation (primarily *L horridus*).

No hygrophilous vegetation is evident within these systems and the percolative nature of soils at these points and across the dendritic drainage features precludes the establishment of such vegetation.. A list of species identified across site is presented in Table 1 below.

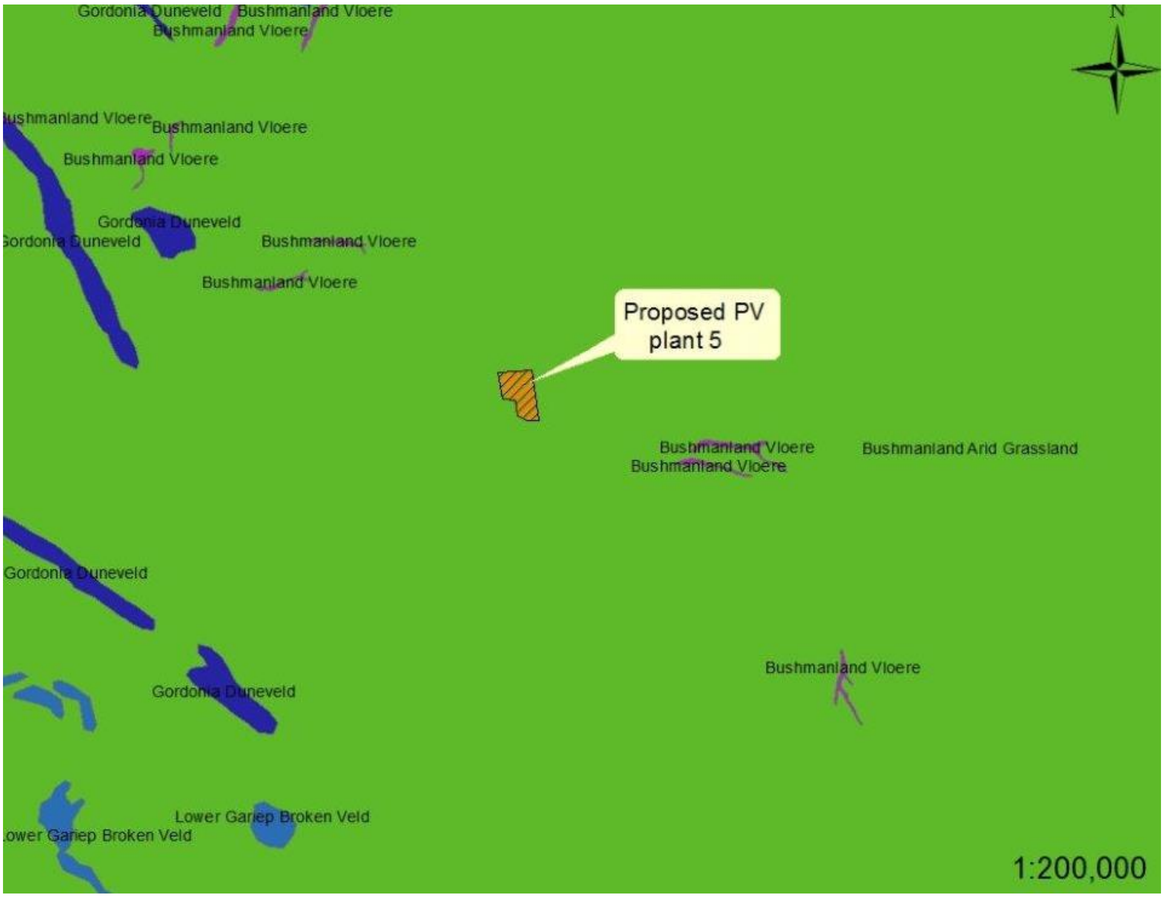

Figure 6. Map showing site in relation to dominant habitat form – Bushmanland Arid Grassland

Table 2. List of observed species within the study site, indicating conservation significance in terms of relevant legislation.

Species	Conservation Significance	
	NC NCA *	NFA#
Aloe dichotoma		
Aristida ascensionis	X	
Aristida congesta		
Euphorbia glanduligera		
Lyceum cinereum		
Lyceum horridus		
Pentzia spinescens		
Rhigozum trichotomum		
Salsola tuberculata		
Stipagrostis ciliata		
Tetragonia arbuscular		

*NC NCA = Northern Cape Nature Conservation Act (1998)
#NFA = National Forest Act (1998) Protected Trees $ = exotic

Figure 7 Image showing typical state of site centrally within PV 5

Figure 8. Image showing quartzite exposure lying to the west of PV5

4.3 "Aquatic" and Riparian Habitat

PV 5 is drained by three minor dendtritic features. According to the US Department of Agriculture, hydro-geomorphological features are indicated primarily by evidence of flow or the deposition of materials (Brinson et al 1993; USDA 2008), while verdant vegetation is a combination of both improved plant water relations and increased nutrient availability. As such, drainage features can be defined as "minor" or "major" systems. The minor features within the site show limited geomorphological characteristics and surface flow through these drainage features is considered to be limited to flood or precipitation events that arise on a frequency of every five years or more (Mr S Strauss *pers comm*). In addition, these features are affected by the presence of the Sishen Saldanha railway line, which traverses these systems.

The minor drainage features are only evident through the establishment of dense and more verdant vegetation, dominated by *L horridus*. (Figure 9) It is also likely that incisement of the drainage features is driven by the passage of livestock, with the dispersal of scat at these points promoting vegetative growth. The drainage lines do not show hygrophilous vegetation as may be defined, nor do they show the presence of geohydromorphic soils, primarily on account of the erratic and intermittent levels of inundation, over extended periods of time. When flow does arise within these features, it is sluggish and ceases abruptly following the cessation of rains. Surface water rapidly drains from site on account of the percolative soils, or is lost to evaporation. It can therefore be argued that under even the more significant rainfalls on site, minor drainage features play only a limited hydrological role. Figures 10 and 11 indicate graphically the drainage features associated with PV5. These images indicate that drainage is primarily towards Wolfkopseloop which is a major drainage line to the south.

Figure 9: An image indicative of a minor drainage feature located within the site..

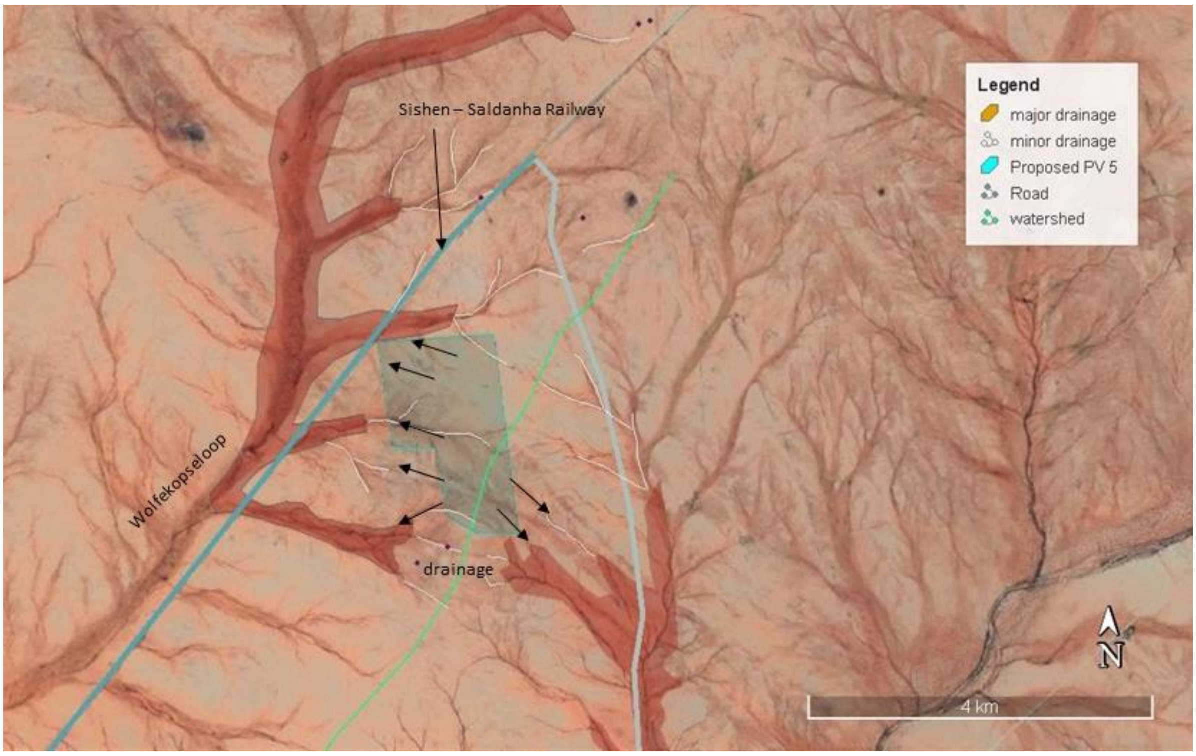

Figure 10. High resolution map showing site of proposed PV5 in relation to drainage features

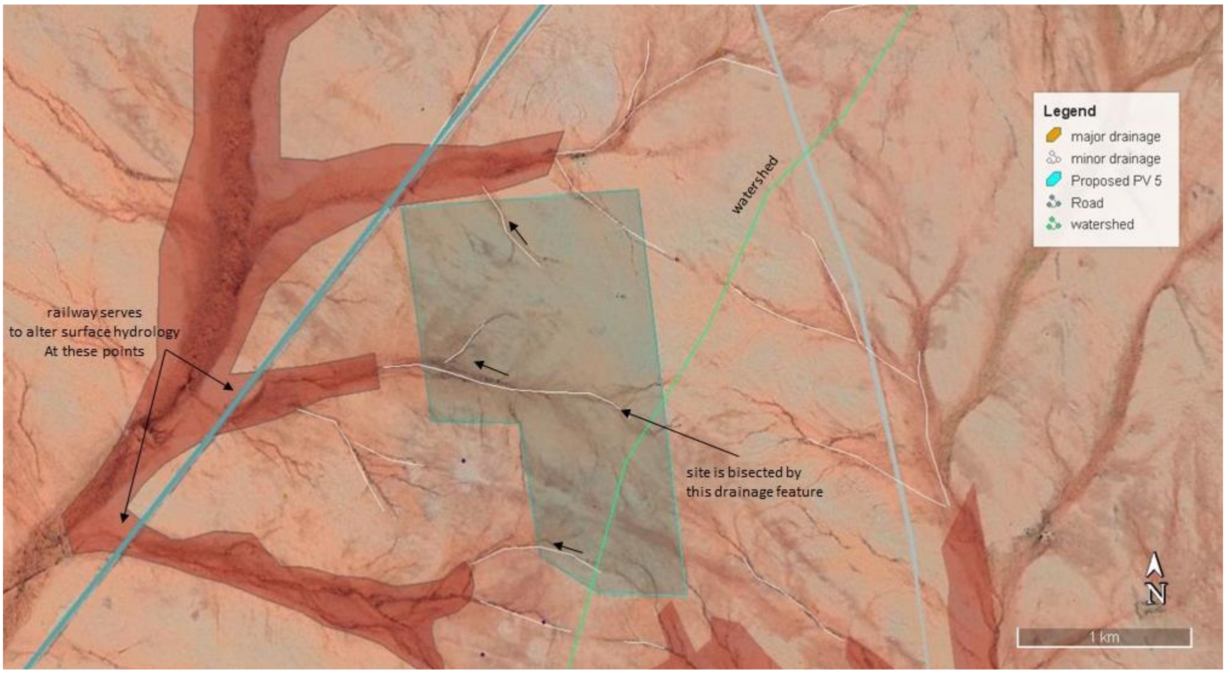

Figure 11. Map showing site of proposed PV5 in relation to minor and major drainage features and the proximal Sishen – Saldanha railway which traverses some drainage features

4.3 Fauna

4.3..1 Terrestrial

Given the xeric nature of the region fauna on site is considered to be typical of these environments. Table 2 below indicates species or evidence of their presence observed on the site and surrounds and includes other species that are likely to be encountered on the site. The occurrence of such species is likely in respect of these animals either utilizing the site as refugia or as part of a wider foraging range or "territory". As is typical of the region, a large number of fossorial and burrowing species, including mammals and invertebrates, were identified across the region in general. Such species included suricates (meerkat) (*Suricata suricatta*) and ground squirrel (*Xerus inauris).* Foraging excavations indicating the presence of aardvark (*Orycteropus afer*), as well as the porcupine (*Hystrix africaeaustralis*) were evident. A number of reptiles were identified on the proximal quartz kopjies including Bibron's thick toed gecko, *Chondrodactylus bibronii* (Figure 12) and a rough scaled gecko (*Pachdactylus sp*). Most reptile and small mammal species presence was associated with quatzite kopjies which offer suitable habitat for refuge.

Other larger mammals that were noted on site include Springbok (*Antidorcas marsupalis),* some of which are noted to be succumbing to the effects of the drought and Steenbok (*Raphicerus campestris*), which were noted to be more resilient to the limited water availability (Du Toit, 1990).

Most larger mammals located within the subject site are not reliant upon the study area in particular and are likely to forage over extensive ranges that extend beyond the study area. Estes (1992) indicates that suricates may use warrens for a number of months or possibly years, before relocating. Noted on other solar PV sites, suricates are quite capable of establishing warrens within solar parks following establishment, while aardvark (*O. afer)* and other fossorial species are capable of excavating under fencing which may initially serve to exclude them from an area.

Figure 12. *Chondrodactylus bibronii* located on site in quartz outcrop.

Table 3. List of terrestrial species identified within and around site and likely to be present within region/site. Species of conservation importance identified.

		Observations	TOPS (2007)	Conservation Importance (IUCN Red List) *
Mammals				
Orycteropus afer	Aardvark	Foraging evidence?		LC
Felis nigripes	Black-footed cat			VU
Atelerix frontalis	South African hedgehog	Observed 2016	Protected	LC
Canis mesomelas	Black back jackal			Not listed
Xerus inauris	Cape ground squirrel	Observed		Not listed
Lepus capensis	Cape hare	Observed		Not listed
Felis caracal ?	Caracal ?	Remains of prey – 2016		Not listed
Procavia capensis	Rock dassie	Observed – 2016		LC
Suricata suricatta	Meerkat	Observed		LC
Aethomys namaquensis	Namaqua rock mouse			Not listed
Hystrix africaeaustralis	Porcupine	Foraging evidence ?		LC
Antidorcas marsupalis	Springbok	Observed		LC
Raphicerus campestris	Steenbok	Observed		LC
Cynictis penicillata	Yellow mongoose	Observed		LC
Reptiles				
Ptenopus spp	Barking gecko			LC
Chondrodactylus bibronii	Fat toed gecko	Observed		Not listed
Naja nivea	Cape cobra			Not listed
Chondrodactylus angulifer	Giant ground gecko			LC
Cordylus spp	Girdled lizard		Protected	*C cataphractus* ; - VU
Psammobates tentorius	Karoo tent tortoise	Observed		Not listed
Geochelone pardalis	Leopard tortoise	Observed – 2016		Not listed
Bitis arietans	Puff adder			Not listed
Agama makarikarica	Spiny agama			Not listed
Amphibians				
Tomopterna cryptotis	Tremolo sand frog			LC
Invertebrates				
Locustana pardalina	Brown locust	Observed		Not listed
Pterinochilus spp	Baboon spider		Protected	Not listed
Seothyra spp	Buckspoor spider			Not listed
Family Vespidae	Various wasps	Observed		
Opistophthalmus spp	Burrowing scorpions?	Burrow entrance ?	Protected	Not listed
Parabuthus spp	Parabuthid scorpion			Not listed
Family Hodotermitidae	Termite			Not listed

TOPS – Threatened or Protected Species GN R151 of the National Environmental Management: Biodiversity Act (Act 10 of 2004)

IUCN – International Union of Conservation Networks

*. LC = Least concern; NT = Near threatened; VU = Vulnerable; EN = Endangered
CR = Critically Endangered; EW = Extinct in the wild; NE = not evaluated; DD = data deficient

4.4 Identification of Environmental Sensitivities

The Kenhardt region in particular and the Northern Cape in general, is presently subject to severe drought conditions. There is a marked decline in habitat diversity, so much so that the use of species occurrence data from transects is of limited value and cannot be utilised due to the limitations on variance. Fauna are also evidently under severe stress. As such, it is clearly difficult to determine ecological significance based upon vegetation form and the occurrence of faunal populations alone. Geomorphological features such as major drainage lines, kopjies and other anomalies in the landscape are by virtue of their variation from the norm, ecologically important factors and can be described as important or "sensitive" features within the subject region.

Notably, and as described above, the proposed PV 5 site offers little eco-morphological variation across the study area, with a primarily uniform topography, minimal variation in elevation and only minor, insignificant drainage features present across most of the site. As such, the proposed development footprint for the establishment of PV5 encompasses the majority of the study area with the exclusion of the minor dendritic drainage features that drain towards the Wolfkopseloop system.

Solar parks are generally benign in nature exhibiting a "light" footprint and low level of disturbance, though extensive impact on the receiving environment (Figure 13). In determining areas of sensitivity Figure 14 below identifies two of the abovementioned drainage features have been excluded from this development footprint in order to maintain the general integrity of the major drainage system that feeds into the Wolfkopseloop.

Figure 13: Image of solar arrays indicating the limited Influence that such structures generally have on the flow of surface waters within a solar facility.

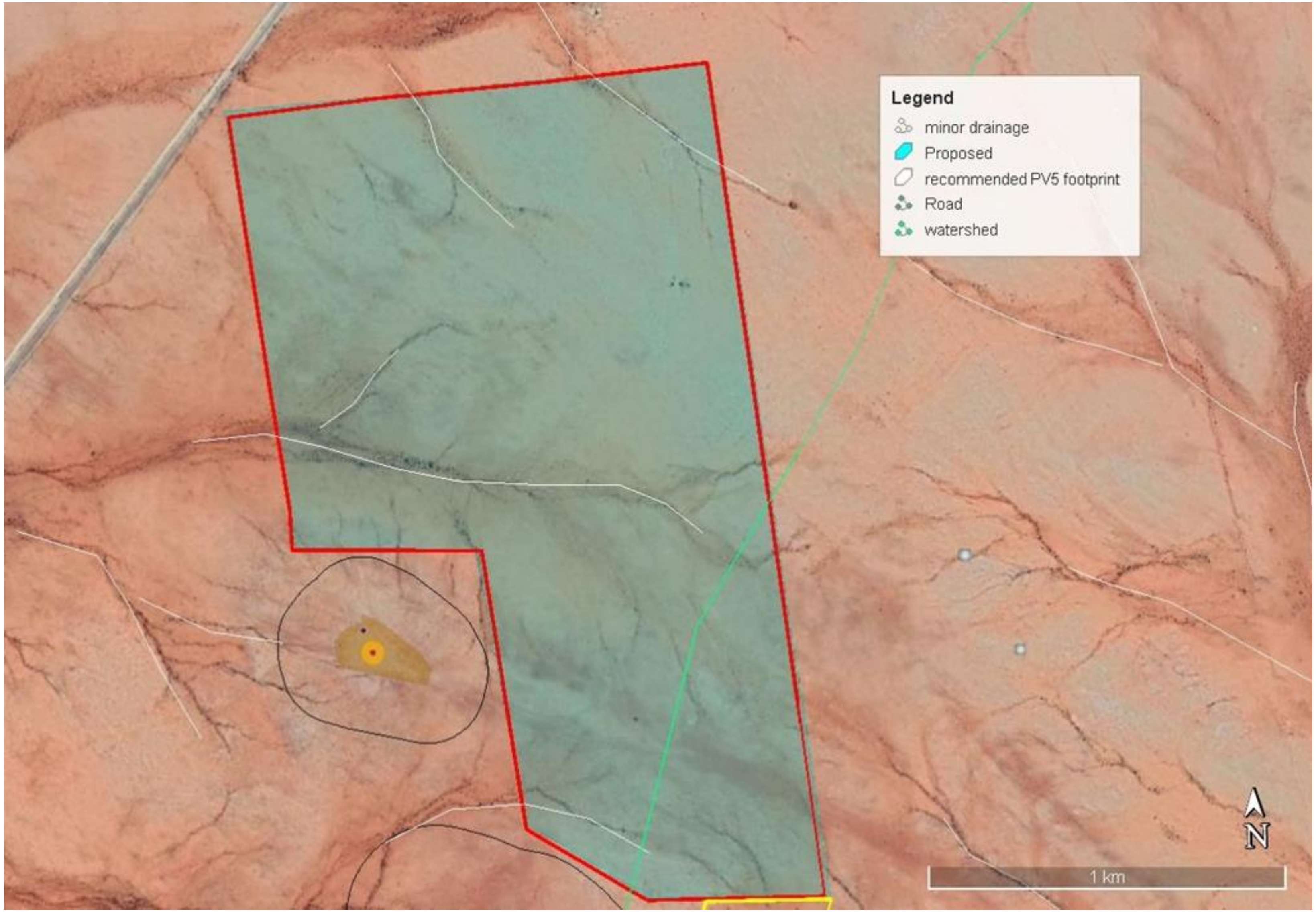

Figure 14. Map indicating recommended extent or footprint of PV-5 facility (red outline).

5. Issues, Risks and Impacts

5.1. Summary of Issues identified during the Project Notification Phase

Await comments and input from interested and affected parties

5.2. Identification of Potential Impacts/Risks

A number of direct, indirect and cumulative impacts on the localised and broader ecology of the region can be identified as a consequence of the proposed development being implemented. Direct impacts are those that are directly attributable to the implementation and operation of the project, while indirect impacts are consequential effects of the project that may not be directly attributable to the development. Cumulative impacts are those externalities that arise from the development and compound existing effects or influences on the ecology of the region. These impacts are also defined as originating from the construction phase or the operational phase and may include the 'decommissioning phase".

5.2.1 Construction Phase

The following potential impacts during the construction phase can be summarised:

Potential impact 1. Alteration of habitat structure and composition;

Potential impact 2 Ousting (and recruitment) of various fauna;

Potential impact 3. Changes in the geomorphological state of the upper drainage lines (i.e. changes to surface drainage patterns) due to construction activities leading to change in plant communities and general habitat structure, within the site and immediately adjacent to it;

Potential impact 4. Increased electrical light pollution, leading to changes in nocturnal behavioural patterns of fauna;

Potential impact 5. Exclusion or entrapment of (in particular) large fauna, on account of the fencing of the site;

Potential impact 6. Changes in edaphics (soils) on account of excavation and import of soils, leading to the alteration of plant communities and fossorial species in and around these points;

Potential impact 7. Changes in subsurface water resources;

Potential impact 8 Changes in water resources and surface water in terms of water quality (i.e. impact on water chemistry) as a result of construction activities; and

Potential impact 9. Exotic weed invasion.

5.2.2 Operational Phase:

The following potential impacts during the Operational Phase can be summarised:

Potential impact 9. Continued alteration of habitat structure and composition on account of continuing low level anthropogenic impacts, such as “shading of vegetation” from arrays.;

Potential impact 10. Ousting (and recruitment) of various fauna on account of long term changes in the surrounding habitat/environment;

Potential impact 11. Changes in the geomorphological state of drainage lines on account of long term climatic changes and the concomitant change in the nature of the catchment arising from the land use change;

Potential impact 12. Changes in water resources and water quality (i.e. impact on water chemistry) as a result of operational activities. Such changes will be related to the long term activities on site, but are likely to be negligible; and

Potential impact 13. Exotic weed invasion as a consequence of regular and continued disturbance of site.

5.2.3 Decommissioning Phase

Such alterations and changes will be dependent upon the expectant post-decommissioning land use. However, abandonment of the site would probably result in:

Potential impact 14. A reversion to the present seral stage, where continued grazing by livestock and herbivory by game will arise;

Potential impact 15. A reversion of present faunal population states within the study area

Potential impact 16. Changes in the geomorphological state of drainage lines as hydraulic changes arise within the catchment; and

Potential impact 17. Exotic weed invasion as a consequence of abandonment of site and cessation of weed control measures.

5.2.4 Cumulative Impacts

Notably PV4 forms one of approximately 6 photovoltaic plants that have been identified for the region . Cumulative impacts arising from the implementation of this project and other land use changes in the region are likely to exhibit the following:

Potential impact 18. Extensive alteration of habitat structure and composition over an extensive and wide area

Potential impact 19. Changes in fauna through exclusion of certain species and beneficiation of others over an extensive and wide area;

Potential impact 20. Increased change in the geomorphological state of drainage lines on account of long term and extensive change in the nature of the catchment;

Potential impact 21. The continued and cumulative loss of habitat at a landscape to regional level, with a particular impact on avi-faunal behaviour.

Potential impact 22. Changes in water resources and surface water in terms of water quality (i.e. impact on water chemistry) on account of extensive changes in the catchment; and

Potential impact 23. Exotic weed invasion as a consequence of regular and continued disturbance across an extensive area of site.

6. Impact Assessment

The above impacts can be further interrogated as per the following:

6.1. Potential Impacts during the Construction Phase

Aspect/Activity	**The ousting of fauna through anthropogenic activities, disturbance of refugia and general change in habitat**
Type of Impact (i.e. Impact Status)	Direct/indirect
Potential Impact	Habitat and species loss
Status	Negative
Mitigation Required	1. Avoidance of westerly drainage features 2. Plant rescue operations 3. Exotic weed control 4. Game sweep of site 5. The maintenance of vegetation and avoidance of the “blading” or clearance of site. 6. Consideration of the siting and layout of the temporary construction site and worker camp
Impact Significance (Pre-Mitigation)	Moderate
Impact Significance (Post-Mitigation)	Low
I&AP Concern	

Aspect/Activity	**Alteration of surface drainage patterns on account of construction activities leading to change in plant communities and general habitat structure**
Type of Impact (i.e. Impact Status)	Direct/indirect
Potential Impact	Habitat change through changes in topographic drivers
Status	Negative
Mitigation Required	1. Establishment of PV facility avoiding identified drainage features 2. Undertaking and completion of earthworks and road construction outside of the high rainfall period (if possible). 3. Avoidance of significant sculpting of land and maintenance of the general topography of the site 4. Maintenance of a high level of housekeeping on site during the construction phase. 5. Inspection of drainage features immediately outside of the footprint of the proposed PV facility and undertake removal of solid waste and litter on a regular basis
Impact Significance (Pre-Mitigation)	Low
Impact Significance (Post-Mitigation)	Very low
I&AP Concern	

Aspect/Activity	**Alteration of surface water quality that lead to change in water chemistry**
Type of Impact (i.e. Impact Status)	Direct/indirect
Potential Impact	Water volume and ecological change
Status	Negative
Mitigation Required	1. Avoidance of identified drainage features and exclusion from development footprint. 2. Alternative water resources to be utilized
Impact Significance (Pre-Mitigation)	Very Low
Impact Significance (Post-Mitigation)	Very low
I&AP Concern	

Aspect/Activity	**The introduction of water to site by import may alter the availability of water to plants within the site and may lead to changes in habitat form and structure around areas that receive such import**
Type of Impact (i.e. Impact Status)	Direct/indirect
Potential Impact	Change in plant water relations
Status	Negative
Mitigation Required	None identified
Impact Significance (Pre-Mitigation)	Very Low
Impact Significance (Post-Mitigation)	Very low
I&AP Concern	

Aspect/Activity	**Changes in edaphics (soils) on account of excavation and import of soils, leading to the alteration of plant communities and fossorial species in and around these points.**
Type of Impact (i.e. Impact Status)	Direct/indirect
Potential Impact	Habitat change and alteration in fauna and faunal behaviour
Status	Negative
Mitigation Required	Ripping of compact soils when and where extensive compaction arises
Impact Significance (Pre-Mitigation)	Low
Impact Significance (Post-Mitigation)	low
I&AP Concern	

Aspect/Activity	**Increased ELP, leading to changes in nocturnal behavioural patterns amongst fauna**
Type of Impact (i.e. Impact Status)	Direct/indirect
Potential Impact	Habitat change and alteration in fauna and faunal behaviour
Status	Negative
Mitigation Required	Reduce level of lighting and placement of lighting to be judiciously considered at time of implementation
Impact Significance (Pre-Mitigation)	Low
Impact Significance (Post-Mitigation)	low
I&AP Concern	

Aspect/Activity	**Exclusion or entrapment of in particular large fauna, on account of the fencing of the site.**
Type of Impact (i.e. Impact Status)	Direct/indirect
Potential Impact	Animal mortalities
Status	Negative
Mitigation Required	1. Ensure that the live electrical fence wire is not placed at ground level. 2. Conduct regular (daily) inspections of the fence line to address any animals that may be affected by the fence
Impact Significance (Pre-Mitigation)	Low
Impact Significance (Post-Mitigation)	low
I&AP Concern	

6.2. Potential Impacts during the Operational Phase

Aspect/Activity	**Alteration of ecological processes on account of the exclusion of certain fauna, inherent to the functional state of the land within the PV facility**
Type of Impact (i.e. Impact Status)	Direct
Potential Impact	Habitat and species loss
Status	Negative
Mitigation Required	Provision of critter paths within the fencing should be considered in the design. Promote and support faunal presence and activities within the proposed PV facility
Impact Significance (Pre-Mitigation)	Low
Impact Significance (Post-Mitigation)	Low
I&AP Concern	

Aspect/Activity	**Increased shading, as a consequence of the PV arrays, will lead to changes in plant water relations and possible changes in plant community structures within the site.**
Type of Impact (i.e. Impact Status)	Direct
Potential Impact	Habitat change and species loss
Status	Negative
Mitigation Required	None identified
Impact Significance (Pre-Mitigation)	Low
Impact Significance (Post-Mitigation)	Low
I&AP Concern	

Aspect/Activity	**Changes in meteorological factors at a local scale, on account of the PV array are likely to arise**
Type of Impact (i.e. Impact Status)	Direct
Potential Impact	Uncertainty in relation to change
Status	Negative
Mitigation Required	None identified
Impact Significance (Pre-Mitigation)	Very low
Impact Significance (Post-Mitigation)	Very low
I&AP Concern	

Aspect/Activity	Abstraction of groundwater for the cleaning of the PV panels, as well as for operational use, will alter the state of subsurface water resources
Type of Impact (i.e. Impact Status)	Direct
Potential Impact	Low level and ongoing cleaning of PV panels over time to reduce demand on aquifers.
Status	Negative
Mitigation Required	1. Preferential use of recycled water sources for operational phase requirements (instead of groundwater). 2. The prudent use of surface water resources. 3. Adopt “dry” cleaning methods, such as dusting and sweeping the site before washing down. 4. Increased monitoring of the impact of dust generation and implement a more judicious cleaning protocol.
Impact Significance (Pre-Mitigation)	Very low
Impact Significance (Post-Mitigation)	Very low
I&AP Concern	

Aspect/Activity	Overhead transmission lines, as well as subtle changes in habitat are likely to result in the alteration of avian behaviour.
Type of Impact (i.e. Impact Status)	Direct
Potential Impact	Change in animal behaviour
Status	Negative
Mitigation Required	None identified
Impact Significance (Pre-Mitigation)	Very low
Impact Significance (Post-Mitigation)	Very low
I&AP Concern	

Aspect/Activity	The fencing of the site, possibly with electric fencing, is likely to impact on faunal behaviour, leading to the exclusion of certain species and possible mortalities
Type of Impact (i.e. Impact Status)	Direct
Potential Impact	Animal mortality
Status	Negative
Mitigation Required	1. Ensure that the live electrical fence wire is not placed at ground level. 2. Conduct regular (daily) inspections of the fence line to address any animals that may be affected by electric the fence
Impact Significance (Pre-Mitigation)	Low
Impact Significance (Post-Mitigation)	Very low
I&AP Concern	

Aspect/Activity	**Alteration of ecological processes on account of the exclusion of certain fauna, inherent to the functional state of the land within the PV facility**
Type of Impact (i.e. Impact Status)	Indirect
Potential Impact	**Habitat and species loss**
Status	Negative
Mitigation Required	1. Provision of critter paths within the fencing should be considered in the design. 2. Promote and support faunal presence and activities within the proposed PV facility
Impact Significance (Pre-Mitigation)	Moderate
Impact Significance (Post-Mitigation)	low
I&AP Concern	

Aspect/Activity	Increased shading, as a consequence of the PV arrays, will lead to changes in plant water relations and possible changes in plant community structures within the site.
Type of Impact (i.e. Impact Status)	Indirect
Potential Impact	Habitat change and species loss
Status	Negative
Mitigation Required	None identified
Impact Significance (Pre-Mitigation)	Very low
Impact Significance (Post-Mitigation)	Very low
I&AP Concern	

Aspect/Activity	Abstraction of groundwater for the cleaning of the PV panels, as well as for operational use, will alter the state of subsurface water resources
Type of Impact (i.e. Impact Status)	Indirect
Potential Impact	Water quality change and general pollution of resource
Status	Negative
Mitigation Required	1. Preferential use of recycled water sources for operational phase requirements (instead of groundwater). 2. The prudent use of surface water resources. 3. Adopt "dry" cleaning methods, such as dusting and sweeping of the site before washing down. 4. Increased monitoring of the impact of dust generation and implement a more judicious cleaning protocol. 5. Low level and ongoing cleaning of the PV panels over time to reduce demand on aquifers
Impact Significance (Pre-Mitigation)	Moderate
Impact Significance (Post-Mitigation)	low
I&AP Concern	

6.3. Potential Impacts during the Decommissioning Phase

Aspect/Activity	A reversion to the present seral stage, where continued grazing by livestock and herbivory by game will arise;
Type of Impact (i.e. Impact Status)	Direct
Potential Impact	Habitat and species change
Status	Neutral
Mitigation Required	None
Impact Significance (Pre-Mitigation)	Low
Impact Significance (Post-Mitigation)	Not applicable
I&AP Concern	

Aspect/Activity	A reversion of present faunal population states within the study area;
Type of Impact (i.e. Impact Status)	Direct
Potential Impact	Habitat and species population change
Status	Neutral
Mitigation Required	None
Impact Significance (Pre-Mitigation)	Low
Impact Significance (Post-Mitigation)	Not applicable
I&AP Concern	

Aspect/Activity	Changes in the geomorphological state of drainage lines as hydraulic changes arise within the catchment;
Type of Impact (i.e. Impact Status)	Direct
Potential Impact	Surface hydrology change
Status	Neutral
Mitigation Required	None
Impact Significance (Pre-Mitigation)	Low
Impact Significance (Post-Mitigation)	Not applicable
I&AP Concern	

Aspect/Activity	**Exotic weed invasion as a consequence of abandonment of site and cessation of weed control measures**
Type of Impact (i.e. Impact Status)	Direct
Potential Impact	Habitat change
Status	Negative
Mitigation Required	Weed control and land management
Impact Significance (Pre-Mitigation)	Medium
Impact Significance (Post-Mitigation)	Low
I&AP Concern	

6.4. Cumulative Impacts

Aspect/Activity	**The ousting of fauna through anthropogenic activities, disturbance of refugia and general change in habitat**
Type of Impact (i.e. Impact Status)	Cumulative – construction phase
Potential Impact	Habitat and species loss
Status	Negative
Mitigation Required	1. Detailed design and integration of habitat and features across all PV facilities within land complex 2. Plant rescue operations 3. Exotic weed control 4. Game sweep of site 5. The maintenance of vegetation and avoidance of the "blading" or clearance. 6. Consideration of the siting and layout of the temporary construction site and worker camp.
Impact Significance (Pre-Mitigation)	Moderate
Impact Significance (Post-Mitigation)	Low
I&AP Concern	

Aspect/Activity	**Alteration of surface drainage patterns on account of construction activities leading to change in plant communities and general habitat structure**
Type of Impact (i.e. Impact Status)	Cumulative – construction phase
Potential Impact	Change in drainage patterns and drainage features Negative
Status	Negative
Mitigation Required	1. Exclusion of major drainage lines from development and integration across all PV facilities 2. Avoid sculpting of land 3. Surface flow energy dissipaters 4. Maintenance of a high level of housekeeping on site during the construction phase. 5. Inspection of drainage features immediately outside of the footprint of the proposed PV facility and removal of litter and solid waste on a regular basis
Impact Significance (Pre-Mitigation)	Moderate
Impact Significance (Post-Mitigation)	Low
I&AP Concern	

Aspect/Activity	**Alteration of surface water quality that leads to change in water chemistry**
Type of Impact (i.e. Impact Status)	Cumulative – Construction phase
Potential Impact	Changes in drainage patterns and water quality
Status	Negative
Mitigation Required	1. Integration of drainage features that traverse spatially contiguous PV parks. 2. Avoidance of significance sculpting of land and maintenance of the general topography of the site including the avoidance of major drainage lines. 3. Placement of energy dissipaters (such as stone levees or similar) within minor drainage lines to reduce velocity of flow through such features 4. Apply sound site management and solid waste management outside of site (within the immediate vicinity)
Impact Significance (Pre-Mitigation)	Low
Impact Significance (Post-Mitigation)	Low
I&AP Concern	

Aspect/Activity	Changes in sub surface water resources may arise
Type of Impact (i.e. Impact Status)	Cumulative – Construction phase
Potential Impact	Effects upon groundwater resources
Status	Negative
Mitigation Required	1. Identify off site water resources 2. Use of recycled water 3. Identify or consider alternative cleaning methods for the PV panels
Impact Significance (Pre-Mitigation)	Moderate
Impact Significance (Post-Mitigation)	Low
I&AP Concern	

Aspect/Activity	Changes in edaphics on account of excavation and import of soils, leading to the alteration of plant communities and fossorial species
Type of Impact (i.e. Impact Status)	Cumulative – Construction phase
Potential Impact	Habitat change and transformation
Status	Negative
Mitigation Required	None identified
Impact Significance (Pre-Mitigation)	Moderate
Impact Significance (Post-Mitigation)	Low
I&AP Concern	

Aspect/Activity	Increased ELP
Type of Impact (i.e. Impact Status)	Cumulative – construction phase
Potential Impact	Habitat alteration
Status	Negative
Mitigation Required	Suitable placement of lighting within sites avoiding 'sensitive' areas Limitation on lumens
Impact Significance (Pre-Mitigation)	Low
Impact Significance (Post-Mitigation)	Very low
I&AP Concern	

Aspect/Activity	Exclusion or entrapment of in particular large fauna, on account of the fencing of the site
Type of Impact (i.e. Impact Status)	Cumulative – Construction phase
Potential Impact	Faunal behavioral change
Status	Negative
Mitigation Required	1. Flushing of game from sites 2. Fence porosity and integration across all sites in complex
Impact Significance (Pre-Mitigation)	Low
Impact Significance (Post-Mitigation)	Very low
I&AP Concern	

Aspect/Activity	General operations and activities associated with the construction of a PV Park.
Type of Impact (i.e. Impact Status)	Cumulative – Construction phase
Potential Impact	Animal mortality
Status	Negative
Mitigation Required	1. Placement of live wires 2. Monitoring of fence line
Impact Significance (Pre-Mitigation)	Very low
Impact Significance (Post-Mitigation)	Very low
I&AP Concern	

Aspect/Activity	**Alteration of ecological processes on account of the exclusion of certain fauna, inherent to the functional state of the land within the proposed PV facility**
Type of Impact (i.e. Impact Status)	Cumulative – Operational phase
Potential Impact	Habitat and species loss
Status	Negative
Mitigation Required	1. Provision of critter paths within the fencing should be considered in the design. 2. Promote and support faunal presence and activities within the proposed PV facility
Impact Significance (Pre-Mitigation)	Moderate
Impact Significance (Post-Mitigation)	Low
I&AP Concern	

Aspect/Activity	**Increased shading, as a consequence of the PV arrays, will lead to changes in plant water relations and possible changes in plant community structures within the site.**
Type of Impact (i.e. Impact Status)	Cumulative – Operational phase
Potential Impact	Exposed soil susceptible to erosion
Status	Negative
Mitigation Required	None identified
Impact Significance (Pre-Mitigation)	Low
Impact Significance (Post-Mitigation)	Not applicable
I&AP Concern	

Aspect/Activity	**Abstraction of groundwater for the cleaning of the PV panels, as well as for operational use, will alter the state of subsurface water resources.**
Type of Impact (i.e. Impact Status)	Cumulative – Operational phase
Potential Impact	Changes in water resource quantity and perhaps quality
Status	Negative
Mitigation Required	1. Preferential use of recycled water for operational phase requirements (instead of groundwater) may be utilized if Municipal supply is inadequate.. 2. The prudent use of surface water resources. 3. Adopt “dry” cleaning methods, such as dusting and sweeping of the site before wash down. 4. Increased monitoring of the impact of dust generation and implement a more judicious cleaning protocol. 5. Low level and ongoing cleaning of the PV panels over time to reduce demand on aquifers.
Impact Significance (Pre-Mitigation)	High
Impact Significance (Post-Mitigation)	Moderate
I&AP Concern	

Aspect/Activity	**Overhead transmission lines, as well as subtle changes in habitat are likely to result in the alteration of avian behavior**
Type of Impact (i.e. Impact Status)	Cumulative – Operational phase
Potential Impact	Changes in faunal behavior
Status	Negative
Mitigation Required	None identified
Impact Significance (Pre-Mitigation)	Very low
Impact Significance (Post-Mitigation)	None identified
I&AP Concern	

Aspect/Activity	**As a large area of land will be affected by multiple PV facilities, it is evident that any mortalities and injury associated with electrocution from fencing may be compounded**
Type of Impact (i.e. Impact Status)	Cumulative – Operational phase
Potential Impact	Cumulative change in faunal populations
Status	Negative
Mitigation Required	Management of potential sources of electrocution – electric fences
Impact Significance (Pre-Mitigation)	Low
Impact Significance (Post-Mitigation)	Very low
I&AP Concern	

7. Impact Assessment Tables

The above impacts can be summarised further in order to determine the overall level of impact association with the construction, operations and decommissioning of the site as well as the cumulative impacts associated with this and other developments in the region.

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Construction Phase													
Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk: Without Mitigation/ Management	Significance of Impact and Risk: With Mitigation/ Management (Residual Impact/ Risk)	Ranking of Residual Impact/ Risk	Confidence Level
The ousting of fauna through anthropogenic activities, disturbance of refugia and general change in habitat	Habitat and species loss	Negative	Site	Long-Term	Substantial	Very likely	Low	Low	Detailed design and incorporation of habitat and features Plant rescue operations Exotic weed control Game sweep of site The maintenance of vegetation and avoidance of the "blading" or clearance. Consideration of the siting and layout of the temporary construction site and worker camp	Moderate	Low	4	High

Alteration of surface drainage patterns on account of construction activities leading to change in plant communities and general habitat structure	Habitat change through changes in topographic drivers	Negative	Site	Medium-Term	Moderate	Likely	High	Low	Avoidance of major drainage features during construction Undertaking and completion of earthworks and road construction outside of the high rainfall period (if possible). Avoidance of significant sculpting of land and maintenance of the general topography of the site Maintenance of a high level of housekeeping on site during the construction phase. Inspection of drainage features immediately outside of the footprint of the proposed PV facility and undertake removal of solid waste and litter on a regular basis.	Low	Very low	5	High

Construction Phase													
Aspect/ Impact Pathway	**Nature of Potential Impact/ Risk**	**Status**	**Spatial Extent**	**Duration**	**Consequence**	**Probability**	**Reversibility of Impact**	**Irreplaceability**	**Potential Mitigation Measures**	**Significance of Impact and Risk**		**Ranking of Residual Impact/ Risk**	**Confidence Level**
										Without Mitigation/ Management	**With Mitigation/ Management (Residual Impact/ Risk)**		
Abstraction from subsurface aquifers may have a significant impact on plant water relations.	Water volume and ecological change	Negative	Local	Long term	Moderate	Likely	High	Low	Alternative water resources to be utilized	Very low	Very Low	5	Medium
The introduction of water to site by import may alter the availability of water to plants within the site and may lead to changes in habitat form and structure around areas that receive such import.	Change in plant water relations	indeterminate	Local	Long term	Slight	Likely	High	Low	None identified	Very Low	Very Low	5	High

Construction Phase													
Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk		Ranking of Residual Impact/ Risk	Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)		
Alteration of surface water quality that lead to change in water chemistry	Water quality change and general pollution of resource	Negative	Local	Short term	Slight	Likely	High	Low	Avoidance of significant sculpting of land and maintenance of the general topography of site. Placement of energy dissipaters within minor drainage lines to reduce velocity of flow through such features.	Very low	Very low	5	Medium

Construction Phase													
Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk		Ranking of Residual Impact/ Risk	Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)		
Changes in edaphics (soils) on account of excavation and import of soils, leading to the alteration of plant communities and fossorial species in and around these points.	Habitat change and alteration in fauna and faunal behaviour	Negative	Site	Long term	Moderate	Likely	High	Low	Ripping of compact soils when and where extensive compaction arises	Low	Low	4	Medium
Increased ELP, leading to changes in nocturnal behavioural patterns amongst fauna	Changes in faunal behaviour	Negative	Local	Long term	Moderate	Very likely	High	Low	Reduce level of lighting and placement of lighting to be judiciously considered at time of implementation .	Low	Very low	5	High

Construction Phase													
Aspect/ Impact Pathway	**Nature of Potential Impact/ Risk**	**Status**	**Spatial Extent**	**Duration**	**Consequence**	**Probability**	**Reversibility of Impact**	**Irreplaceability**	**Potential Mitigation Measures**	**Significance of Impact and Risk**		**Ranking of Residual Impact/ Risk**	**Confidence Level**
										Without Mitigation/ Management	**With Mitigation/ Management (Residual Impact/ Risk)**		
Exclusion or entrapment of in particular large fauna, on account of the fencing of the site.	Animal mortalities	Negative	Site	Long term	Slight	Very likely	High	Low	Ensure that the live electrical fence wire is not placed at ground level. Conduct regular (daily) inspections of the fence line to address any animals that may be affected by the fence	Very low	Very low	5	High

Table 1-2 Indirect impact assessment summary table for the Construction Phase

Construction Phase													
Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk		Ranking of Residual Impact/ Risk	Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)		

The ousting of fauna through anthropogenic activities, disturbance of refugia and general change in habitat	Habitat and species loss	Negative	Local	Long-Term	Substantial	Likely	Moderate	Low	Detailed design and incorporation of habitat and features Plant rescue operations Exotic weed control Game sweep of site The maintenance of vegetation and avoidance of "blading" or clearance. Consideration of the siting and layout of the temporary construction site and worker camp.	Moderate	Low	4	High
Alteration of surface drainage patterns on account of construction activities leading to change in plant communities and general habitat structure	Habitat change through changes in topographic drivers	Negative	Local	Short term	Moderate	Likely	High	Low	Undertaking and completion of earthworks and road construction outside of the high rainfall period (if possible). Avoidance of significance sculpting of land and maintenance of the general	Low	Very low	5	High

Construction Phase													
Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk		Ranking of Residual Impact/ Risk	Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)		
									topography of the site. Placement of energy dissipaters (such as stone levees or similar) within minor drainage lines to reduce velocity of flow through such features. Maintenance of a high level of housekeeping on site during the construction phase. Inspection of drainage features immediately outside of the footprint of				

Construction Phase													
Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk: Without Mitigation/ Management	Significance of Impact and Risk: With Mitigation/ Management (Residual Impact/ Risk)	Ranking of Residual Impact/ Risk	Confidence Level
									the proposed PV facility and undertake removal of solid waste and litter on a regular basis.				

Alteration of surface water quality that lead to change in water chemistry	Water quality change and general pollution of resource	Negative	Local	Short term	Slight	Likely	High	Low	Exclusion of major drainage lines from the development footprint. Avoidance of significant sculpting of land and maintenance of the general topography of site. Placement of energy dissipaters within minor drainage lines to reduce velocity of flow through such features. Maintenance of a high level of housekeeping on site during the construction phase. Inspection of drainage features immediately outside of the footprint of the proposed PV facility and removal of litter and solid waste on a regular basis.	Very low	Very low	5	Medium

Construction Phase													
Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk		Ranking of Residual Impact/ Risk	Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)		
Changes in edaphics (soils) on account of excavation and import of soils, leading to the alteration of plant communities and fossorial species in and around these points.	Habitat change and alteration in fauna and faunal behaviour	Negative	Local	Long term	Slight	Likely	High	Low	Ripping of compact soils when and where extensive compaction arises	Very low	Very low	5	Medium

Construction Phase													
Aspect/ Impact Pathway	**Nature of Potential Impact/ Risk**	**Status**	**Spatial Extent**	**Duration**	**Consequence**	**Probability**	**Reversibility of Impact**	**Irreplaceability**	**Potential Mitigation Measures**	**Significance of Impact and Risk**		**Ranking of Residual Impact/ Risk**	**Confidence Level**
										Without Mitigation/ Management	**With Mitigation/ Management (Residual Impact/ Risk)**		
Increased ELP, leading to changes in nocturnal behavioural patterns amongst fauna	Changes in faunal behaviour	Negative	Local	Long term	Slight	Likely	High	Low	Provision of critter paths within fencing should be considered in the design. Promote and support faunal presence and activities within the proposed PV facility, where applicable.	Very low	Very low	5	High

Construction Phase													
Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk		Ranking of Residual Impact/ Risk	Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)		
Exclusion or entrapment of in particular large fauna, on account of the fencing of the site.	Animal mortalities	Negative	Local	Long term	Slight	Likely	High	Low	Ensure that live electrical fence wire is not placed at ground level. Conduct regular (daily) inspections of the fence line to address any animals that may be affected by the fence	Very low	Very low	5	High

Table 1-3 Direct Impact assessment summary table for the Operational Phase

Operational Phase														
Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk		Ranking of Residual Impact/ Risk	Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)		
Alteration of ecological processes on account of the exclusion of certain fauna, inherent to the functional state of the land within the PV facility	Habitat and species loss	Negative	Site	Long-Term	Moderate	Very likely	High	Low	Provision of critter paths within the fencing should be considered in the design. Promote and support faunal presence and activities within the proposed PV facility	Low	Low	4	High
Increased shading, as a consequence of the PV arrays, will lead to changes in plant water relations and possible changes in plant community structures within the site.	Habitat change and species loss	Neutral?	Site	Long-Term	Slight	Likely	High	Low	None identified	Very low	Not Applicable	5	High

Operational Phase													
Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk		Ranking of Residual Impact/ Risk	Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)		
Changes in meteorological factors at a local scale, on account of the PV array are likely to arise	Uncertainty in relation to change	Neutral	Site	Long-Term	Slight	Likely	High	Low	None identified	Very Low	Not Applicable	5	High

Abstraction of groundwater for the cleaning of the PV panels, as well as for operational use, will alter the state of subsurface water resources	Water quantity changes with possible impact on habitat	Negative	Local	Very short term	Substantial	Likely	Moderate	Moderate	Preferential use of recycled water sources for operational phase requirements (instead of groundwater). The prudent use of surface water resources. Adopt “dry” cleaning methods, such as dusting and sweeping the site before washing down. Increased monitoring of the impact of dust generation and implement a more judicious cleaning protocol. Low level and ongoing cleaning of PV panels over time to reduce demand on aquifers.	Moderate	Low	4	High

Operational Phase													
Aspect/ Impact Pathway	**Nature of Potential Impact/ Risk**	**Status**	**Spatial Extent**	**Duration**	**Consequence**	**Probability**	**Reversibility of Impact**	**Irreplaceability**	**Potential Mitigation Measures**	**Significance of Impact and Risk**		**Ranking of Residual Impact/ Risk**	**Confidence Level**
										Without Mitigation/ Management	**With Mitigation/ Management (Residual Impact/ Risk)**		
The fencing of the site, possibly with electric fencing, is likely to impact on faunal behaviour, leading to the exclusion of certain species and possible mortalities	Animal mortality	Negative	Site	Long term	Moderate	Likely	High	Low	Ensure that the live electrical fence wire is not placed at ground level. Conduct regular (daily) inspections of the fence line to address any animals that may be affected by electric fence.	Low	Very low	5	High

Table 1-4 Indirect Impacts for the Operational Phase

Operational Phase													
Aspect/ Impact Pathway	*Nature of Potential Impact/ Risk*	**Status**	**Spatial Extent**	**Duration**	**Consequence**	**Probability**	**Reversibility of Impact**	**Irreplaceability**	*Potential Mitigation Measures*	*Significance of Impact and Risk*		*Ranking of Residual Impact/ Risk*	*Confidence Level*
										Without Mitigation/ Management	*With Mitigation/ Management (Residual Impact/ Risk)*		
Alteration of ecological processes on account of the exclusion of certain fauna, inherent to the functional state of the land within the PV facility	Habitat and species loss	Negative	Site	Long-Term	Substantial	Very likely	Low	Low	Provision of critter paths within the fencing should be considered in the design. Promote and support faunal presence and activities within the proposed PV facility	*Moderate*	*Low*	*4*	*High*

Increased shading, as a consequence of the PV arrays, will lead to changes in plant water relations and possible changes in plant community structures within the site.	Habitat change and species loss	Negative	Local	Short term	Slight	Likely	High	Low	**None identified**	***Very low***	***Not Applicable***	***5***	***High***

Abstraction of groundwater for the cleaning of the PV panels, as well as for operational use, will alter the state of subsurface water resources	***Water quality change and general pollution of resource***	Negative	Local	Short term	Substantial	Likely	Moderate	Moderate	**Preferential use of recycled water sources for operational phase requirements (instead of groundwater).** **The prudent use of surface water resources.** **Adopt "dry" cleaning methods, such as dusting and sweeping of the site before washing down.** **Increased monitoring of the impact of dust generation and implement a more judicious cleaning protocol.** **Low level and ongoing cleaning of the PV panels over time to reduce demand on aquifers.**	***Moderate***	***Low***	***4***	***High***

Table 1-5 Cumulative Impact assessment summary table for the Construction Phase

Construction Phase													
Aspect/ Impact Pathway	**Nature of Potential Impact/ Risk**	**Status**	**Spatial Extent**	**Duration**	**Consequence**	**Probability**	**Reversibility of Impact**	**Irreplaceability**	**Potential Mitigation Measures**	**Significance of Impact and Risk**		**Ranking of Residual Impact/ Risk**	**Confidence Level**
										Without Mitigation/ Management	**With Mitigation/ Management (Residual Impact/ Risk)**		

The ousting of fauna through anthropogenic activities, disturbance of refugia and general change in habitat	Habitat and species loss	Negative	Local to Regional	Long-Term	Substantial	Very likely	Moderate	Low	Detailed design and incorporation of habitat and features Plant rescue operations Exotic weed control Game sweep of site The maintenance of vegetation and avoidance of the “blading” or clearance. Consideration of the siting and layout of the temporary construction site and worker camp.	Moderate	Low	4	High
	Changes in drainage patterns and water quality	Negative	Regional	Long term	Moderate	Likely	Moderate	Moderate	1.Avoid construction during the rainy season (if possible and practical). 2.Avoidance of significance sculpting of land and maintenance of the general	Low	Low	4	Medium

Alteration of surface water quality that leads to change in water chemistry									topography of the site including the avoidance of major drainage lines. 3.Placement of energy dissipaters (such as stone levees or similar) within minor drainage lines to reduce velocity of flow through such features 4.Apply good site management and solid waste management outside of site (within the immediate vicinity)				
Changes in sub surface water resources may arise	Effects upon groundwater resources	Negative	Regional	Long term	Substantial	Likely	Moderate	Moderate	Identify off site water resources Use of recycled water Identify or consider	Moderate	Low	4	Medium

Construction Phase													
Aspect/ Impact Pathway	**Nature of Potential Impact/ Risk**	**Status**	**Spatial Extent**	**Duration**	**Consequence**	**Probability**	**Reversibility of Impact**	**Irreplaceability**	**Potential Mitigation Measures**	**Significance of Impact and Risk**		**Ranking of Residual Impact/ Risk**	**Confidence Level**
										Without Mitigation/ Management	**With Mitigation/ Management (Residual Impact/ Risk)**		
									alternative cleaning methods for the PV panels				
Changes in edaphics on account of excavation and import of soils, leading to the alteration of plant communities and fossorial species	Habitat alteration	Negative	Regional	Long term	Moderate	Likely	High	Low	Ripping of compact soils when and where extensive compaction arises	Low	Very low	5	Medium
Increased ELP	Faunal behavioural change	Negative	Regional	Long term	Slight	Likely	High	Low	Review the placement of lighting on the site.	Very low	Very low	5	Medium

Construction Phase													
Aspect/ Impact Pathway	**Nature of Potential Impact/ Risk**	**Status**	**Spatial Extent**	**Duration**	**Consequence**	**Probability**	**Reversibility of Impact**	**Irreplaceability**	**Potential Mitigation Measures**	**Significance of Impact and Risk**		**Ranking of Residual Impact/ Risk**	**Confidence Level**
										Without Mitigation/ Management	**With Mitigation/ Management (Residual Impact/ Risk)**		
Exclusion or entrapment of in particular large fauna, on account of the fencing of the site	Animal mortality	Negative	Regional	Long term	Slight	Likely	High	Low	Placement of live wires Monitoring of fence line	Very low	Very low	5	Medium

Table 1-6 Cumulative Impact assessment summary table for the Operational Phase

Operational Phase													
Aspect/ Impact Pathway	**Nature of Potential Impact/ Risk**	**Status**	**Spatial Extent**	**Duration**	**Consequence**	**Probability**	**Reversibility of Impact**	**Irreplaceability**	**Potential Mitigation Measures**	**Significance of Impact and Risk**		**Ranking of Residual Impact/ Risk**	**Confidence Level**
										Without Mitigation/ Management	**With Mitigation/ Management (Residual Impact/ Risk)**		
Alteration of ecological processes on account of the exclusion of certain fauna, inherent to the functional state of the land within the proposed PV facility	Habitat and species loss	Negative	Regional	Long-Term	Substantial	Very likely	Low	Low	Provision of critter paths within the fencing should be considered in the design. Promote and support faunal presence and activities within the proposed PV facility	Moderate	Low	4	High
Increased shading, as a consequence of the PV arrays, will lead to changes in plant water relations and possible changes in plant community structures within the site.	Exposed soil susceptible to erosion	Negative	Site	Medium-Term	Moderate	Likely	High	Low	None identified	Low	Not Applicable	4	High

Abstraction of groundwater for the cleaning of the PV panels, as well as for operational use, will alter the state of subsurface water resources.	Changes in water resource quantity and perhaps quality	Negative	Regional	Long term	Severe	Likely	Moderate	Low	Preferential use of recycled water for operational phase requirements (instead of groundwater). The prudent use of surface water resources. Adopt "dry" cleaning methods, such as dusting and sweeping of the site before wash down. Increased monitoring of the impact of dust generation and implement a more judicious cleaning protocol. Low level and ongoing cleaning of the PV panels over time to reduce demand on aquifers.	High	Moderate	3	Medium
Overhead transmission lines, as well as subtle changes in habitat are likely to result in the alteration of avian behaviour	Changes in faunal behaviour	Negative	Site	Long term	Slight	Likely	High	Low	None identified	Very low	Not Applicable	5	High

Operational Phase													
Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk		Ranking of Residual Impact/ Risk	Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)		
As a large area of land will be affected by multiple PV facilities, it is evident that any mortalities and injury associated with electrocution from fencing may be compounded	Cumulative change in faunal populations	Negative	Regional	Long term	Slight	Likely	High	Low	Management of potential sources of electrocution – electric fences	Low	Very low	5	High

Table 1-7Decommissioning Phase Impact assessment summary table

Decommissioning Phase													
Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk		Ranking of Residual Impact/ Risk	Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)		
A reversion to the present seral stage, where continued grazing by livestock and herbivory by game will arise;	Habitat and species change	Neutral	Site	Long-Term	Moderate	Very likely	Low	Low	None identified	Low	Not Applicable	4	Medium
A reversion of present faunal population states within the study area; .	Habitat and species population change	Neutral	Site	Long term	Moderate	Likely	High	Low	None identified	Low	Not Applicable	4	Medium

Decommissioning Phase													
Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk		Ranking of Residual Impact/ Risk	Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)		
Changes in the geomorphological state of drainage lines as hydraulic changes arise within the catchment;	Surface hydrology change	Neutral	Local	Long term	Moderate	Very likely	High	Low	None identified	Low	Not Applicable	4	Moderate
Exotic weed invasion as a consequence of abandonment of site and cessation of weed control measures	Habitat change	Negative	Local - Regional	Long term	Moderate	Very likely	High	Low	Weed control and land management	Moderate	Low	4	High

7.1. Impact Assessment Summary

Given the above impacts and mitigation measures, the overall impact significance of the project can be determined. Table 4 presents this determination.

Table 4: Overall Impact Significance (Post Mitigation)

Phase	**Overall Impact Significance**
Construction	Low
Operational	Very low
Decommissioning	Low
Nature of Impact	**Overall Impact Significance**
Cumulative - Construction	Low
Cumulative - Operational	Low
Cumulative - Decommissioning	Low

8. Legislative and Permit Requirements

The proposed establishment of a PV facility within the study site is considered to elicit a requirement for compliance with the following legislation.

1. The National Environmental Management : Biodiversity Act (Act 10 of 2004)
2. The National Water Act (Act 36 of 1998)
3. The National Forest Act (Act 84 of 1998)
4. The Northern Cape Nature Conservation Act (Act 9 of 2009)
5. The Conservation of Agricultural Resources Act (Act 43 of 1983)

The potential applicability of the abovementioned acts to the subject site is provided below:

1. The National Environmental Management: Biodiversity Act (Act 10 of 2004)

This Act serves to control the disturbance and land utilisation within certain habitats, as well as the planting and control of certain exotic species. The proposed development, taking place in the identified Bushmanland Arid Grassland environment, may not necessitate any particular application for a change in land use from an ecological perspective, however the effective disturbance and removal of species identified in Tables 2 and 3, as well as possible other species (i.e. TOPS species), will require specific permission from the applicable authorities.

In addition, the planting and management of exotic plant species on site, if and where required, will be governed by the Alien and Invasive Species (AIS) regulations, which were gazetted in 2014. These regulations compel landowners to manage exotic weeds on land under their jurisdiction and control.

2. The National Water Act (Act 36 of 1998).

The National Water Act controls activities in and around water resources, as well as the general management of water resources, including abstraction of groundwater and disposal of water. Authorisation for changes in land use, up to 500 m from a defined water resource / wetland system will require at the minimum the compilation of a risk assessment and depending upon outcome, an application for use under a General Authorisation or a Water Use Licence from the Department of Water and Sanitation. The proposed development does not intrude into *de facto* wetland or riparian areas and therefore it is submitted that a Water Use Licence will not be required.

3. The National Forest Act (Act 84 of 1998)

The National Forest Act (Act 84 of 1998) governs the removal, disturbance, cutting or damage and destruction of identified “protected trees”. Listed species that may be encountered with the site include *Boscia spp* and possibly *Acacia erioloba*.

It is unlikely that an application for the “clearing of a natural forest”, as defined within the Act, will be required on the site in question. Consideration of whether to retain, cut or disturb listed species that are encountered will determine the necessity for a license in terms of S 7 of the Act.

4. The Northern Cape Conservation Act.

The Northern Cape Conservation Act under its pertinent regulation, governs the disturbance of species listed in Tables 2 and 3 above, or possibly other species not yet identified on site. A permit from the Provincial Department of Environment and Nature Conservation will be required in order to disturb or translocate such species.

5. The Conservation of Agricultural Resources Act

Invasive plant species that should be removed or maintained only under certain commercial situations are identified in terms of the Conservation of Agricultural Resources Act (CARA). This Act will be applicable to the project if and where such plants arise within or adjacent to the project area. Notably most listed alien invasive species are propagated and driven by the disturbance of land during and following construction.

As the proposed site is not within protected areas, nor within 5 kilometres of a protected area, are not within 10 kilometres of a World Heritage site and do not form part of a critical biodiversity area (CBA), the various regulations within the National Environmental Management Act and the NEM Protected Areas Act are not applicable to this site. It is also noted that the site does not fall within any expansion area in terms of a conservation strategy for the Northern Cape.

9. Environmental Management Programme Inputs

Utilising the above information the following broad issues are considered within the Environmental Management Programme that would be associated with the proposed development.

Pre-Construction Phase:

- Pre-construction evaluation and possible plant rescue operations;
- Identification of intrusion of the proposed construction site and development footprint, into minor drainage lines (if any);
- Identification of laydown areas, roadways etc. on site and evaluation of affected points within site, particularly in respect of floral and faunal presence; and
- Permitting requirements in terms of the National Water Act and Northern Cape Conservation Act.

Construction Phase:

- Site induction and interaction within management on ecological aspects;
- Site inspection of any fauna within the construction area during post fencing completion;
- Monitoring of operations, including species presence within site, mortalities and sitings;
- Maintenance of vegetation and avoidance of unnecessary clearance of site;

- Exotic weed management; and
- Erosion control measures to be implemented where applicable.

Post Construction Phase:

- Monitoring of faunal activities within the fenced area of the site and immediate proximity of site;
- Management of faunal intrusion through the fencing, including possible mortalities;
- Consideration of lighting regime around the site and the impact of ELP.
- Vegetation management on site – consideration of redress methods of growth and habitat form around site;
- Exotic weed management; and
- Erosion control measures.

10. Conclusion and Recommendations

An ecological evaluation of the proposed PV5 Kenhardt site was undertaken during a period of intense drought and during the early summer of 2019. The evaluation included the identification of drainage systems and their biophysical state, topographic features and a holistic review of all components within the ecological landscape. Included in the assessment was consideration of fauna (excluding avi-fauna). The primary impacts identified as a consequence of the development proceeding relate to, inter alia;

- Changes in the broader habitat as a consequence of variation in physical factors within the site (e.g. shading of vegetation, changes in surface water flow regime);
- Changes in the broader surface and possibly sub surface hydrology; and
- The ousting, and in some cases recruitment of species, with subsequent variation in populations in and around the development.

The ecological evaluation has determined that there are limited habitats of ecological significance or value on the site in question and that in general, the prevailing topography and landscape form will be broadly preserved, should the land revert to a photo voltaic facility. However, given the eco-morphological and hydrological indicators on site, it was determined that the development area of PV 5 should exclude portions of the upper extent of two drainage features that serve the Wolfkopseloop river, located to the north of the site. As such the development footprint proposed would generally align with that presented in Figure 14, above. In addition, it is stated that ecological components associated with the site will be retained in a broader perspective, with only subtle changes to the eco-geomorphology of the minor drainage systems that lie within the proposed project area becoming evident. There will however also be minor to moderate changes evident in the terrestrial environment resulting from the development, which in turn will be manifest in changes in faunal components of the environment.

None of the above impacts have been identified as being of high significance (with the implementation of mitigation measures), most impacts arising can be considered to be of low to very low significance in a holistic evaluation. Notably however, is the fact that this project forms one of six relatively contiguous photovoltaic facilities that cover a combined area of more than 2000ha. As such cumulative impacts are likely to become more evident within each site, as the broader ecology changes in response to these developments and ecologically important habitats become more isolated. The corollary of this state is that impacts arising from the individual PV facilities will become concentrated and sequestered to a singular land unit within the region, thereby avoiding a state where these facilities are spatially scattered across the greater landscape.

Given the above, it is evident that the proposed solar Kenhardt PV 5 facility within the boundaries of the study area, cannot be precluded from the portion of the Farm Onder Rugseer.

Should the development application be approved, judicious management of the site would include:

- Placement of the bulk of the facility's development footprint within or closely aligned to the recommended footprint
- The incorporation of minor drainage features into the PV facility through suitable arrangement of modules and recognition of the drainage line during the detailed planning phase.
- Avoidance of excessive clearance of vegetation within the site;
- Maintenance of the 300m buffer between the western perimeter of the facility and the identified quartz kopjies.
- Management of exotic weed invasion that may arise during construction and operation phases;
- Management of fauna within the site and surrounds, as well as the incorporation of "wildlife" porosity into fence lines and the implementation of measures on the energised fence line to avoid mortalities to wildlife; and
- General land management practices to avoid excessive erosion, dust emissions and possible sources of pollution to ground and surface water resources.

The above, along with the various mitigation measures espoused in this report should be incorporated as conditions, into any authorisation granted by the relevant authority.

11. Final Specialist Statement and Authorisation Recommendation

It is our opinion that with the implementation of the above, the proposed PV5 Kenhardt Solar Facility which entails the establishment of some 245ha of modules and support infrastructure on the site in question, is a suitable land use for the area and as such should be sanctioned by the relevant authority.

Little ecological impact is likely to arise from the proposed development should the recommended development footprint be employed, however the implementation of certain mitigation measures, as contained in the EMPr and presented above, (including floral and faunal management) should also be incorporated into the approval of the application.

11.1. EA Condition Recommendations

Some conditions that should be included in the environmental authorisation from an ecological perspective are:

1. The proposed development is set back from the major channels associated with the Wolfkopseloop drainage system.

2. The applicant should undertake the relocation or maintenance of identified specimens of *Aloe dichotoma*, where encountered. This may also apply to *Boscia albitrunca* and other such species.

3. The applicant must engage in the management of exotic vegetation where this is found to arise on site.

4. The applicant should, during the construction and operations of the project assume responsibility for the management of fauna within the site and surrounds, as well as the incorporation of "wildlife" porosity into fence lines and the implementation of measures on the energised fence line to avoid mortalities to wildlife.

5. General land management practices to avoid excessive erosion, dust emissions and possible sources of pollution to ground and surface water resources should be set in place.

12. References

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IUCN Red List www.iucnredlist.org.

Visual Impact Assessment: Kenhardt PV5

Basic Assessments for the proposed construction of a Solar Photovoltaic (PV) Facility (Kenhardt PV5) and associated electrical infrastructure, near Kenhardt, in the Northern Cape.

Report prepared for:	*Report prepared by:*
CSIR – Environmental Management Services	Quinton Lawson and Bernard Oberholzer
PO Box 320 Stellenbosch 7599 South Africa	PO box 471 Stanford 7210 South Africa

November 2019

Specialist Expertise

Quinton Lawson Architect (qarc)

Qualifications:
Bachelor of Architecture (Univ. of Natal 1977)

Professional registration/membership:
Professional member of the SA Council for the Architectural Profession (SACAP), reg. no. 3686.
Member of the Cape Institute for Architects and SA Institute of Architects.
B-BBEE Status: Level 4.

Quinton has practiced as a professional architect since 1978, specialising in architectural and urban design, environmental design and computer visualisation.

He was one of the founding partners of Meirelles Lawson Architects formed in 1988, initially specialising in economic and sustainable housing. He was a senior partner at MLB Architecture and Urban Design, with specialist expertise in visual modelling and design solutions.

In the past he has been a visiting lecturer at UCT teaching a post-graduate course on Computer Techniques in Landscape Architecture, including visualisation and visual assessment techniques.

Together with BOLA, Quinton has been involved in numerous visual impact assessments over a number of years, and previously served on the Impact Assessment Review Committee of Heritage Western Cape.

Bernard Oberholzer Landscape Architect + Environmental Planner (BOLA)

Qualifications:
Bachelor of Architecture (UCT 1970), Master of Landscape Architecture (U. of Pennsylvania 1975)

Professional registration/membership:
Professional member of the SA Council for the Landscape Architectural Profession (SACLAP), reg. no. 87018.
Fellow of the Institute of Landscape Architects of South Africa.
B-BBEE Status: Level 4.

Bernard has 40 years of experience as a professional landscape architect, specialising in, environmental planning, coastal planning, urban landscape design and visual assessments.

He is currently an independent consultant, and was for 7 years the Convenor of the Master of Landscape Architecture Programme at UCT.

He has presented papers on *Visual and Aesthetic Assessment Techniques*, and provides specialist services as a reviewer of visual impact studies prepared by other firms.

He is the author of *Guideline for Involving Visual and Aesthetic Specialists in EIA Processes,* prepared with the CSIR for the Dept. of Environmental and Development Planning, Provincial Government of the Western Cape, 2005.

Bernard has been involved in numerous land use suitability studies and visual assessments for a wide range of projects, and serves as a member of the Stanford Heritage Committee.

Bernard and Quinton were joint authors of the visual specialist chapters for the National Wind and Solar SEA and National Electricity Grid Infrastructure SEA, with the CSIR, for the Department of Environmental Affairs.

Specialist Declaration

We, Quinton Lawson and Bernard Oberholzer, as the appointed independent specialists, in terms of the 2014 EIA Regulations (as amended), hereby declare that:

- we act as the independent specialist in this application;
- we 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;
- regard the information contained in this report as it relates to our specialist input/study to be true and correct, and do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 (as amended) and any specific environmental management Act;
- we declare that there are no circumstances that may compromise our objectivity in performing such work;
- we 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;
- we will comply with the Act, Regulations and all other applicable legislation;
- we have no, and will not engage in, conflicting interests in the undertaking of the activity;
- we have no vested interest in the proposed activity proceeding;
- we undertake to disclose to the applicant and the competent authority all material information in our 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 ourselves for submission to the competent authority;
- we have ensured that information containing all relevant facts in respect of the specialist input/study was distributed or made available to interested and affected parties and the public and that participation by interested and affected parties was facilitated in such a manner that all interested and affected parties were provided with a reasonable opportunity to participate and to provide comments on the specialist input/study;
- we have ensured that the comments of all interested and affected parties on the specialist input/study were considered, recorded and submitted to the competent authority in respect of the application;
- all the particulars furnished by us in this specialist input/study are true and correct; and
- we realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Name of Specialist: Quinton Lawson and Bernard Oberholzer

Signature of the specialist: ______________________________

Date: 30 November 2019

Executive Summary

The proposed Kenhardt PV 5 Solar Energy Facility (SEF) project is one of two phases of a solar farm located on the Farm Onder Rugzeer 168 about 17 km north-east of the town of Kenhardt. Besides the solar arrays, the 250ha facility would include a 2ha substation, as well as a control centre with offices, warehouse and laydown areas. A proposed 132kV powerline would connect the SEF to the existing Nieuwehoop Substation about 8,5km away.

The proposed SEF and connecting powerline are in a remote and arid part of the Northern Cape, with no particular visual or scenic features. The only potential receptors are users of the gravel R383 Route (about 4km away), the Rugseer farmstead on the property (nearly 4km away), and several surrounding farmsteads, all more than 6km away, some of which are in a view shadow. The proposed SEF and powerline would therefore have very low visibility.

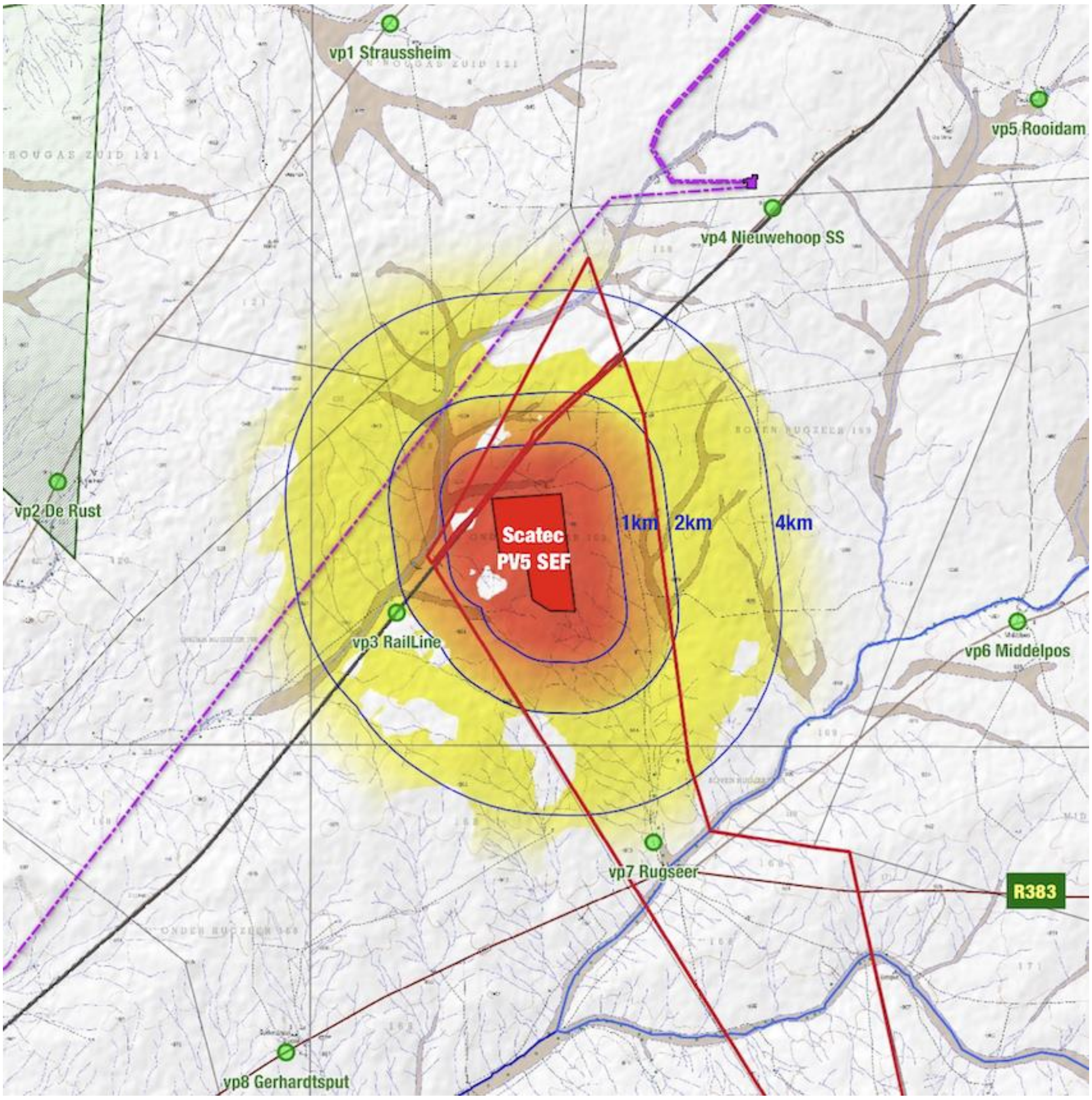

Fig.1: Map showing the relatively small viewshed and considerable distance of receptors from the proposed Kenhardt PV 5 solar farm.

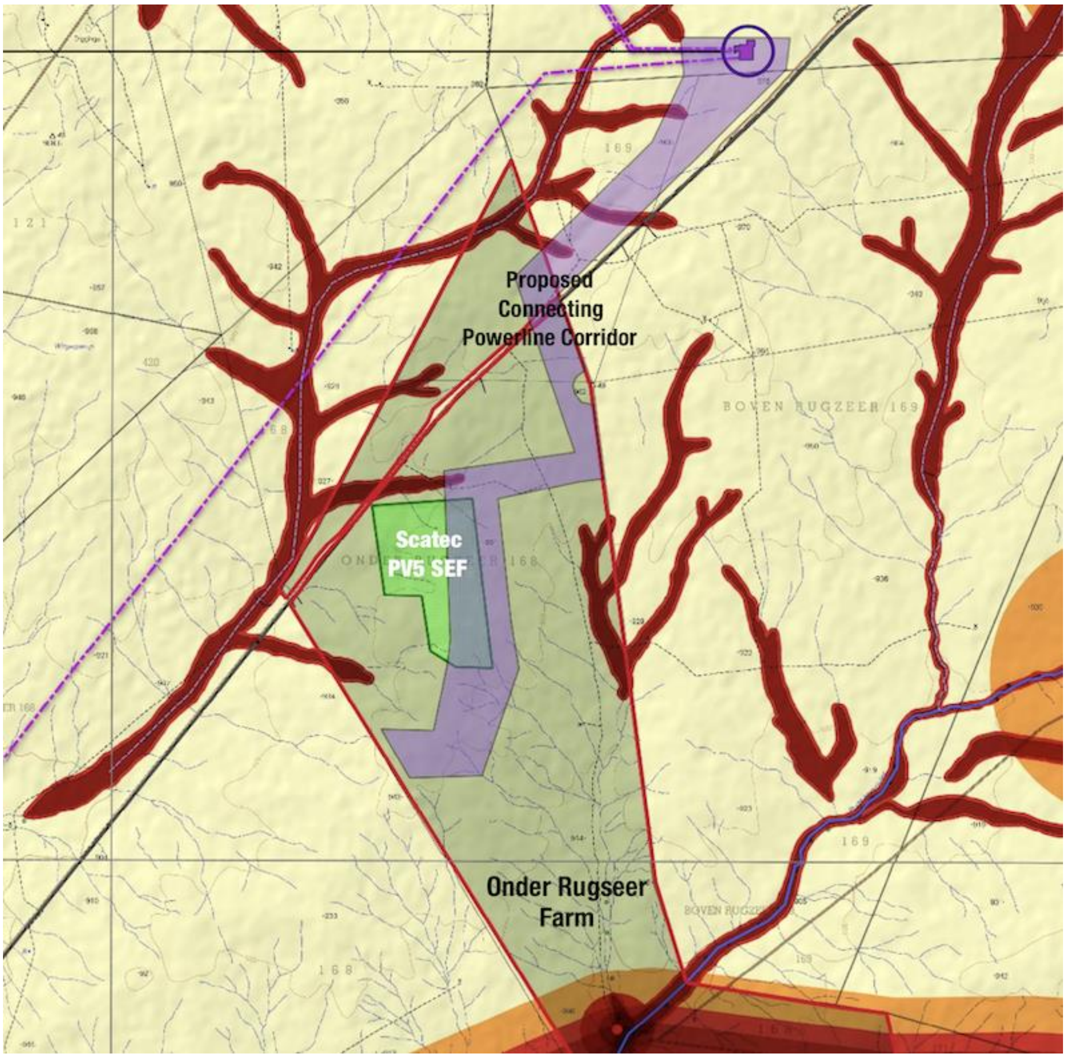

Fig. 2: The dry drainage courses, often lined with trees, are the only landscape features of note on the site

The relative visual impact significance of the proposed SEF and connecting powerline for the various phases are indicated in the table below.

Overall Impact Significance of SEF and Related Infrastructure

Phase	Visual impact significance before mitigation	Visual Impact Significance after mitigation
Construction	Moderate	Low
Operational	Moderate	Low
Decommissioning	Moderate	Very low

Overall Impact Significance of Connecting Powerline

Phase	Visual impact significance before mitigation	Visual Impact Significance after mitigation
Construction	Low	Very low
Operational	Low	Low
Decommissioning	Low	Very low

The cumulative visual impact significance of the Kenhardt PV 5 solar farm, seen together with the Kenhardt PV 4 and 6 solar farms, as well as the other proposed and approved solar farms within 30km radius, was considered to be moderate during the operational phase and very low after the decommissioning phase, assuming mitigation. The reasons for this are the remoteness of the subject area, the featureless nature of the landscape, and the fact that the solar farms are within a REDZ.

The 30m monopoles for the connecting powerline, that runs for a relatively short distance of about 10km to the Nieuwehoop Substation, are smaller than those for the main Eskom powerline that feeds Kenhardt, and therefore the cumulative visual impact was considered to be low during the operational phase and very low after decommissioning.

There are no fatal flaws from a visual perspective and authorisation could therefore be given for the Kenhardt PV 5 solar facility, subject to the visual mitigation measures being implemented and a heritage permit issued.

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List of Abbreviations

BAR	Basic Assessment Report
DEA	Department of Environmental Affairs
EMPr	Environmental Management Programme
O&M	Operations and maintenance
PV	Photovoltaic
REDZ	Renewable Energy Development Zone
SEA	Strategic Environmental Assessment
SEF	Solar energy farm
VIA	Visual Impact Assessment

Glossary

Definitions	
Receptor	Individuals, groups or communities who are subject to the visual influence of a particular project
Viewpoint	A selected point in the landscape from which views of the project are ascertained
Viewshed	The outer boundary defining a view catchment area, used to determine the zone of visual influence.
View shadow	An area within the view catchment visually obscured from the project, usually by topography.
Visual absorption capacity	The ability of an area to visually absorb development by means of screening topography, vegetation or buildings.

COMPLIANCE WITH THE APPENDIX 6 OF THE 2014 EIA REGULATIONS (AS AMENDED)

Requirements of Appendix 6 – GN R982	**Addressed in the Specialist Report**
1. (1) A specialist report prepared in terms of these Regulations must contain- a) details of- i. the specialist who prepared the report; and ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	Page 2.
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Page 3.
c) an indication of the scope of, and the purpose for which, the report was prepared;	Section 1
(cA) an indication of the quality and age of base data used for the specialist report;	Section 2.1
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 5
d) the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 1.3
e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 2
f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Section 4.2
g) an identification of any areas to be avoided, including buffers;	Map 8
h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Map 8
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 2.2
j) a description of the findings and potential implications of such findings on the impact of the proposed activity or activities;	Section 6
k) any mitigation measures for inclusion in the EMPr;	Section 6
l) any conditions for inclusion in the environmental authorisation;	Section 11
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 9
n) a reasoned opinion- i. whether the proposed activity, activities or portions thereof should be authorised; (iA) regarding the acceptability of the proposed activity or activities; and ii. if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Sections 6, 9 and 11
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	Section 2.3
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	Section 2.3 Refer to EAP

Requirements of Appendix 6 – GN R982	Addressed in the Specialist Report
q) any other information requested by the competent authority.	Refer to EAP
(2) Where a government notice by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	N/A

VISUAL IMPACT ASSESSMENT

This report presents the Visual Impact Assessment that was prepared by Quinton Lawson and Bernard Oberholzer as part of the Basic Assessment (BA) Process for the proposed construction of the Scatec Solar Photovoltaic Facilities 4, 5 and 6, near Kenhardt in the Northern Cape Province.

1. Introduction and Terms of Reference

1.1. Scope, Purpose and Objectives of this Specialist Report

The Visual Impact Assessment (VIA) is one of several specialist studies being carried out as part of the Scoping Report for the proposed Solar Energy Facility (SEF), and should be read in conjunction with the Heritage Impact Assessment (HIA).

The VIA includes an assessment of potential visual impacts and risks associated with the proposed SEF and provides recommended mitigations to minimise potential visual impacts. These are used to inform the siting and layout of the project and for inclusion in the Environmental Scoping Report.

The visual assessment includes related infrastructure, such as the powerline grid connection and switching station, which form part of the Basic Assessment Report (BAR).

1.2. Terms of Reference

The following form part of the Terms of Reference for the visual specialist study:

- A description of the regional and local landscape features;
- Identification and mapping of landscape features and visually sensitive receptors;
- Assessing (identifying and rating) potential visual impacts on the environment / receptors;
- Identification of relevant legislation and legal requirements;
- Formulation of possible mitigation measures and rehabilitation procedures / management guidelines; and
- Comment on any potential fatal flaws relating to visual aspects, along with recommendations regarding approval of the project.

1.3. Assessment Details

Type of Specialist Investigation	Identification and mapping of visual and scenic resources, and sensitive visual receptors.
Date and Duration of Specialist Site Investigation	21-22 November 2019 2 days including travel time.
Season	Early summer
Relevance of Season	The season was not a consideration, nor had any effect on carrying out a visual assessment. Clear visibility was required for the photographic survey.

2. Approach and Methodology

The methodology involved a number of standard procedures including those in the Guideline for Involving Visual and Aesthetic Specialists (Oberholzer, B. 2005), including the following steps:

- A baseline survey of existing scenic resources and visual characteristics of the study area was made, including desktop work and field observations.
- A photographic survey included views from potentially sensitive receptor locations. A number of cameras were used to record features and determine the GPS coordinates and compass direction of viewpoints.
- View corridors / routes and important viewpoints / receptors were mapped in relation to the proposed SEF.
- Distance radii from the proposed SEF were mapped to determine its potential visibility from the identified viewpoints.

- The viewsheds of the proposed SEF and connecting powerline were mapped to determine their zones of visual influence as well as those areas in a view shadow.
- Photomontages were constructed from selected viewpoints using panoramic photographs taken in the field, along with digital terrain modelling and superimposing a 3D model of the proposed SEF. The montages gave a realistic impression of the proposed SEF from the identified viewpoints at a range of distances.
- The potential visibility, zone of visual influence and photomontages of the proposed SEF provided a quantitative measure of the visual impact of the proposed solar facility.
- Existing vegetation cover, land uses, topographic features and general intactness of the landscape, along with the overall 'sense of place' provided a qualitative measure of visual impact.

2.1. Information Sources

The main sources of information for the visual assessment included the following:

- Project description data provided by the CSIR (November 2019).
- Chief Directorate: National Geospatial Information 1:50000 Topographic, 1:250000 Topo-Cadastral series maps and datasets.
- Council for Geoscience: 1:1 000 000 Geological Map of South Africa: Spatial Dataset 2011
- Shuttle Radar Topography Mission (SRTM) 1 arcSEC 30m DEM Data 2014
- Google Earth Satellite Imagery 2019
- Google Maps and Open Street Map (OSM) Data 2018
- DEA: Renewable Energy EIA Application Database (REEA) Official Release 2019 Quarter 3
- DEA: South Africa Protected Areas Database (SAPAD) Official Release 2019 Quarter 3
- DEA: South Africa Conservation Areas Database (SACAD) Official Release 2019 Quarter 3
- SANBI: National Freshwater Ecosystem Priority Areas (NFEPA) River and Wetland Datasets 2015
- SAHRA: National Heritage Sites Inventory Database 2017
- ESKOM: Electricity Grid Infrastructure (EGI) Dataset 2018
- CAA: Civil Aviation Authority: South Africa Airport, Airfields and Obstacle Datasets 2018

2.2. Assumptions, Knowledge Gaps and Limitations

No details of the actual layout and design of the solar PV panels were available at the time of the visual assessment. Assumptions have been made on the nature of the proposed substation and O&M buildings, as well as lighting and fencing, as indicated in Table 1, as architectural details of these will only become available at a later stage.

However, given the relatively small visual scale of the proposed SEF and related infrastructure, as well as the considerable distance of the receptors in the area, it is unlikely that this would have a bearing on the overall visual impact significance ratings.

2.3. Consultation Processes Undertaken

The public participation process still needs to run its course and any visual issues that are raised will be addressed in the final BAR.

3. Description of Project Aspects relevant to Visual Impacts

The proposed Kenhardt PV 5 SEF project is located on the farm Onder Rugzeer 168 about 18 km north-east of Kenhardt in the Northern Cape, (see Map 1). The facility would be developed in three phases (Kenhardt PV 4, 5 and 6) of 100 MW each. Each phase would consist of a solar field comprising solar arrays of photovoltaic (PV) panels reaching a height of about 10m at their maximum tilt.

Associated infrastructure that has visual implications includes an onsite substation of 2 ha with transformers reaching about 30m.

An operations and maintenance (O&M) control centre adjacent to the collector substation, plus offices, warehouse, ablutions, parking, storage, laydown areas and internal gravel roads would also be provided. Water storage tanks would be required to serve these facilities.

Security fencing about 3m high would be required, along with an access control gate and guard house on the access road. Security and area lighting would also be required.

During the construction phase a temporary construction yard, batching plant, temporary offices and laydown area would be located on the site. The batching plant can be dis-assembled and moved to each of the construction sites.

The SEF will connect to the Eskom Nieuwehoop Substation via a 132kV powerline over a distance of approximately 8,5 km.

A list of components for the proposed SEF, that have potential visual implications, is given in Table 1 below. A general layout of the project and route taken during the field trip, is indicated on Map 2.

Table 1: Description of Proposed Kenhardt PV 5 Solar Energy Facility

Facility	Extent/Footprint	Height	Comments
SEF project area	± 250 ha incl. roads	n/a	100MW
Solar PV arrays	Single axis, fixed axis, dual axis or fixed tilt options.	Max. 10m	Galvanised steel and aluminium mounting structures.
Offices	1 000m^2	Max. 7m	
Operations control centre	500m^2	Max. 7m	
Warehouse/workshop	500m^2	Max. 7m	
Ablution facilities	50m^2	Max. 7m	
24 onverter/inverter stations	2 500m^2	2,5 - 7m	
Onsite substation	20 000m^2	Max. 7m	Pylons up to 30m
Guard house	40m^2	Max. 3m	
Battery storage	200m^2		
Internal powerlines	33kV	9m	Above ground/ underground.
Internal service roads	4m wide	n/a	Gravel surface.
Access roads	Max. 8m wide	n/a	Gravel surface.
Water storage tanks	To be determined		
Security fencing	Perimeter and internal security fencing.	± 3 m	
Security Lighting	To be determined		Including substation and O&M buildings.
132kV overhead powerline to Nieuwehoop Substation	31m wide servitude Approx. 8,5km length	22,5 – 30m	Within a 300m wide corridor
Construction phase laydown area	5 ha		Temporary construction yard and batching plant.

4. Description of the Receiving Environment

4.1. Baseline Environmental Description

Landscape Setting

The site is situated in a region known as the Kaiingveld, some 65km south of the Orange River, and 18km northeast of the nearest town, Kenhardt, which lies on the R27 Route, which heads north to towns on the Orange River. This arid region forms part of Bushmanland in the Northern Cape.

The site lies adjacent to the long, straight and dusty gravel road (R383) between Kenhardt and Putsonderwater. Farms tend to be large because of the low grazing potential, with farmsteads spread about 10km apart.

Fig. 3: Sishen-Saldanha railway and road

Geology and Topography

The study area is underlain by complex metamorphic rocks, including granitoids, gneiss and biotite, with patches of white gleaming quartzite often visible on higher ground, (see Map 3 Geology). Much of the area is however covered by more recent sediments, such as sand, gravel, alluvium and calcrete. A good idea of the geology can be observed in the cuttings of the Sishen-Saldanha railway line to the northwest of the site.

The geology and arid climate has resulted in a gently undulating landscape with few topographic features of note, and therefore structures, such as powerlines and substations, can be seen for several kilometres.

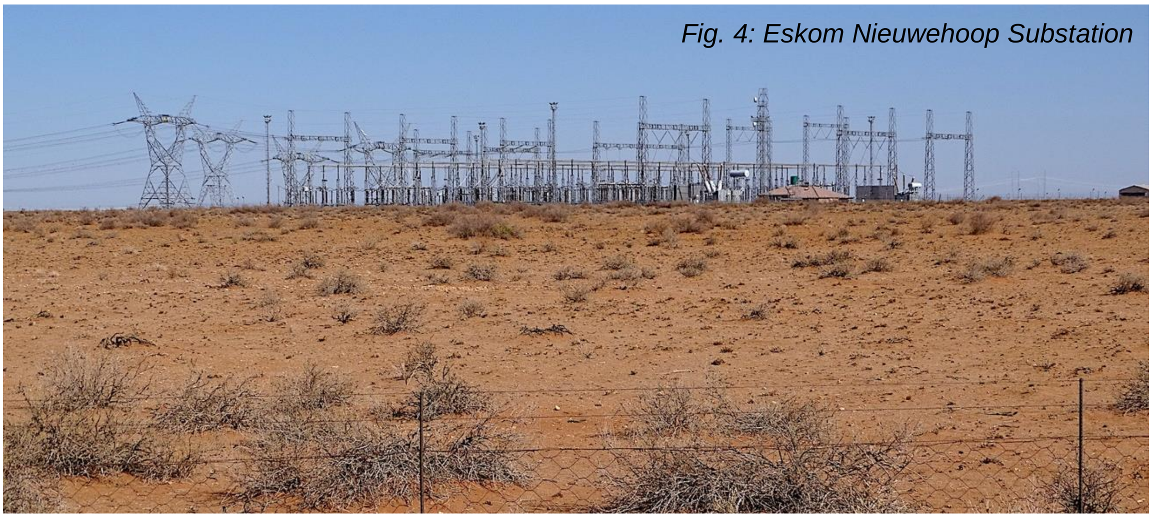

Fig. 4: Eskom Nieuwehoop Substation

Vegetation and Land Use

The study area is a dry parched landscape with almost no trees except for the Acacia thorn trees and invasive alien mesquite (*Prosopis*) trees that line the dry river courses. Because the area has suffered from seven years of drought, little grass cover remains and even the hardy shrubs have withered. Characteristic quiver trees (kokerboom), grow in patches or, because of their sculptural form, are used as feature trees at entrances to farms. Shade trees around farmsteads include the Eucalyptus.

Farming activity consists mainly of grazing by merino and dorper sheep, the small flocks often seeking shade near farmsteads. Antelope have also suffered from the drought and are now scarce, although one, possibly a duiker, was seen on the site.

Only one farmstead, Rugseer, is located on the property, the other farmsteads being 7km or more away, (see Map 2). Other solar energy farms have been proposed or approved to the north of the site.

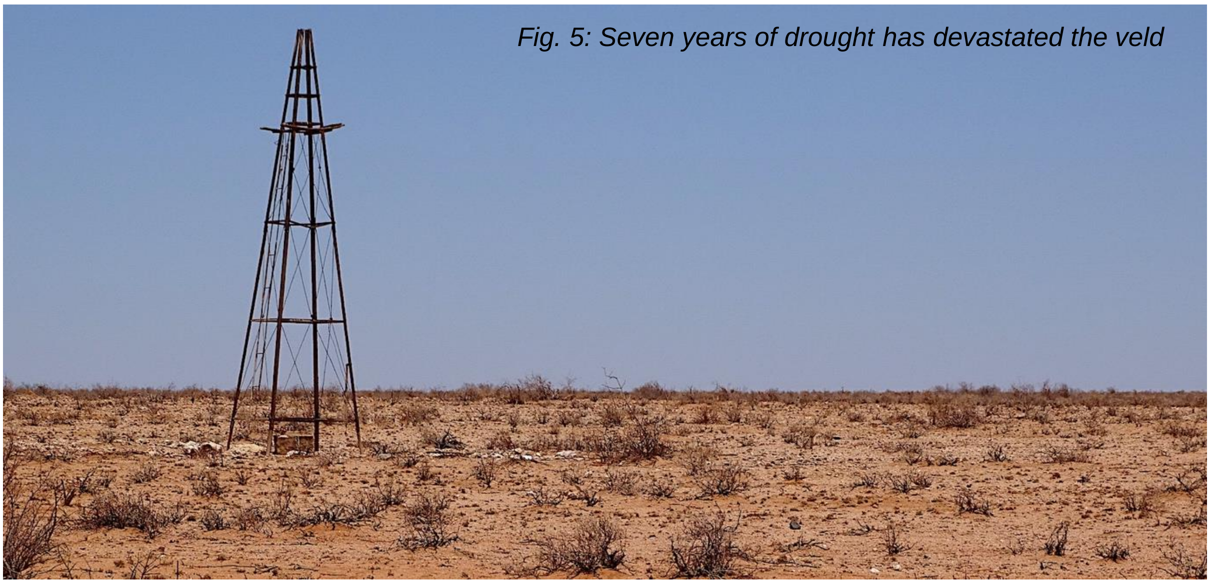

Fig. 5: Seven years of drought has devastated the veld

Scenic Resources and Sense of Place

The featureless landscape is interrupted only by the thin lines of trees along the dry river courses and small scattered farmsteads hidden among a few trees. The occasional windmill, with its concrete reservoir, dots the landscape, although many of these are now derelict. The exposed, bleached landscape has a strong sense of isolation and stillness, even timelessness.

Fig. 6: Gerhardtsput farmstead on the R383 Route

A summary of visual features and sensitive receptors is given in Table 2 below.

Table 2: Visual Features and Sensitive Receptors

Scenic Resource	**Landscape features within or adjacent to the development site.**
Topographic features	There are few topographic features within the study area, the main features being the tree-lined drainage features, which provide some visual interest in the expansive arid landscape.
Water Features	In the dry landscape, drainage courses providevisual and amenity value.
Cultural landscapes	Intact wilderness or rural landscapes, contribute to scenic value and sense of place, along with green patches of cultivated land and tree copses around farmsteads. Cultural landscapes include archaeological and historical sites identified in the Heritage Assessment.
Sensitive Receptors	**Receptors adjacent to the site or in the local surroundings.**
Protected Areas	There are no nature reserves or other protected areas in or around the study area.
Private reserves, game farms	There are 2 game farms in the area, which potentially have value for the local economy.
Human settlements, farmsteads	Besides the Rugseer farmstead on the property, there are 3 farmsteads (De Rust, Middelpos and Gerhardtsput) within 10km of the proposed SEF, although 2 of these are in a view shadow.
Arterial roads	The R27 Route is more than 10km from the proposed SEF, while the gravel R383 passes through the property just south of the site. The latter is used by residents and visitors to the area, and therefore has some visual sensitivity.
Cultural and heritage sites	These form part of the heritage study, but could have visual implications.

4.2 Identification of Environmental Sensitivities

Given the relatively featureless nature of the study area, described above, the only sensitive visual features are the drainage courses, neighbouring farmsteads, and game farms, which are some distance away. Heritage features, documented by others, may have visual significance.

Other local features in the landscape, such as the existing Eskom Nieuwehoop Substation, powerlines and the Sishen-Saldanha railway line are visual intrusions that have already altered the landscape character of the area.

No-go areas and other levels of visual sensitivity in the defined study area are indicated on Map 8. Visual sensitivity mapping at the broad regional scale for the Wind and Solar PV SEA (CSIR, 2015) indicated a 'Low' visual sensitivity for the study area.

Visual buffers indicated in the Wind and Solar PV SEA are listed in Table 3 below. This was for mapping at a regional scale and was used as a guide. Visual sensitivity categories and related buffers at the site scale are listed in Table 4. Buffers for visual features are indicated on Map 5 for the proposed SEF and Map 6 for the proposed connecting powerline.

Table 3: Visual buffers for Solar PV Facilities at the Regional Scale

Landscape features/criteria	Solar PV SEA (2015)	Comments relating to proposed SEF
Project area boundary	-	Farm boundary setback usually 30m.
Ephemeral streams/ tributaries	-	Subject to freshwater assessment. 32 m buffers indicated in the interim.
Steep slopes (gradient)	>1:4 (v. high sensitivity) 1:4 -1:10 (high sensitivity)	None on the proposed SEF site.
Prominent ridgelines, peaks and rock outcrops	250m (v. high sensitivity)	None on the proposed SEF site.
Arterial / district gravel roads	0-250m (v. high sensitivity) 250m-1 km (mod. sensitivity)	The R383 is approx. 2km from the proposed SEF site.
Scenic routes, passes	0-500m (v. high sensitivity)	None in the immediate area.
Protected Areas	0-1,5 km (v. high sensitivity) 1,5-2 km (high sensitivity) 2-3 km (mod. sensitivity)	None in the immediate area.
Private reserves/ game farms/ guest farms.	0-1 km (v. high sensitivity) 1-2 km (high sensitivity) 2-3 km (mod. sensitivity)	Two game farms are about 8 and 12.5km from the proposed SEF site.
Farmsteads	0-250m (high sensitivity) 250-500m (mod. sensitivity)	Surrounding farmsteads are 7km or more from the SEF site.

Table 4: Visual Sensitivity Mapping Categories for the Proposed SEF

Scenic Resources	Very high sensitivity (No-go)	High visual sensitivity	Medium visual sensitivity	Low visual sensitivity
Topographic features	Feature	Within 250m	-	-
Steep slopes	Slopes > 1:4	Slopes > 1:10	-	-
Drainage courses	Feature	Within 50m	-	-
Protected Landscapes / Sensitive Receptors				
Private reserves / game farms	within 500m	within 1 km	within 2 km	-
Farmsteads outside site	within 500m	within 1 km	within 2 km	-
Farmsteads inside site	within 250m	within 500m	-	
Arterial routes	within 250m	within 500m	within 1km	-

5. Issues, Risks and Impacts

5.1. Summary of Issues identified during the Project Notification Phase

No comments have been received yet from the notification period or public participation. This section will therefore be updated once the information is available.

5.2. Identification of Potential Impacts/Risks

The potential impacts identified during the visual assessment are listed below:

Construction Phase

- Potential effect of dust and noise from trucks and construction machinery during the construction period, and the effect of this on residents and visitors to the area, particularly users of the main arterial routes, (R27 and R383), to the site.
- Potential visual effect of haul roads, access roads and stockpiles on the exposed landscape

Operational Phase

- Potential visual intrusion of solar arrays and related infrastructure and the impact on receptors, including residents and visitors, as well as game farms in the area.
- Potential visual impact of an industrial type activity on the rural or wilderness character of the area.

Decommissioning Phase

- Potential visual effect of any remaining structures, platforms and disused roads on the landscape.

Cumulative Impacts

- Potential combined visual effect of the solar farm with other existing and proposed renewable energy farms in the area.

6. Impact Assessment

6.1 Criteria for Determining Visual Impact

Visibility:

Estimated degrees of visibility based on distance of the proposed SEF and related infrastructure are indicated in Table 5 below:

Table 5: Degrees of Visibility of Proposed SEF and Related Infrastructure

	Very high visibility	0-500m	Prominent feature within the observer’s view frame
	High visibility	500m-1km	Relatively prominent within observer’s view frame
	Moderate visibility	1-2km	Only prominent as part of the wider landscape
	Low visibility	2-4km	Visible as a minor element in the landscape
	Very low visibility	>4km	Hardly visible with the naked eye in the distance

The height of the solar PV arrays is relatively low (10m), but the substation pylons are higher. Possible degrees of visibility from a number of viewpoints are indicated in Table 6 below. (See also photomontages in Figures 1 and 2). Visibility of lights at night would not be significant because of the considerable distance of receptors. Visibility of the proposed powerline connection would also not be significant for the same reason.

Table 6: Viewpoints and Potential Visibility of Proposed SEF and Powerline

Viewpoint	Latitude	Longitude	Distance to PV arrays	Distance to powerline	Visibility
VP1 Straussheim	29.122128º S	21.265498º E	9,54 km	7,43 km	Not visible from farmstead. In a view shadow.
VP2 De Rust	29.203416º S	21.199390º E	8,42km	9,76 km	Not visible from farmstead. In a view shadow.
VP3 rail line 2km	29.226520º S	21.267080º E	2,26 km	3,19 km	Moderately visible from rail line. Not a sensitive viewpoint.
VP4 Nieuwehoop substation	29.154686º S	21.341905º E	6,94 km	n/a	Hardly visible from substation. Not a sensitive viewpoint.
VP5 Rooidam	29.135234º S	21.394866º E	12,07 km	5,93 km	Not visible from farmstead because of distance and view shadow.
VP6 Middelpos	29.227783º S	21.390981º E	8,58 km	7,91 km	Hardly visible. Derelict farmstead facing SE.
VP7 Rugseer	29.267075º S	21.318477º E	4,78 km	3,98 km	Moderately visible. Farmstead faces SE, screened by trees.
VP8 Gerhardtsput	29.304453º S	21.245222º E	10,06 km	9,19 km	Not visible from farmstead. In a view shadow.

Scenic Resources / Sensitive Receptors: (Map 8)

There are no topographic or scenic features of note in the study area. The general area is sparsely populated, the farmsteads being far apart, and mostly a considerable distance from the proposed SEF. Visual sensitivity is therefore low.

Visual Exposure: (Maps 5, 6 and 7)

The viewshed, or zone of visual influence, potentially extends for some distance to the south-east, but is more restricted to the north-west by the topography, where parts of the area are in a view shadow. The zone of visual influence of the proposed SEF and powerline would therefore be fairly limited and would not extend beyond 10km.

Landscape Integrity:

The natural landscape intactness of the area has been altered to some extent by the Sishen-Saldanha rail line, Nieuwehoop Substation and powerlines. The clustering of proposed solar facilities would help to minimise visual intrusion in the larger landscape.

Visual Absorption Capacity:

The area around the proposed site is generally flat to gently undulating, with low grass and scrub vegetation and therefore visually exposed, with low visual absorption capacity, i.e. low potential to screen any proposed structures.

The above visual criteria are summarised in Table 7 below in order to determine visual impact **consequence** for the proposed SEF, related infrastructure and powerline grid connection. **Significance** is determined by multiplying consequence with probability as indicated in Table 8, based on the diagram below.

Fig. 7: The diagram below provides a guide to assessing risk/impact significance as a result of consequence and probability, the results of which are indicated in Table 8.

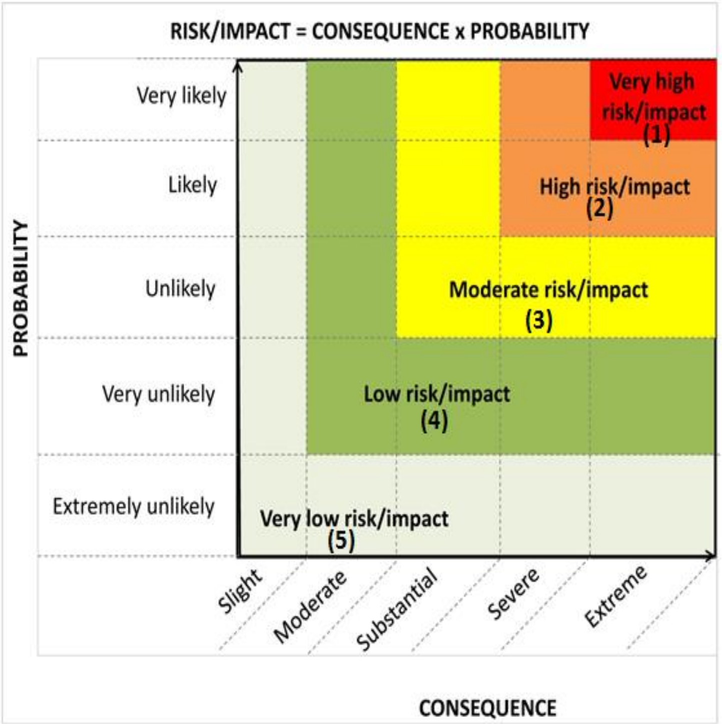

Table 7: Visual Impact Consequence

Visual Criteria	Comments	Solar PV arrays	Related Infrastructure	Connecting Powerline
Visibility of facilities	Distance from receptors is a mitigating factor.	Medium	Medium	Low
Visibility of lights at night	Distance from receptors is a mitigating factor.	Low	Low	Low
Visual exposure	Viewshed extends mainly to SE. Some areas are in a view shadow.	Medium	Medium	Low
Scenic resources and receptors	No scenic features of note. Receptors are isolated farmsteads.	Low	Low	Low
Landscape integrity	Rural character, with previous disturbance by rail and powerlines.	Low	Low	Low
Visual absorption capacity	Visually exposed landscape. Low visual absorption capacity.	Medium	Medium	Medium
Consequence	Summary	**Moderate**	**Moderate**	**Slight**

Table 8: Visual Impact Significance

	Comments	Solar PV arrays	Related Infrastructure	Connecting Powerline
Spatial extent	Distance from receptors is a mitigating factor. Powerlines have small footprint.	Local	Local	Local
Duration	Construction phase:	short term	short term	short term
	Operational phase:	long term	long term	long term
Reversibility of impacts	Visual impacts are reversible at the decommissioning phase.	High	High	High
Irreplaceability of resource	The landscape can be rehabilitated at the decommissioning phase.	Low	Low	Low
Probability	Mitigations will have a minimal effect.	Very likely	Very likely	Very likely
Consequence	(See Table 7)	Moderate	Moderate	Slight
Significance	Consequence x Probability (See Figure 1 below)	**Low risk (4)**	**Low risk (4)**	**V. low risk (5)**

Table 9: Potential Impacts during the Construction Phase

Aspect/Activity	**Site preparation**
Type of Impact	Direct
Potential Impact	Dust and noise from trucks and construction machinery. Visual intrusion of earthworks, haul roads and stockpiles.
Status	Negative
Mitigation Required	Location of construction yards, batching plants and stockpiles in visually unobtrusive areas, away from public roads. Implementation of the EMPr.
Impact Significance (Pre-Mitigation)	Moderate (Level 3)
Impact Significance (Post-Mitigation)	Low (Level 4)
I&AP Concern	Unknown at this stage

Table 10: Potential Impacts during the Operational Phase

Aspect/Activity	
Type of Impact	Direct
Potential Impact	Visual intrusion of solar arrays and related infrastructure on receptors.
Type of Impact	Indirect
Potential Impact	Visual effect of industrial type activity on the rural / wilderness character of the area.
Status	Negative
Mitigation Required	Location of the substation and O&M buildings in an unobtrusive low-lying area, away from public roads, and/or screened with earth berms where necessary. Internal access roads kept as narrow as possible, and existing roads or tracks used as far as possible. Outdoor / security lighting fitted with reflectors to minimise light spillage. Location of internal powerlines underground where possible. Discrete outdoor signage to be used and intrusive commercial or billboard signage prohibited.
Impact Significance (Pre-Mitigation)	Moderate (Level 3)
Impact Significance (Post-Mitigation)	Low (Level 4)
I&AP Concern	Unknown at this stage

Table 11: Potential Impacts during the Decommissioning Phase

Aspect/Activity	
Type of Impact	Direct
Potential Impact	Visual effect of any remaining structures, platforms and disused roads on the landscape.
Status	Negative
Mitigation Required	Solar PV arrays removed and building structures demolished or recycled for new uses. Hardened platform areas and access roads no longer required to be ripped and regraded. Exposed or disturbed areas revegetated or returned to grazing pasture or natural vegetation to blend with the surroundings.
Impact Significance (Pre-Mitigation)	Moderate (Level 3)
Impact Significance (Post-Mitigation)	Very low (Level 5)
I&AP Concern	Unknown at this stage.

Table 12: Potential Cumulative Impacts

Aspect/Activity	
Type of Impact (i.e. Impact Status)	Direct
Potential Impact	Visual effect of accumulated solar energy farms.
Status	Negative
Mitigation Required	Cluster solar energy farms in low sensitivity areas.
Impact Significance (Pre-Mitigation)	Moderate (Level 3)
Impact Significance (Post-Mitigation)	Moderate (Level 3) Cumulative impacts would be difficult to mitigate.
I&AP Concern	Unknown at this stage.

7. Impact Assessment Tables

The assessment of impacts and recommendation of mitigation measures as discussed above are collated in Tables below.

Table 13a: Impact Assessment Summary Table for the Construction Phase (SEF and related infrastructure)

Construction Phase													
Direct Impacts													
Aspect/ Impact Pathway	**Nature of Potential Impact/ Risk**	**Status**	**Spatial Extent**	**Duration**	**Consequence**	**Probability**	**Reversibility of Impact**	**Irreplaceability**	**Potential Mitigation Measures**	**Significance of Impact and Risk**		**Ranking of Residual Impact/ Risk**	**Confidence Level**
										Without Mitigation/ Management	**With Mitigation/ Management (Residual Impact/ Risk)**		
Dust and noise from construction	Visual effect on rural character	Negative	Site	Short-term	Moderate	Very likely	High	Low	Implement EMPr	Moderate	Low	4	Medium
Visual intrusion of site works	Visual impact on residents and visitors	Negative	Site	Short-term	Moderate	Very likely	High	Low	Suitably locate construct. camp	Moderate	Low	4	Medium

Table 13b: Impact Assessment Summary Table for the Operational Phase (SEF and related infrastructure)

Operational Phase													
Direct Impacts													
Aspect/ Impact Pathway	**Nature of Potential Impact/ Risk**	**Status**	**Spatial Extent**	**Duration**	**Consequence**	**Probability**	**Reversibility of Impact**	**Irreplaceability**	**Potential Mitigation Measures**	**Significance of Impact and Risk**		**Ranking of Residual Impact/ Risk**	**Confidence Level**
										Without Mitigation/ Management	**With Mitigation/ Management (Residual Impact/ Risk)**		
Introduction of solar arrays and infrastructure in the landscape	Visual impact on receptors	Negative	Local	Long-term	Moderate	Very likely	High	Low	Locate substation and buildings in unobtrusive area. Keep access roads narrow. Manage lighting and signage.	Moderate	Low	4	High
	Visual intrusion on rural landscape	Negative	Local	Long-term	Moderate	Very likely	High	Low		Moderate	Low	4	High

Table 13c: Impact Assessment Summary Table for the Decommissioning Phase (SEF and related infrastructure)

Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk		Ranking of Residual Impact/ Risk	Confidence Level
Decommissioning Phase													
Direct Impacts													
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)		
Visual effect of remaining structures, platforms and disused roads	Visual impact on receptors	Negative	Local	Long-term	Moderate	Very likely	High	Low	Structures demolished or recycled. Platforms and access roads ripped/ regraded. Disturbed areas revegetated or returned to grazing pasture.	Moderate	Very low	5	High
	Visual intrusion on rural landscape	Negative	Local	Long-term	Moderate	Very likely	High	Low		Moderate	Very low	5	High

Table 13d: Cumulative Impact Assessment Summary Table (SEF and related infrastructure)

Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk		Ranking of Residual Impact/ Risk	Confidence Level
Cumulative Impacts (Construction, Operational and Decommissioning Phases)													
Direct Impacts													
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)		
Introduction of additional solar energy farm	Cumulative visual impacts transform the rural landscape	Negative	Local	Long-term	Moderate	Very likely	High	Low	Cluster solar energy farms in low sensitivity areas.	Moderate	Moderate	4	High

Table 14a: Impact Assessment Summary Table for the Construction Phase (Connecting Powerline)

Construction Phase													
Direct Impacts													
Aspect/ Impact Pathway	**Nature of Potential Impact/ Risk**	**Status**	**Spatial Extent**	**Duration**	**Consequence**	**Probability**	**Reversibility of Impact**	**Irreplaceability**	**Potential Mitigation Measures**	**Significance of Impact and Risk**		**Ranking of Residual Impact/ Risk**	**Confidence Level**
										Without Mitigation/ Management	**With Mitigation/ Management (Residual Impact/ Risk)**		
introduction of access tracks and site works	Visual effect on rural character and receptors	Negative	Local	Short-term	slight	Very likely	High	Low	Location of pylons in low-lying areas. Access roads kept as narrow as possible. Implementation of EMPr.	Very low	Very Low	5	Medium

Table 14b: Impact Assessment Summary Table for the Operational Phase (Connecting Powerline)

Operational Phase													
Direct Impacts													
Aspect/ Impact Pathway	**Nature of Potential Impact/ Risk**	**Status**	**Spatial Extent**	**Duration**	**Consequence**	**Probability**	**Reversibility of Impact**	**Irreplaceability**	**Potential Mitigation Measures**	**Significance of Impact and Risk**		**Ranking of Residual Impact/ Risk**	**Confidence Level**
										Without Mitigation/ Management	**With Mitigation/ Management (Residual Impact/ Risk)**		
Introduction of pylons into the landscape	Visual impact on receptors	Negative	Local	Long-term	Moderate	Very likely	High	Low	Maintenance of pylons	Low	Low	4	High
	Visual intrusion on rural landscape	Negative	Local	Long-term	Moderate	Very likely	High	Low		Low	Low	4	High

Table 14c: Impact Assessment Summary Table for the Decommissioning Phase (Connecting Powerline)

Decommissioning Phase													
Direct Impacts													
Aspect/ Impact Pathway	**Nature of Potential Impact/ Risk**	**Status**	**Spatial Extent**	**Duration**	**Consequence**	**Probability**	**Reversibility of Impact**	**Irreplaceability**	**Potential Mitigation Measures**	**Significance of Impact and Risk**		**Ranking of Residual Impact/ Risk**	**Confidence Level**
										Without Mitigation/ Management	**With Mitigation/ Management (Residual Impact/ Risk)**		
Visual effect of remaining structures, platforms and disused roads	Visual impact on receptors	Negative	Local	Long-term	Moderate	Very likely	High	Low	Pylons removed. Roads ripped/ regraded. Disturbed areas revegetated.	Low	Very low	5	High
	Visual intrusion on rural landscape	Negative	Local	Long-term	Moderate	Very likely	High	Low		Low	Very low	5	High

Table 14d: Cumulative Impact Assessment Summary Table (Connecting Powerline)

Cumulative Impacts (Construction, Operational and Decommissioning Phases)													
Direct Impacts													
Aspect/ Impact Pathway	**Nature of Potential Impact/ Risk**	**Status**	**Spatial Extent**	**Duration**	**Consequence**	**Probability**	**Reversibility of Impact**	**Irreplaceability**	**Potential Mitigation Measures**	**Significance of Impact and Risk**		**Ranking of Residual Impact/ Risk**	**Confidence Level**
										Without Mitigation/ Management	**With Mitigation/ Management (Residual Impact/ Risk)**		
Introduction of additional powerlines	Cumulative visual impacts transform the rural landscape	Negative	Local	Long-term	Moderate	Very likely	High	Low	Existing powerline corridors used where possible	Low	Low	4	High

7.1. Impact Assessment Summary

Table 15a: Overall Impact Significance for SEF and Related Infrastructure (Post Mitigation)

Phase	Overall Impact Significance
Construction	Low
Operational	Low
Decommissioning	Very low
Nature of Impact	**Overall Impact Significance**
Cumulative - Construction	Moderate
Cumulative - Operational	Moderate
Cumulative - Decommissioning	Very low

Table 15b: Overall Impact Significance for Connecting Powerline (Post Mitigation)

Phase	Overall Impact Significance
Construction	Low
Operational	Low
Decommissioning	Very low
Nature of Impact	**Overall Impact Significance**
Cumulative - Construction	Low
Cumulative - Operational	Low
Cumulative - Decommissioning	Very low

No-go Alternative

The solar facility layout within the identified Kenhardt PV 5 site still needs to be finalised. However, the visual assessment takes the overall development envelope into account.

In the no-go alternative, there would be no solar energy facilities or additional powerlines and therefore no additional visual intrusion on the rural landscape and on surrounding farmsteads. At the same time no renewable energy would be produced at the site for export to the national grid.

The potential visual impact significance of the no-go scenario would be neutral as there would be no further visual impacts. It is assumed that low intensity grazing would continue with possible detrimental effects on the vegetation cover.

8. Legislative and Permit Requirements

The National Environmental Management Act (Act No. 107 of 1998). (NEMA) and the (NEMA EIA Regulations (2014, as amended) apply as the proposed solar energy facility is a listed activity. As the site falls within a gazetted Renewable Energy Development Zone (REDZ), a Basic Assessment (BA) is required. The need for a visual assessment has been identified.

The National Heritage Resources Act (Act No. 25 of 1999) (NHRA), and associated provincial regulations, provide legislative protection for natural, cultural and scenic resources, as well as for archaeological and paleontological sites within the study area. This report deals with visual considerations, including scenic resources, which form part of the National Estate. The Visual Assessment would therefore form part of the Heritage Assessment in terms of obtaining the relevant permits.

Other than the above legislation, there are no specific policies or guidelines for visual and scenic resources for the Northern Cape. The Guideline for Involving Visual and Aesthetic Specialists in EIA Processes, by the Provincial Government of the Western Cape, was used as a general guide.

The South African Civil Aviation Authority (SACAA) has an Obstacle Notice 4/2017 requiring solar project applications to be accompanied by a Glint and Glare Impact Assessment Report with relevance to aviation. As the Kenhardt airstrip is some 14 km from the project site, and only small aircraft take off and land at the airstrip, no Glint and Glare Impact Assessment is considered necessary.

9. Environmental Management Programme Inputs

Planning and Design Phase

Ensure that visual management measures are included as part of the EMPr, monitored by an Environmental Control Officer (ECO), including the siting of the construction yard and material stockpiles in visually unobtrusive positions in the landscape, away from public roads.

Construction Phase Monitoring:

Implement dust suppression and litter control measures, as well as rehabilitation of borrow pits and haul roads to minimise their visual effect on the surroundings. Ensure regular reporting to an environmental management team by the ECO during the construction phase.

Operation Phase Monitoring:

Ensure that visual mitigation measures are monitored by management on an on-going basis, including the control of signage, lighting and wastes on the site by the appointed Environmental Manager.

Decommissioning Phase Monitoring:

Ensure that procedures for the removal of structures and stockpiles during the decommissioning phase are implemented, including recycling of materials and rehabilitation of the site to a visually acceptable standard as prescribed in a rehabilitation plan, and signed off by the delegated authority.

10. Conclusion and Recommendations

The proposed Kenhardt PV 5 solar farm is one of 3 phases of 250 ha each, which in turn forms part of a grouping of solar farms in the area. These fall within a REDZ identified for this purpose. The site itself forms part of the arid Bushmanland region of the Northern Cape.

The generally flat to gently rolling terrain is visually exposed with the result that structures can be seen for several kilometres. However, there are no scenic features of note, and the main receptors, being surrounding farmsteads, are spread fairly far apart, ranging from about 7 to 12km distance from the proposed SEF, and more than 5km from the connecting powerline. This means that visibility of the proposed SEF and powerline is low, (hardly visible to not visible from the farmsteads).

Taking into account the relatively low structures and the local scale of the proposed project, the visual impact significance was considered to be **moderate** before mitigation and **low** after mitigation, and **low** both before and after mitigation for the powerline. The visual landscape could be restored after decommissioning which means the visual significance would be **very low** with mitigation for this phase.

11. Final Specialist Statement and Authorisation Recommendation

Key visual management actions include locating the substation and other buildings, as well as construction camps, in an unobtrusive position in the landscape away from public roads. The arid landscape is particularly fragile and therefore new access roads and disturbance generally should be kept to a minimum for both the proposed SEF and connecting powerline.

There are no fatal flaws from a visual perspective arising from the proposed project, and given the marginal nature of agriculture in the area, the renewable energy project is probably an inherently suitable land use that should receive authorisation, provided the mitigations are implemented and a heritage permit is issued.

12. References

Holland, H. 2016. Ch. 8 Visual Impact Assessment: Scoping and EIA for Proposed Development of a 75 MW Solar PV Facility (Kenhardt PV 1) on Remainder Onder Rugseer Farm 168, north-east of Kenhardt, Northern Cape Province.

Lawson, Q. and Oberholzer, B. 2014. National Wind and Solar PV SEA Specialist Report: Landscape Assessment, with CSIR for Department of Environmental Affairs.

Oberholzer, B. 2005. Guideline for Involving Visual and Aesthetic Specialists in EIA Processes: Edition 1 CSIR Report No. ENV-S-C 2005 053 F. Provincial Government of the Western Cape, Department of Environmental Affairs and Development Planning.

SOCIOECONOMIC IMPACT ASSESSMENT:

Basic Assessments for the proposed construction of three Solar Photovoltaic (PV) Facilities (i.e. Kenhardt PV4, Kenhardt PV5 and Kenhardt PV6) and associated electrical infrastructure, near Kenhardt, in the Northern Cape.

Report prepared for:	*Report prepared by:*
CSIR – Environmental Management Services	Applied Science Associated (Pty) Ltd
P O Box 320	3 Red Oak Lane
Stellenbosch	Stellenbosch
7599	7600
South Africa	South Africa

13 December 2019

Curriculum Vitae – *Rudolph du Toit*

Personal information

Name: Rudolph du Toit

Company: Applied Science Associates (Pty) Ltd

Position: Managing Director

Date of birth: 23 May 1978

Tertiary education

Masters:

Master of Philosophy (M.Phil.) in Development Planning

School of Public Leadership

University of Stellenbosch (US), 2007-2009

Research publications

- Contributing author to: Dalal-Clayton, B. (2013) ***The Role of Strategic Environmental Assessment in Promoting a Green Economy: Background document for the OECD DAC SEA task Team workshop on SEA & Green Economy, Lusaka, 17- 18 January 2013***. IIED, London

- Du Toit, R. (2009). ***Developing a Scorecard for Sustainable Transport: A Cape Town Application.*** Stellenbosch University Press

- Michelle Audouin, Mike Burns, Alex Weaver, David le Maitre, Patrick O'Farrell, Rudolph du Toit, Jeanne Nel. (2015). ***An Introduction to Sustainability Science and its Links to Sustainability Assessment.*** *In Morrison-Saunders, A. and Pope, J., Eds. Handbook of Sustainability Assessment.* Edward Elgar Publishing, 321 -349. ISBN 978-1-78347-136-2

Specialist studies

The following table presents an abridged list of projects that I have been involved in, indicating my role in each project

Specialist Experience		
Project	**Role**	**Date**
1. Mulilo Renewable Project Developments (Pty) Ltd Gemsbok Solar PV1 75MW Solar Photovoltaic EIA in the Northern Cape	Conducting the Social Impact Assessment (SIA) as part of the suite of EIA specialist studies	September 2014
2. Mulilo Renewable Project Developments (Pty) Ltd Gemsbok Solar PV2 75MW Solar Photovoltaic EIA in the Northern Cape	Conducting the Social Impact Assessment (SIA) as part of the suite of EIA specialist studies	September 2014
3. Mulilo Renewable Project Developments (Pty) Ltd Boven Solar PV1 75MW Solar Photovoltaic EIA in the Northern Cape	Conducting the Social Impact Assessment (SIA) as part of the suite of EIA specialist studies	September 2014
4. Scatec (Pty) Ltd Rugseer Farm Solar PV1 75MW Solar Photovoltaic EIA in the Northern Cape	Conducting the Social Impact Assessment (SIA) as part of the suite of EIA specialist studies	August 2015
5. Scatec (Pty) Ltd Rugseer Farm Solar PV2 75MW Solar Photovoltaic EIA in the Northern Cape	Conducting the Social Impact Assessment (SIA) as part of the suite of EIA specialist studies	August 2015
6. Scatec (Pty) Ltd Rugseer Farm Solar PV3 75MW Solar Photovoltaic EIA in the Northern Cape	Conducting the Social Impact Assessment (SIA) as part of the suite of EIA specialist studies	August 2015
7. Windlab Developments South Africa (Pty) Ltd Ishwati Emoyeni 140 MW Wind Energy EIA near Murrysburg in the Western Cape: Appeal response	Drafting of response to EA appeal submissions by Interested and Affected Parties	October 2015
8. Mainstream Renewable Energy (Pty) Ltd 2 x 140MW Wind Energy Facility EIA near Victoria West	Conducting the Social Impact Assessment (SIA) as part of the suite of EIA specialist studies	April 2016
9. Mulilo Renewable Project Developments (Pty) Ltd Gemsbok & Rugseer Solar PV2 75MW Solar Photovoltaic EIA in the Northern Cape: Appeal	Drafting of appeal against the competent authority decision to refuse EA	August 2016
10. Scatec (Pty) Ltd Rugseer Farm Solar PV1,2, & 3 75MW Solar Photovoltaic EIAs in the Northern Cape: Appeal	Drafting of appeal against the competent authority decision to refuse EA	July 2016
11. Veroniva (Pty) Ltd Vryheid 75MW Solar Photovoltaic EIA in the North-West Province	Conducting the Social Impact Assessment (SIA) as part of the suite of EIA specialist studies	June 2016 (on-going)

1. SPECIALIST DECLARATION

I, **Rudolph du Toit** as the appointed independent specialist, in terms of the 2014 EIA Regulations (as amended), hereby declare that I:

- I act as the independent specialist in this application;
- I 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;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct, and do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 (as amended) and any specific environmental management Act;
- 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 have no vested interest in the proposed activity proceeding;
- 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;
- I have ensured that information containing all relevant facts in respect of the specialist input/study was distributed or made available to interested and affected parties and the public and that participation by interested and affected parties was facilitated in such a manner that all interested and affected parties were provided with a reasonable opportunity to participate and to provide comments on the specialist input/study;
- I have ensured that the comments of all interested and affected parties on the specialist input/study were considered, recorded and submitted to the competent authority in respect of the application;
- all the particulars furnished by me in this specialist input/study are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Name of Specialist: **Rudolph du Toit**

Signature of the specialist: ________________________________

Date: **28 December 2019**

2. EXECUTIVE SUMMARY

The main income source among vulnerable communities within the Kai! Garib Local Municipality in general, and the town of Kenhardt in particular; appears to be government subsidies, with limited income generated from employment within industries operating within Kenhardt. Risky social behaviour (*i.e.* teenage pregnancy and drug abuse) is a major challenge in the area. Such social deviance could threaten social capital on which much of the existing livelihood strategies within the project area depend. Unemployment seems to be the single greatest challenge and problem driver in Kenhardt. Not only does unemployment deprive community members of income, it also constrains empowerment and the subsequent ability to perceive one's subjective social reality as meaningful. This more often than not exacerbates risky social behaviour.

Vulnerable community members might be negatively impact by the proposed project through the influx of opportunistic job seekers. Such an influx might threaten existing social structures and social support networks. Risky social behaviour might also be increased as a result of the proposed project; as deviant behaviour (e.g. prostitution and teenage pregnancy) are likely to increase as more outsiders migrate into Kenhardt in search of employment. Frustrated expectations of employment, created by the proposed development, could also contribute feelings of distrust in the developer and, in isolated instances, damage to project property and potential intimidation of staff. Furthermore, the likelihood of job losses once the proposed project reaches its decommissioning phase is high.

Positive socio-economic impacts likely to result from the project are increased local spending, the creation of local employment opportunities and the proposed development of an Economic Development Plan. These impacts will benefit the community through the creation of income generation opportunities and human development through skills development and training.

The overall significance rating of the *negative* socio-economic impacts associated with the proposed project is ***low to moderate*** (post mitigation); whereas the overall significance rating of the *positive* socio-economic impacts associated with the proposed development is ***moderate*** (with enhancement).

3. Contents

List of Figures

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4. COMPLIANCE WITH THE APPENDIX 6 OF THE 2014 EIA REGULATIONS (AS AMENDED)

Requirements of Appendix 6 – GN R982	Addressed in the Specialist Report
1. (1) A specialist report prepared in terms of these Regulations must contain- details of- the specialist who prepared the report; and the expertise of that specialist to compile a specialist report including a curriculum vitae;	See page 2-3 of this report.
a declaration that the specialist is independent in a form as may be specified by the competent authority;	Chapter 1
an indication of the scope of, and the purpose for which, the report was prepared;	Section 1.1
(cA) an indication of the quality and age of base data used for the specialist report;	Section 2
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 9 and 10
the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 1.3
a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 2
details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Section 8 and 9
an identification of any areas to be avoided, including buffers;	Section 9 and 10
a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Section 6
a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 4
a description of the findings and potential implications of such findings on the impact of the proposed activity or activities;	Section 9 and 10
any mitigation measures for inclusion in the EMPr;	Section 9 and 10
any conditions for inclusion in the environmental authorisation;	Section 16
any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 13
a reasoned opinion- whether the proposed activity, activities or portions thereof should be authorised; (iA) regarding the acceptability of the proposed activity or activities; and if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Section 14, 15 and 16
a description of any consultation process that was undertaken during the course of preparing the specialist report;	Section 5
a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	N/A
any other information requested by the competent authority.	N/A
(2) Where a government notice by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	N/A

5. SOCIOECONOMIC IMPACT ASSESSMENT

This report presents the Socio-economic Impact Assessment that was prepared by Rudolph du Toit of Applied Science Associates (Pty) Ltd as part of the Basic Assessment (BA) Process for the proposed construction of the Scatec Solar Photovoltaic Facilities 4, 5 and 6, near Kenhardt in the Northern Cape Province.

1. Introduction and Methodology

1.1 Scope, Purpose and Objectives of this Specialist Report

This Social Impact Assessment Report investigates the potential social disruptors and associated social impacts likely to result from the development of the proposed Kenhardt PV4, Kenhardt PV5 and Kenhardt PV6 and associated electrical infrastructure, projects near Kenhardt in the Northern Cape. In this regard, the study focuses on the town of Kenhardt and not the individual land parcels on which the proposed projects will developed, as most, if not all, of the anticipated social impacts will be experienced in the urban area nearest to the proposed developments (i.e. Kenhardt). Social disruptors and impacts under investigation are those which are most likely to significantly influence social and cultural concerns, values, consequences and benefits to communities.

The objective of this SIA is to assist with informed decision-making by the competent authority (DEA) as, as well as the development of appropriate management directives, as it relates to the consideration of social impact likely to result from the proposed development.

1.2 Terms of Reference

The following terms of reference was provided for this study:

- Describe the socio-economic context of the Kenhardt area, focusing on aspects that are potentially affected by a solar PV project, and taking into consideration the current situation as well as the trends, the local planning (IDPs and SDFs), other developments in the area. The study should look more broadly than the individual land parcels on which the proposed projects will developed, as most, if not all, of the anticipated social impacts may be experienced in the urban areas nearest to the proposed project.
- Apply a variety of appropriate options for sourcing information, such as review of analogous studies, available databases and social indicators, and use of interviews with key affected parties such as local communities, local landowners & government officials (local and regional) etc.
- The socio-economic study does not lend itself to providing a spatially based sensitivity map. Therefore, instead, the study could provide a simplified schematic mapping of the links between the project actions (i.e. interventions) and the receiving social environment (i.e. the socio-ecological system), which may occur at a local, provincial or national scale, and showing how these links can be optimized to enhance benefits and minimize negative impacts.
- Consider social issues such as potential in-migration of job seekers, opportunities offered by training and skills development, phasing of employment over the duration of the REIPPPP program, cumulative effects with other REIPPPP projects in the local area, implications for local planning and resource use.
- Provide recommendations to enhance the socio-economic benefits of the proposed solar PV project and to avoid (or minimise) the potential negative impacts.

- Identify and assess potential social benefits and costs as a result of the proposed development, for all stages of the project, and including the estimated direct employment opportunities.
- Evaluate the implications of the social investment programme associated with REIPPPP projects on the local socio-economic context.
- Determine mitigation and/or management measures which could be implemented to as far as possible reduce the effect of negative impacts and enhance the effect of positive impacts;
- Incorporate and address all issues and concerns raised by I&APs and the public (if applicable).
- Incorporate and address all review comments made by the Project Team (CSIR and Project Applicant).
- Provide review input on the preferred infrastructure layout and routes following the sensitivity analysis.
- Review the Generic EMPr for 1) Power Lines and 2) Substations (GN 435) and confirm if there are any specific environmental sensitivities or attributes present on the site and any resultant site specific impact management outcomes and actions that are not included in the pre-approved generic EMPr (Part B – Section 1). If so, provide a list of these specific impact management outcomes and actions based on the format of the report template provided by the CSIR.

1.3 Assessment Details

Type of Specialist Investigation	Socio-economic Impact Assessment
Date and Duration of Specialist Site Investigation	30 July 2014 (3 Days)
Season	N/A
Relevance of Season	N/A

2. Approach and Methodology

Approach: SIA Guidelines

The DEA&DP Guideline for Social Impact Assessment (Barbour, 2007) is used to provide policy and quality control guidelines for the social assessment process used in this report. *Table 2.1* elaborates on the guideline's key activities, objectives and areas of particular interest for assessment.

Table 1 DEA& DP Social Impact Assessment Guidelines (Source: Barbour, 2007*)*

1. Key Activities
1.1. Describe and obtain an understanding of the proposed intervention (type, scale, location), the communities likely to be affected and determine the need and scope of the SIA
1.2. Collect baseline data on the current social environment and historical social trends
1.3. Identify and collect data on the social impact assessment variables and social change processes related to the proposed intervention
1.4. Assess and document the significance of social impacts associated with the proposed intervention
1.5. Identify alternatives and mitigation measures.
2. Key Objectives

2.1	Assess the proposed development in terms of its fit with the relevant legislative, policy and planning requirements
2.2	Identify and assess the factors that contribute to the overall quality of life (social wellbeing) of people not just their standard of living
2.3	Identify and assess the needs of vulnerable, at risk, groups and/or ethnic minorities or indigenous peoples
2.4	Clearly identify which individuals, groups, organisations and communities stand to benefit from the proposed intervention and those that stand to be negatively affected. In so doing the assessment must identify and emphasize vulnerable and underrepresented groups
2.5	Recognise that social, economic and biophysical systems and impacts are inextricably interconnected, and identify and understand the impact pathways created when changes in one domain trigger impacts across other domains
2.6	Acknowledge and incorporate local knowledge and experience into the assessment process
2.7	Identify and assess developmental opportunities and not merely the mitigation of negative or unintended outcomes.
3.	**Key Areas of Particular Interest**
3.1	Where vulnerable communities are present
3.2	With high poverty and unemployment levels
3.3	Where access to services, mobility and community networks are affected
3.4	Where local livelihoods depend on access to and use of environmental resources and services
3.5	Of important tourism or recreation value
3.6	Where the existing character and “sense of place” will be altered.

Data Collection

Data sources consulted to compile the socio-economic baseline include internet sources (e.g. Statistics South Africa website), provincial and local government reports and publications (e.g. Integrated Development Plans (IDPs) and Spatial Development Plans (SDPs); as well as previously conducted Environmental Impact Assessments (EIAs) conducted in the study area. Where necessary, one-on-one conversation of with selected informants were also used to obtain context-specific information.

Data Analysis

Data was analysed by consulting documents of various origins (government, academia and consultants) which dealt with similar aspects of the socio-economic environment, and which was published over different time-frames; thereby establishing a nuanced and longitudinal perspective of the receiving environment. Information thus obtained was evaluated to establish status quo socio-economic conditions, prevailing social structures, local demographic trends, and potential change processes present in the study area.

3. Information Sources

The primary and secondary data sources used in the SIA include:

- Primary data generated through participant observation techniques;
- The South African Guideline for Involving Social Assessment Specialists in EIA (Barbour, 2007);
- The Kai !Garib Local Municipality IDP of 2015/17;
- Municipal Demarcation Board 2018 Municipal Capacity Assessment: Kai! Garib Local Municipality;
- Orlight SA (Pty) Ltd's "Kenhardt Solar PV Power Plant"; BioTherm (Pty) Ltd's "Aries Solar PV Facility"; AES Solar Energy Limited's "Olvyn Kolk PV Power Plant" and the Eskom SOC's "Aries-Helios 765 kV transmission line upgrade");
- The 2011 Census report (Statistics South Africa (StatsSA), 2011); and
- Academic journal articles on the topics of vandalism, teenage pregnancy and poverty such as Ceccato and Haining (2005).

4. Assumptions, Knowledge Gaps and Disclaimer

This SEIA is based on a number of key assumptions, which are aligned with industry practice, and is consequently subject to certain limitations. When deliberating the information, opinions and findings of this report; the relevant assumptions and limitations should be considered. However, the assumptions and limitations are not expected to invalidate the findings of this report.

Key assumptions:

- The SEIA is based on the technical information provided by the Applicant and which is assumed to be accurate (e.g. the proposed location, extent, scale of the project);
- The SEIA is largely based on secondary data. Accordingly, with the exception of field work conducted in 2015, no primary research or social surveys have been conducted as part of this assessment. However, the level of assessment and its attendant data sources were deemed adequate for the purposes of this study[1];
- The accuracy of secondary data sources directly influences the quality of this Social Impact Assessment. However, the data used in this assessment is published by reputable authors and are therefore deemed to be of sufficient quality for the purpose of this study; and
- It is assumed that the socio-economic conditions, as found during the assessment, will not undergo significant changes between the date of data collection and the release of this report.

Key limitations:

- Socio-economic impacts are inherently interconnected and do not lend itself to clear disaggregation into distinct impacts;
- Socio-economic impacts are notoriously difficult to quantify, and represents differing levels of significance to different individuals. Accordingly, the same impact might be experienced in vastly different ways by different individuals within the same community;

[1] As a general rule, socio-economic conditions will only exhibit significant change over relatively long timeframes, or following dramatic socio-economic or environmental events. Accordingly, the findings of the 2015 fieldwork conducted in the town of Kenhardt is still considered to be reasonably accurate.

- Socio-economic impacts, being the product of human behaviour, are derived from baseline information and anticipated project implications; as opposed to being empirically measured; and
- Humans, and the communities in which they live are adaptable, dynamic and open systems. Accordingly, the communities under investigation in this SEIA might react to various factors not necessarily related to the proposed development; thereby complicating clear inference of observed social change to anticipated project impacts.

Disclaimer:

The opinions expressed in this report have been based on the information supplied to ASA by the Applicant, CSIR, and available government publications. While ASA has exercised all due care in reviewing the available information, the conclusions drawn from this information are contingent on the veracity thereof. As a result, ASA does not accept responsibility for any errors or omissions in said information, nor does it accept any liability arising from any decisions or actions resulting therefrom. The opinions and findings presented in this report are relevant to the proposed development and its receiving environment as it existed at the time of the assessment; and is not necessarily applicable to socio-economic realities, conditions and/or features that may arise after the release of this report.

5.Consultation Processes Undertaken

Extensive fieldwork was conducted within the Kenhardt area in 2014, including telephonic consultation with selected landowners.

6. Description of Project Aspects relevant to Socioeconomic Impacts

The Project Applicant, Scatec, is proposing to design, construct and operate three 100 MW Solar PV power generation facilities, south of Upington in the Northern Cape Province (referred to as Kenhardt PV 4, 5 and 6) (Figure 1). The proposed facilities will be constructed on the farm Onder Rugzeer 168, which is situated alongside the farm Boven Rugzeer (Remaining Extent of Farm Number 169) and the proposed Eskom Nieuwehoop Substation. Each 100 MW plant will cover an approximate footprint of 250 hectares, however, this footprint could be further reduced during the planning stage. It is understood that the location of the proposed plants within the selected sites will be informed by the proximity to the proposed Eskom Nieuwehoop Substation, as well as the recommendations of the specialist studies and field work. The proposed project will make use of PV solar technology to generate electricity from the sun's energy. The Applicant is proposing to develop a facility with a possible maximum installed capacity of 100 MW of electricity from PV solar energy.

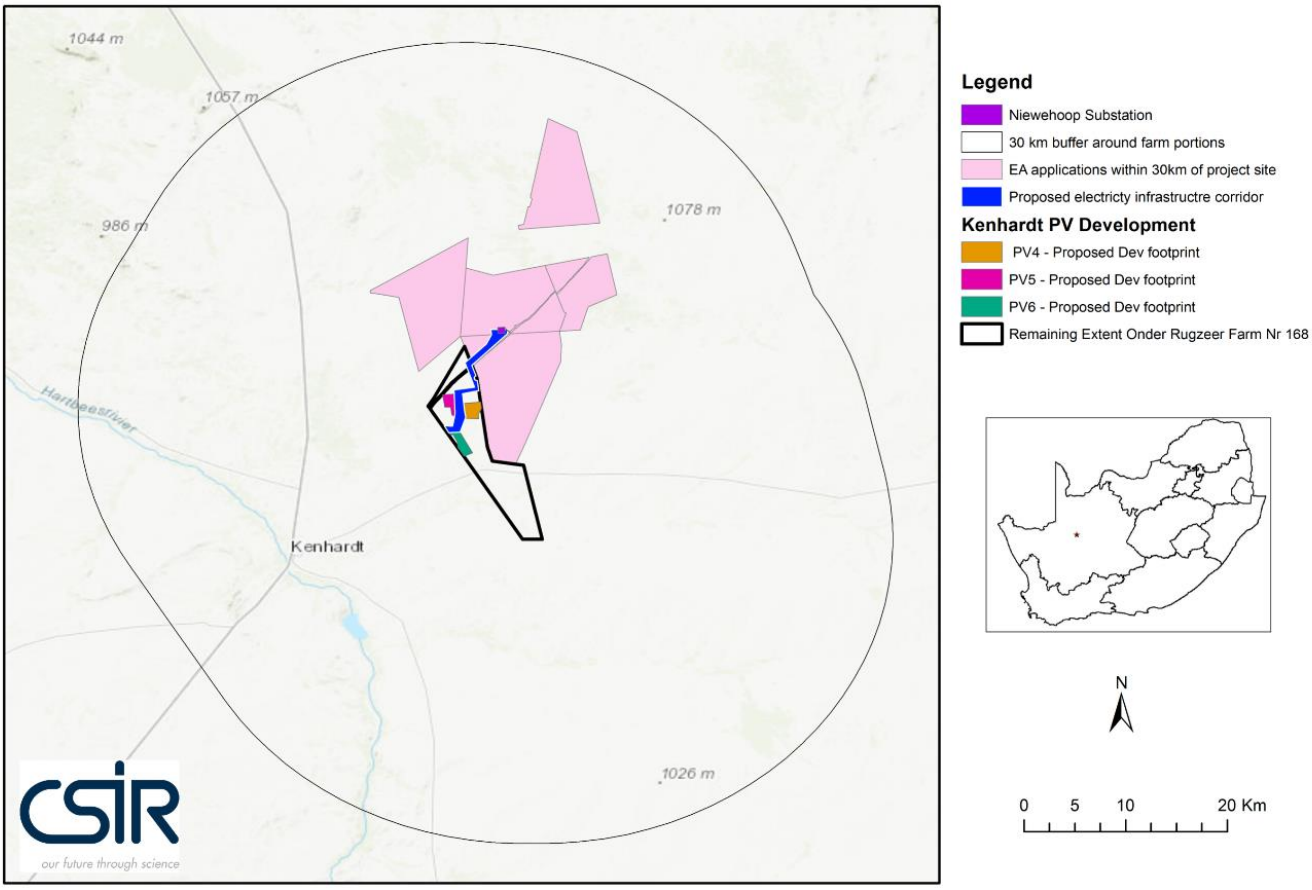

Figure 1 Map showing location of potential solar projects in immediate vicinity of the Scatec Kenhardt Phase 2 solar PV projects

From a socioeconomic perspective, the most important project as aspects are: (i) employment creation over the lifetime of the project, and (ii) the Economic Development Plan Scatec proposes to implement should the project obtain preferred bidder status.

Employment opportunities created during the construction phase for the PV projects equates to approximately 90 to 150 skilled and 400 to 450 unskilled employment opportunities during the construction phase, and approximately 20 skilled and 40 unskilled employment opportunities during the operational phase (i.e. 20 years). It should be noted that the employment opportunities provided in this report are estimates and is dependent on the final engineering design.

Scatec further proposes an Economic Development Plan which sets out to achieve the following:

- Create a local community trust which has an equity share in the project life to benefit historically disadvantaged communities;
- Initiate a training strategy to facilitate employment from the local community; and
- Give preference to local suppliers of components for the construction of the facility.

The creation of employment opportunities, as well as the proposed Economic Development Plan, will serve not only as potential positive project benefits to the local community; but is also likely to serve as an economic pull factor which may result in in-migration to the Kenhardt area.

7. Description of the Receiving Environment

7.1 Baseline Environmental Description

<u>7.1.1 Secondary data sources</u>

The study area is located within the ZF Mgcawu District Municipality. The actual project footprint is located in the !Kheis Local Municipality (part of the ZF Mgcawu District Municipality). However, the closest urban centre, Kenhardt, is located in the Kai !Garib Local Municipality. Given the proximity of the proposed project to the town of Kenhardt; the focus of this SIA will be on the Kai !Garib Local Municipality (Figure 2), as this is where the vast majority of potential project impacts (both positive and negative) might manifest.

The major social challenges faced in the Kai !Garib Municipal area include (Kai !Garib IDP, 2015/17):

- Increases in drug abuse;
- Increases in children under 10 years abusing alcohol;
- Increases in teenage pregnancies;
- Increased crime linked to alcohol and drug abuse;
- High youth unemployment rates; and
- Increased prevalence of HIV & AIDS.

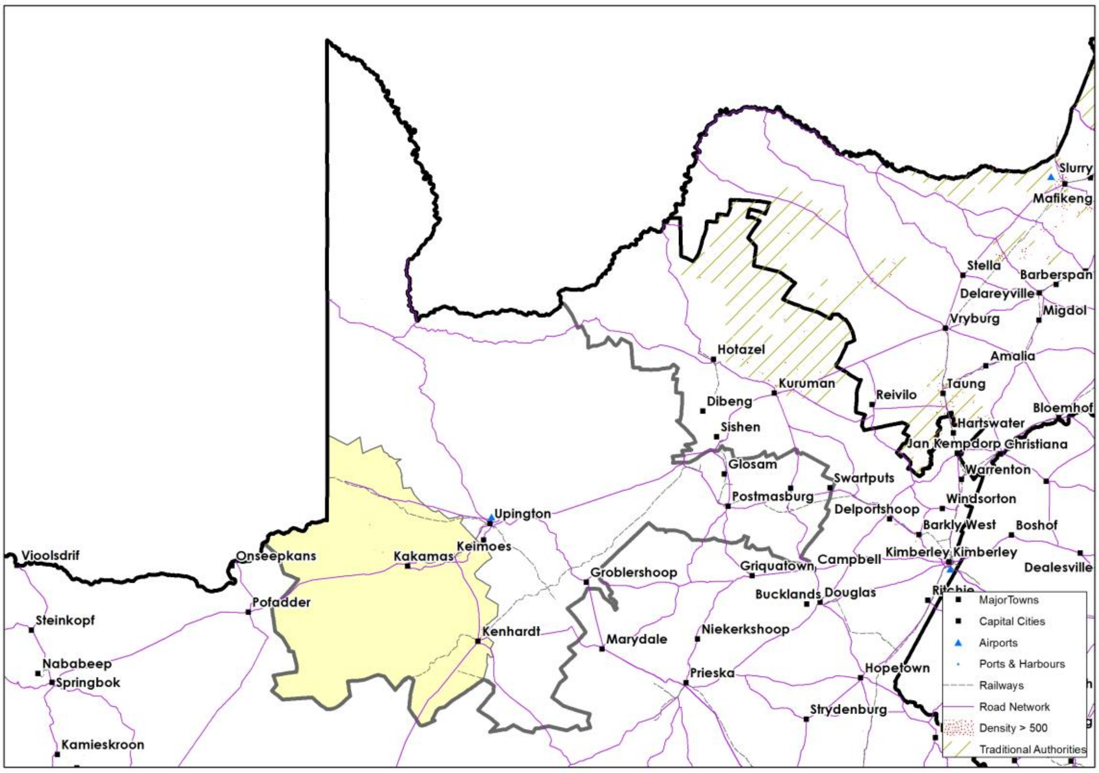

Figure 2 Location of the Kai! Garieb Local Municipality

(*Source*: Municipal Capacity Assessment, 2018)

7.1.1.1Demographics

According to the Kai !Garib IDP (2015/17) and the Stats SA 2011 Census data, the total population of the Kai !Garib municipal area is 65 869; of which 6 679 resides in the Kenhardt area. A total of 16 703 households resides in the Kai !Garib Local Municipality, with 34.6% of households being female headed.

The total female population dominates the total male population by 8.5% (Kai !Garib IDP, 2015/17). Small households (1 to 2 members) constitute 48.8% of the households in the Kai !Garib Local Municipality, while large households (>5 members) only constitute 14.8% (Municipal Capacity Assessment, 2018). The average household size in the Kai !Garib Local Municipality is 2.9 members per household. Notably, the percentage of small households in the Kai !Garib Local Municipality is higher than both the municipal average and national average (Figure 3).

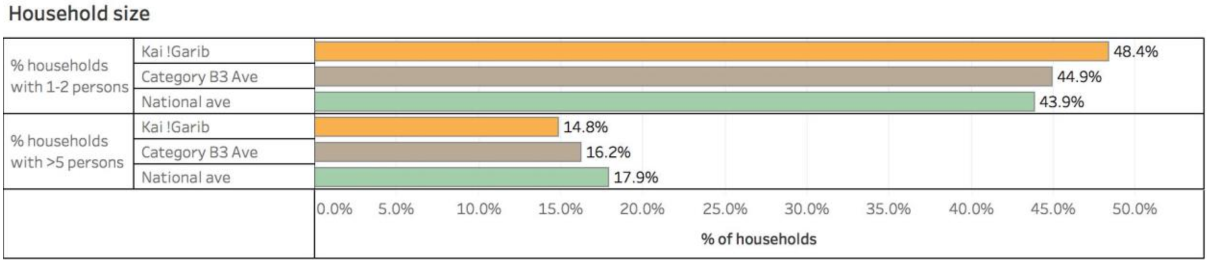

Figure 3 Household size within the Kai! Garib Local Munucipality

(Source: Municipal Capacity Assessment, 2018)

Population of the working age demographic (15 to 65 years) makes-up 70.5% of the population, whereas those below 15 years of age comprises 24.4% of the population; the + 65 years age group makes-up 5.1% of the population. According to the 2011 StatsSA census data, the dependency ratio (the economically active population vs the non-economically active population) within the Kai! Garieb Local municipality is 41.9%. However, the Municipal Demarcation Board's 2018 Municipal Assessment places the official dependency ration at 48.3% (Municipal Capacity Assessment, 2018). Figure 4 provides an indication of the age structure of the Kai! Garib Local Municipality as compared to the Category B3 municipal average and national average respectively.

Figure 4 Age breakdown of the Kai! GArib Local Municipality

(Source: Municipal Capacity Assessment, 2018)

7.1.1.2 Economic profile

The official unemployment rate of 10% has decreased by 6.1% since the 2011 Census measurement of 16.1% (Kai !Garib IDP, 2015/17). The economic sector is dominated by agriculture, hunting and forestry which provides 72% of jobs within the Kai! Garib Local Municipality; while electricity, gas and water (the sector relevant to the proposed development) only contribute 0.2% to total employment in the area (Figure 5).

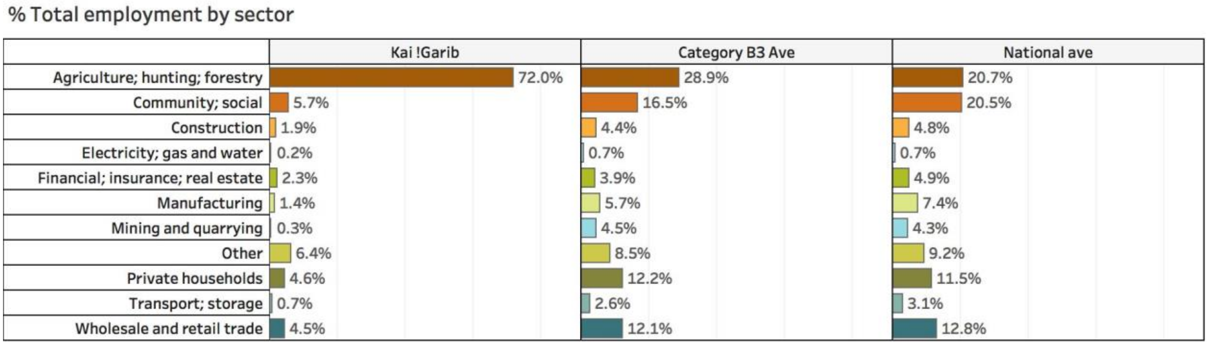

Figure 5 Total employment per sector within the Kai! Garib Local Municipality

(Source: Municipal Capacity Assessment, 2018)

In terms of dependency ratio (48.3%) and GINI coefficient (0.548), the Kai! Garib Local Municipality scores above average both in terms of the Category B3 municipal average and in terms of the national average (Municipal Capacity Assessment, 2018) (Figure 6). This implies that the Kai! Garib Local Municipality has a lower dependency ratio, and is less unequal than the national average.

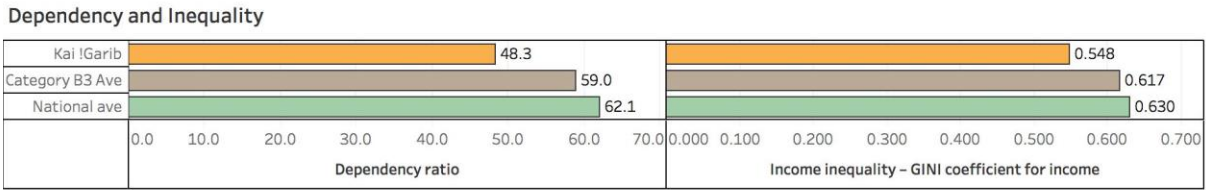

Figure 6 Dependency and inequality within the Kai! Garib Local Municipality

(Source: Municipal Capacity Assessment, 2018)

7.1.1.3 Education

The Kai! Garieb Local Municipality has a below average number of educational facilities, when compared with other level B3 municipalities and the national average. Figure 7 illustrates that the Kai! Garib Local Municipality has 3.6 primary schools per 10 000 population, but only 1.1 high schools per 10 000 population; which is 2.2% less than the national average (Municipal Capacity Assessment, 2018).

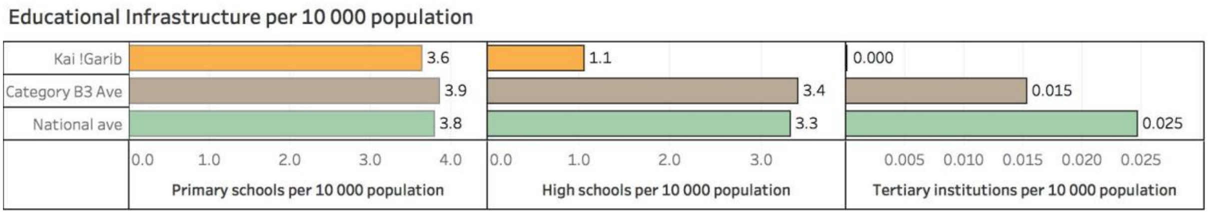

Figure 7 Dependency and inequality within the Kai! Garib Local Municipality

(Source: Municipal Capacity Assessment, 2018)

The matric pass rate within the Kai! Garib Local Municipality is slightly higher than the national average at 75.2%; while the local youth school enrolment is 14.7% lower than the national average at 74.9%. Furthermore, the local levels of education reveal that people with primary education (8.7%) and some secondary education (39.5%) is higher than the respective national averages; while those with secondary education (15.6%) are less than the national average (Municipal Capacity Assessment, 2018) (Figure 8).

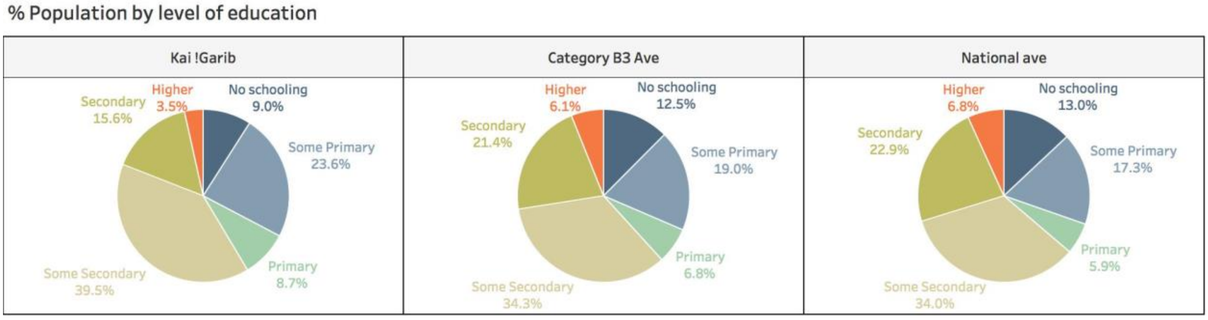

Figure 8 Percentage of population by level of education within the Kai! Garib Local Municipality

(Source: Municipal Capacity Assessment, 2018)

7.1.1.4 Basic services

Households in the Kai! Garib Local Municipality has above average access basic services, such as electricity, potable water, flush toilets and refuse removal. Within these categories, the Kai! Garib Local Municipality performs above both the national average for and the average for category B3 municipalities (Municipal Capacity Assessment, 2018) (Figure 9). There is a pressing need for low cost housing in the Kai! Garib Local Municipality, and the 2015/17 IDP reports an alarming increase in informal settlement growth (Kai! Garib IDP, 2015/17). According to 2011 Census data, 88.4% of the local population live in formal housing, with 43.1% living in informal structures (StatsSA, 2011). In the town of Kenhardt in particular, the current housing backlog is 250 houses (Kai! Garib IDP, 2015/17).

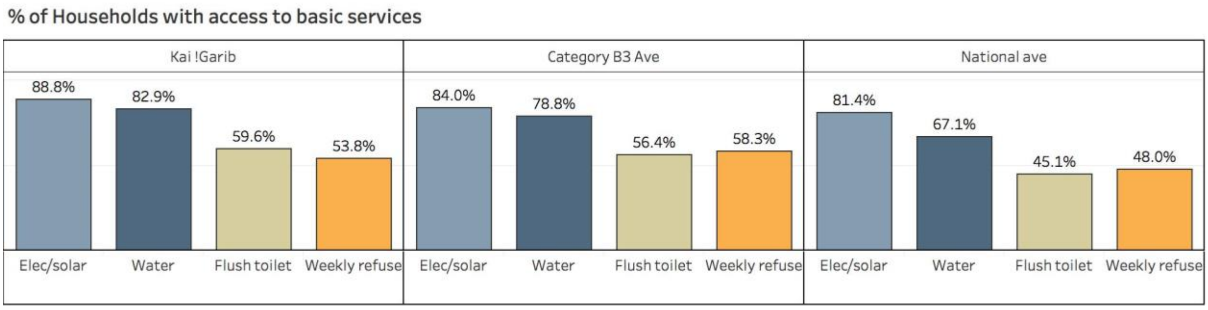

Figure 9 Percentage of households with access to basic services within the Kai! Garib Local Municipality

(Source: Municipal Capacity Assessment, 2018)

7.1.2 Fieldwork

While the secondary baseline information is useful in establishing a municipal-wide picture of the most prominent socioeconomic trends; it is not particularly informative with regards to the specific conditions present in the town of Kenhardt. To compensate for this limitation, fieldwork was conducted in the town of Kenhardt during 2014, in preparation for the assessment of the 2015 Scatec EIA Report.

The following section is reproduced from the 2015 Scatec EIA Report:

Informants[2] in Kenhardt indicated that levels of unemployment in the town are particularly high. All informants interviewed indicated that the vast majority of the economically active population is dependent on some form of government subsidy (reported to be approximately R 1300 per person per month). These statements appear to be reliable given the very limited amount of businesses operating within Kenhardt. Businesses generally consist of liquor stores, restaurants and accommodation (Bed and Breakfast), with only one observed clothing store (PEP) and one general dealer (KLK). Employment figures for these businesses appear to range from a minimum of one to a maximum of four employees. Agriculture in the Kenhardt area is dominated by sheep farming which requires particularly low levels of labour (approximately 2-4 labours per farm) (R. Grobbelaar, personal communication, 31 July 2014), with limited seasonal increases in labour requirements during the shearing season. Larger employers in Kenhardt include the local high school, the Kai !Garib municipal offices, the Department of Social Development satellite office and the local police station.

Subsequently, the local labour market appears to offer very limited absorption of the economically active component (i.e. approximately 4675 employment opportunities, based on a 70.5% working age demographic for the Kai !Garib municipal area) of the 6679 inhabitants of the Kenhardt area.

Participant observation further supports the claim of high unemployment. Groups of young men (approximately 16 to 30 years of age) where observed loitering on various street corners during the normal working hours of both days of the site visit (a Wednesday and Thursday during the weekday). Furthermore, public infrastructure (public telephones, the public swimming pool and benches) where vandalised to such an extent that further use of these facilities is impossible. Acts of social disorder, such as loitering and vandalism, are regularly associated with poverty and elevated levels of distress within communities (Richardson & Shackleton, 2014). According to Fisher and Baron’s (1982) Equity-Control Theory (ECT), acts of vandalism are often triggered by a perceived violation of norms related to fairness in terms of social and environmental arrangements. From this perspective, acts of vandalism can be understood as an attempt to reduce inequality.

Ceccato and Haining (2005) report that vandalism is particularly obvious in areas with low social integration and organisation; whereas Nowak *et. al.* (1990) reports higher levels of vandalism in areas with high unemployment rates and low private property ownership. A possible alternative interpretation of social disorder could be the “Broken Windows” theory put forward by Wilson and Keeling (1982). According to this theory, the presence of vandalism (or social disorder), however minor, creates a condition in which further vandalism is sanctioned; thereby increasing its frequency. However, acts of vandalism in Kenhardt were perpetrated in the formal, well maintained precinct of the town, as well as in the informal, poorly maintained precinct. This suggests that the “Broken Windows” theory does not apply to the observed social disorder in Kenhardt.

Informants further indicated that teenage pregnancies and drug abuse were major social issues in Kenhardt, and that the prevalence of these issues is increasing. This claim is validated by secondary data contained in the Kai !Garib Draft IDP (2014), which lists teenage pregnancy and drug abuse as major social challenges within the larger municipal area. Both these issues elevate the local dependency ratio, thereby placing already stressed livelihood strategies under even more strain.

Teenage pregnancy may be positively related to elevated levels of poverty, associated idleness and inappropriate forms or recreation (Were, 2007). Recreational opportunities in Kenhardt are extremely limited. A public rugby field and an oval racing track just outside of town are the only public recreational facilities offered. Informants identified an informal nightclub on the north-eastern outskirts of Kenhardt, which is associated (according to informants) with alcohol abuse and other forms of inappropriate recreation. Informants further confirmed that no internet cafes or public internet facilities are available

[2] Sociological research ethics dictates that the identity of informants (i.e. those being interviewed) should be protected if *any* possibility of physical, mental, emotional or legal harm exists. Accordingly, the identities of informants are not disclosed in this study.

in Kenhardt, which contributes to the overall lack of recreation/entertainment opportunities. Poverty and limited recreation opportunities may be contributing factors to the high teenage pregnancy rate. However, poor sex education, limited understanding of and access to modern contraception and lack of parental guidance are likely exacerbating factors.

With regards to teenage pregnancy; interviewed parents communicated disappointment and indignation, rather than concern about the practical implications of teenage pregnancy. This suggests a violation of existing cultural norms. It is therefore assumed that further escalation of teenage pregnancies (and/or teenage sexual activity) would continue to disrupt the Kenhardt community not only in terms of livelihoods, but also in terms of family relations. The relative lack of employment in and around Kenhardt is suggestive of a community heavily reliant on kinship and reciprocity for its economic survival. Accordingly, further deterioration of kinship ties as a result of cultural taboos might jeopardize the already precarious livelihood strategies of young mothers and their children.

8.Identification of Environmental Sensitivities

The high prevalence of female headed households (34%), combined with a dependency ratio of 48%, suggests that the Kai! Garib Local Municipality has a high proportion of vulnerable households; both in terms of social and financial jeopardy. A local unemployment rate of 10% is reported for the Kai! Garib Local Municipality which, though being lower than the national average, is nonetheless significant. Moreover, the Kai! Garib Local Municipality 2015/17 IDP reports that: "*The majority of residents are still dependant on government pensions, implying that a large part of the residents of Kai !Garib earn less than R 1 800-00 per month*."(Kai! Garib IDP 2015/17). Taken as a whole, this baseline information suggests that existing and future employment opportunities, as well as social support structures are of particular importance within the Kai! Garib Local Municipality. Notably, the local economy is disproportionately dependent on the agricultural sector; making-up 72% of the local economy (Kai! Garib IDP 2015/17). As such, its appears beneficial to diversify the local economy so as to reduce its dependence on the agricultural sector, while simultaneously seeking to protect employment within agriculture.

A second sensitivity appears to be suggested by the high incidence of 1-2 person households in the Kai! Garib Local Municipality, at 48.8% which is notably higher than the national average (Municipal Capacity Assessment, 2018). Small households are typically associated with a risk of escalated in-migration once the current household's income stream become more stable or expand. Regard should therefore be had to the fact hat the average household size in the Kai! Garib Local Municipality is a low 2.9 members per household. The baseline information consequently points toward a latent risk of in-migration, or chain migration, should economic conditions within the Kai! Garib Local Municipality improve. However, this risk appears to be moderated by the above average provision of basic services in the Kai! Garib Local Municipality, which suggest that existing bulk infrastructure and service provision are not under undue pressure. Accordingly, an influx of migrants is unlikely to disrupt basic service delivery or strain local bulk infrastructure.

The Kai! Garib Local Municipality's above average percentage of people with a primary education (8.7%) and some secondary education (39.5%) suggests that employment creation within the skilled and highly skilled sectors will not serve to absorb excess labour, and is unlikely to directly contribute to poverty alleviation. Any attempt at job creation in the area should therefore seek to create employment in the unskilled to semi-skilled sector; as this is likely to result in the most beneficial outcome in terms of labour absorption and poverty alleviation.

A final area of concern is the increased HIV prevalence and teenage pregnancy rate reported in the Kai! Garib 2015/17 IDP. Although no official figures are provided, these concerns were repeated by respondents during the fieldwork, and identified as key social ills. Given the relative vulnerability of the local community (both socially and economically); the risk posed by in-migration should be flagged as a concern. Most saliently, in-migration might encourage risky social behaviour among local youths, which includes early sexual experimentation and alcohol abuse. Furthermore, in-migration might destabilise local social structures aimed at setting social norms and serving as social safety nets.

9. Identification of Potential Impacts/Risks

The potential impacts associated with the BA are:

The no-go option

- No-go impact 1: Loss of employment and support industry creation

Construction/ Operational Phase

- Potential impact 1: Disruption of local social structures
- Potential impact 2: Increased risky social behavior
- Potential impact 3: Increased burden on existing social and bulk services
- Potential impact 4: Unrealistic expectations regarding local job creation and housing
- Potential impact 5: Limited employment created during the construction and operational phases
- Potential Impact 6: Development of locally-owned support industries to respond to construction-related activities
- Potential impact 7: Human development via the proposed Economic Development Plan

Decommissioning Phase

- Potential impact 8: Job losses

Cumulative Impacts

- Cumulative impact 1: Exacerbated in-migration of job seekers
- Combined impact of multiple Economic Development Plans

9.1 The no-go option

It is evident that none of the identified impacts (discussed under 5.2 through 5.4 below) will realise, should the proposed development not be constructed. However, this does not imply that the no-go option poses no impacts.

In this regard, it should be noted that the negative impacts identified for the preferred option might come into being, even in the absence of the proposed development; as most of these impacts are associated with non-development-related phenomena such as macro-economic fluctuations (e.g. a reduction in the Rand/US Dollar exchange rate will impact negatively on the local economy which could trigger similar job-seeking, influx, and socio-structural impacts as identified for the proposed development).

The positive impacts related to the construction and operation of the proposed development are not particularly significant, and likely to be temporary in nature, and therefore unlikely to accrue long-term benefits to the poor and those seeking permanent employment. The notable exception in this regard is the Economic Development Plan proposed by Scatec; which is likely to result in moderate positive impacts. However, the limited significance and temporary nature of the majority of project benefits cannot be construed as rendering it inconsequential. Logic appears to dictate that any improvement in the lives of the poor and vulnerable, however fleeting, is an improvement worth implementing.

Accordingly, a decision not to construct the proposed development (i.e. the no-go option) is likely to result in negative economic impacts on the immediate project area, commensurate to the potential positive impacts (with enhancement) likely to accrue from construction and operational phase employment and small-scale support industry creation; as these represents the opportunity cost forgone by selecting the no-go option.

9.2 Potential Impacts during the Construction Phase and Operational Phase

Potential impact 1: Disruption of local social structures as a result of the construction work force and in-migration of job seekers

Aspect/Activity	Site preparation and operation of the facility
Type of Impact (i.e. Impact Status)	Direct
Potential Impact	**Disruption of local social structures as a result of the construction work force and in-migration of job seekers**: The size of the anticipated workforce is a product of the scale of the proposed development, which is significant enough to support the inference of a large labour pool. On the other hand, in-migration as a result of jobseeker influx is likely to occur as a result of the high unemployment rate, and low-income levels in the study area. Consequently, there exists a strong possibility that jobseekers, who resides outside of the immediate project area may migrate into the immediate project area in search of employment.
Status	Negative
Mitigation Required	None available
Impact Significance (Pre-Mitigation)	Moderate (Level 3)
Impact Significance (Post-Mitigation)	Moderate (3)
I&AP Concern	No

Potential impact 2: Increased risky social behavior

Aspect/Activity	Site preparation and operation of the facility
Type of Impact (i.e. Impact Status)	Direct
Potential Impact	**Increased risky social behaviour:** Two commonly observed forms of risky social behaviour observed in poor or marginalized communities, are early sexual debut among teenagers (Dinkleman *et al*, 2008) and increased criminal behaviour. Disturbance of local social structures and the temporary increase in local spending power expected to result from workforce influx into the immediate project area, are likely to exacerbate the probability of risky social behaviour. Even though such influx is not expected to be a long-term feature of the local community; the impacts associated with risky social behaviour evidently are of a long-term nature.
Status	Negative
Mitigation Required	• No construction workers should be allowed to sleep at the construction site. • The construction workforce should receive HIV awareness training prior to the commencement of construction. • HIV and TB testing and counselling should be made available to the construction workforce free of charge. This can be achieved in collaboration with the local clinic or treatment initiatives like Right to Care (http://www.righttocare.org) which provides HIV and TB testing on-site via mobile clinics. • Local (within the immediate project area) HIV infection rates/ARV treatment loads must be monitored (annually) through close interaction with the local clinic. Should infections and treatment loads increase at a rate greater than the anticipated rate of increase; the Developer (or his appointed agent) must re-evaluate its HIV awareness training, take corrective action where necessary, and repeat said training.
Impact Significance (Pre-Mitigation)	Moderate (Level 3)
Impact Significance (Post-Mitigation)	Low (Level 4)
I&AP Concern	No

Potential impact 3: Increased burden on existing social and bulk services as a result of workforce and job seeker influx

Aspect/Activity	**Site preparation and operation of the facility**
Type of Impact (i.e. Impact Status)	Direct
Potential Impact	**Increased burden on existing social and bulk services as a result of workforce and job seeker influx:** Increased local population, within the immediate project area, is likely to occur as a result of the proposed development. Such an increase might be significant in terms of its effect on social structures and socio-economic wellbeing, but is not expected to be significant in terms of its impact on local social and bulk services. However, it should be noted that the bulk of the construction workforce is likely to be housed in backyard dwellings within existing informal settlements, with its attendant health challenges (e.g. poor sanitation and variable access to electricity for heating and lighting purposes). These impacts are, however, expected to be ad hoc and unlikely to impact on the larger community.
Status	Negative
Mitigation Required	None available
Impact Significance (Pre-Mitigation)	Low (Level 4)
Impact Significance (Post-Mitigation)	Low (Level 4)
I&AP Concern	No

Potential impact 4: Unrealistic expectations regarding local job creation with associated discontent and potential negativity towards the proposed development

Aspect/Activity	**Site preparation and operation of the facility**
Type of Impact (i.e. Impact Status)	Direct
Potential Impact	**Unrealistic expectations regarding local job creation with associated discontent and potential negativity towards the proposed development:** While the absolute elimination of employment and housing expectations are neither possible nor desirable; a consorted effort by the developer would be required to manage such expectations to be within reasonable bounds. Importantly, early intervention would be vitally important to help shape such expectations from as early stage as possible within the project development program. In the absence of such management initiatives, communities will shape their own expectations, which is bound to be informed by their specific needs. It is in the developer's best interest to manage these expectations, as a failure to do so might lead to discontent and potential negativity towards the development, with its attendant negative impacts (e.g. public opposition, potential protest action and potential damage to property).
Status	Negative
Mitigation Required	• The Applicant, or Contractor, must engage the local community (within the immediate project area) on the nature, duration, number and availability of employment opportunities well in advance of any construction activities taking place. It is recommended that existing social structures be utilised for such interaction, and that the process be commenced once environmental authorisations has been granted. • The Contractor should establish an employment desk at the construction site to facilitate employment-related queries, and maintain a register of applicants which reflects their respective expertise, skill level and contact/residential details. Whenever planned or ad hoc employment is considered, the register

	should be consulted to identify appropriately qualified candidates. • The existence of the employment desk, and the relevant procedures associated with the selection and appointment of workers must be communicated to the local community. • It is strongly suggested that every effort should be made to employ local residents.
Impact Significance (Pre-Mitigation)	Low (Level 4)
Impact Significance (Post-Mitigation)	Very Low (Level 5)
I&AP Concern	No

Potential impact 5: Limited employment created during the construction and operational phases of the development

Aspect/Activity	**Site preparation and operation of the facility**
Type of Impact (i.e. Impact Status)	Direct
Potential Impact	**Limited employment created during the construction and operational phases of the development:** A limited number of temporary jobs might be created for residents of the immediate project area. These jobs are expected to be for semi-skilled and unskilled labourers within the construction sector. Given the nature of the proposed development, very limited permanent employment opportunities for local residents are anticipated to result from the operation of the development. Accordingly, the relative employment creation capacity of the proposed development should be approached with caution.
Status	Positive
Enhancement Required	• The Contractor should establish an employment desk at the construction site to facilitate employment-related queries, and maintain a register of applicants which reflects their respective expertise, skill level and contact/residential details. Whenever planned or ad hoc employment is considered, the register should be consulted to identify appropriately qualified candidates. • The existence of the employment desk, and the relevant procedures associated with the selection and appointment of workers must be communicated to the local community. • It is strongly suggested that every effort should be made to employ local residents.
Impact Significance (Pre-Mitigation)	Moderate (Level 3)
Impact Significance (Post-Mitigation)	Moderate (Level 3)
I&AP Concern	No

Potential impact 6: Development of locally-owned support industries to respond to construction-related activities

Aspect/Activity	**Site preparation and operation of the facility**
Type of Impact (i.e. Impact Status)	Direct
Potential Impact	**Development of locally-owned support industries to respond to construction-related activities:** Limited opportunity exists for locally owned support industries to be developed in response to the construction-related activities associated with the proposed development (e.g. local accommodation, catering, and transport services). Such opportunities are anticipated to be temporary in nature.
Status	Positive
Enhancement Required	None available
Impact Significance (Pre-Mitigation)	Low (Level 4)
Impact Significance (Post-Mitigation)	Low (Level 4)
I&AP Concern	No

Potential impact 7: Human development via the proposed Economic Development Plan

Aspect/Activity	Site preparation and operation of the facility
Type of Impact (i.e. Impact Status)	Direct
Potential Impact	**Human development via the proposed Economic Development Plan:** Scatec indicated that an Economic Development Plan will be developed, should the proposed project be successful (i.e. selected as a preferred bidder, not merely obtaining a positive Environmental Authorisation). The positive impacts are self-evident and will relate to the creation of employment, local spending and human capacity development. However, the attainment of these positive impacts will create substantial social and economic pull factors which are likely to attract job seekers (i.e. a potential negative impact). Such negative impacts are however considered to be acceptable in light of the much-needed development in the area. Furthermore, these negative impacts are largely unavoidable, especially through EIA-level (i.e. project-level) interventions; as it is caused by complex structural inequalities which needs to be addressed at a strategic policy level. Subsequently, no mitigation is proposed.
Status	Positive
Enhancement Required	• The proponent should engage with local NGOs, CBOs and local government structures to identify and agree upon relevant skills and competencies required in the Kenhardt community • Such skills and competencies should then be included in the Economic Development Plan • Where possible, align Economic Development Plan with Local Municipality's IDP
Impact Significance (Pre-Mitigation)	Moderate (Level 3)
Impact Significance (Post-Mitigation)	Moderate (Level 3)
I&AP Concern	No

9.3 Potential Impacts during the Decommissioning Phase

Potential impact 8: Job losses

Aspect/Activity	Decommissioning
Type of Impact (i.e. Impact Status)	Direct
Potential Impact	**Job losses:** It is expected that the proposed projects could be decommissioned after an operational lifespan of approximately 20 years. Decommissioning of the proposed development will result in job losses. Though unavoidable in projects of this nature, appropriate measures should be taken to plan for such retrenchments and to provide the affected community with alternatives where practical and appropriate. Secondary impacts might result from incorrect decommissioning of project infrastructure which might be used for inappropriate purposes. This in turn could result in health and safety impacts on the local community.
Status	Negative
Mitigation Required	• The proponent should comply with relevant South African labour legislation when retrenching employees • Scatec should also implement appropriate succession training of locally employed staff earmarked for retrenchment during decommissioning • All project infrastructures should be decommissioned appropriately and thoroughly to avoid misuse
Impact Significance (Pre-Mitigation)	Moderate (Level 3)
Impact Significance (Post-Mitigation)	Moderate (Level 3)

I&AP Concern	No

9.4 Cumulative Impacts

Cumulative impact 1: Exacerbated in-migration of job seekers

Aspect/Activity	
Type of Impact (i.e. Impact Status)	Indirect
Potential Impact	**Exacerbated in-migration of job seekers**
Status	Negative
Mitigation Required	None available
Impact Significance (Pre-Mitigation)	Moderate (Level 3)
Impact Significance (Post-Mitigation)	Moderate (Level 3)
I&AP Concern	No

Cumulative impact 2: Combined human development caused by multiple Economic Development Plans being implemented

Aspect/Activity	
Type of Impact (i.e. Impact Status)	Indirect
Potential Impact	**Combined impact of multiple Economic Development Plans:** Should more than one solar PV facility be developed in the study area; it is very likely that multiple community development funds/initiatives might be implemented by the relevant project developers as part of their respective obligations under REIPPP. Such multiple Economic Development Plans is likely to enhance creation of employment, local spending and human capacity development (as discussed under Potential Impact 7 above)
Status	Posative
Mitigation Required	None available
Impact Significance (Pre-Mitigation)	Moderate (Level 3)
Impact Significance (Post-Mitigation)	Moderate (Level 3)
I&AP Concern	No

The incidence and severity of the in-migration of job seekers as well as increases in social deviance might increase as more solar energy facilities and associated electrical infrastructure (such as transmission lines) are developed in the study area. This is of importance as several other solar energy developments are being proposed in the Kenhardt area, as listed in Table 2 below. However, such increases are similarly associated with most other forms of economic and social development and should therefore be expected from any industrial-scale developments in the study area.

Finally, the cumulative success of the proposed project and other projects offering significant socio-economic benefits are likely to present a major economic pull factor which might exacerbate in-migration into the study area as well as increases in social deviance. However, the cumulative socio-economic benefit offered by industrial scale development in the study area outweighs the negative impacts associated with economic growth. It should also be borne in mind that influx of job seekers does not necessarily equate in social deviance; i.e. influx of job seekers is a social disruptor which *could* result in social impacts.

No significant cumulative impact is expected to result from decommissioning of the proposed development.

Table 2 Renewable energy projects and associated powerlines identified within 30km of the Scatec Phase 2 project

DEFF REF NO	PROJECT TITLE	DATE APPLICATION RECIEVED	APPLICANT	EAP	LOCAL MUNICIPALITY	TECHNOLOGY	MW	EA STATUS
14/12/16/3/3/2/1072	THE 75 MW AMDA CHARLIE PV SEF NORTH OF KENHARDT WITHIN THE KAI !GARIB LM IN THE NORTHERN CAPE PROVINCE	2018/09/12	AMDA Charlie (Pty) Ltd	Cape Environmental Assessment Practitioners (Pty) Ltd	Kai !Garib Local Municipality	Solar PV	75	Approved
14/12/16/3/3/2/1073	THE 75 MW AMDA Alpha PV SEF NORTH OF KENHARDT WITHIN THE KAI !GARIB LM IN THE NORTHERN CAPE PROVINCE	2018/09/11	AMDA Charlie (Pty) Ltd	Cape Environmental Assessment Practitioners (Pty) Ltd	!Kheis Local Municipality	Solar PV	75	Approved
14/12/16/3/3/2/847	75mw Solar Photovoltaic Facility (Boven 4) on the remaining extent of Boven Rugzeer Farm 169, North East of Kenhradt in the Northern Cape Province	2015/10/18	Boven Solar PV4 (Pty) Ltd	CSIR	!Kheis Local Municipality	Solar PV	75	Approved
14/12/16/3/3/2/842	75MW solar energy facility (Gemsbok PV4) on Protion 3 of Gemsbok Bult farm 120 near Kenhardt within the Kheis Local Municipality in the Northern cape province	2015/10/28	Gemsbok Solar PV3 (Pty) Ltd	CSIR	!Kheis Local Municipality	Solar PV	75	Approved
14/12/16/3/3/2/843	75MW solar energy facility (Gemsbok PV5) on Protion 8 of Gemsbok Bult farm 120 near Kenhardt within the Kheis Local Municipality in the Northern cape province	2015/10/28	Gemsbok Solar PV3 (Pty) Ltd	CSIR	!Kheis Local Municipality	Solar PV	75	Approved

14/12/16/3/3/2/1035	The 100MW Skeerhok 3 PV SEF north-east of Kenhardt within the Kheis Local Municipality, Northern Cape Province	2017/09/19	Juwi Renewable Energies (Pty) Ltd	Juwi Renewable Energies (Pty) Ltd	!Kheis Local Municipality	Solar PV	100	Approved
14/12/16/3/3/2/710	Proposed construction of Gemsbok PV1 75MW in Kenhardt, Northern Cape	2014/05/01	To review	CSIR	!Kheis Local Municipality	Solar PV	0	In process
14/12/16/3/3/2/711	Proposed construction of Gemsbok PV2 75MW in Kenhardt, Northern Cape	2014/05/01	To review	CSIR	!Kheis Local Municipality	Solar PV	0	In process
14/12/16/3/3/2/712	Proposed construction of the Boven PV1 75MW in Kenhardt, Northern Cape	2014/05/01	To review	CSIR	!Kheis Local Municipality	Solar PV	0	In process

10. Impact Assessment Tables

The assessment of impacts and recommendation of mitigation measures as discussed above are collated in Tables 3 to 5 below.

Table 3 Impact Assessment Summary Table for the Construction and Operational Phase

Aspect/ Impact pathway	Nature of potential impact/ risk	Status	Spatial Extent	Dura-tion	Conse-quence	Proba-bility	Reversi-bility of impact	Irreplace-ability of receiving environ-ment/ resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confi-dence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
CONSTRUCTION AND OPERATIONAL PHASE													
Impact 1: Influx of workforce and job seekers	Disruption of existing social structures	Negative	Local	Medium to Long-term	Substantial	Likely	Low	Moderate	None	Moderate	Moderate	3	Medium
Impact 2: Influx of workforce and job seekers	Increases in social deviance	Negative	Local	Medium-term	Substantial	Likely	Low	Moderate	• No construction workers should be allowed to sleep at the construction site. • The construction workforce should receive HIV awareness training prior to the commencement of construction. • HIV and TB testing and counselling should be made available to the construction workforce free of charge. This can be achieved in collaboration with the local clinic or treatment	Moderate	Low	4	Medium

Aspect/ Impact pathway	Nature of potential impact/ risk	Status	Spatial Extent	Dura-tion	Conse-quence	Proba-bility	Reversi-bility of impact	Irreplace-ability of receiving environ-ment/ resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confi-dence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
									initiatives like Right to Care (http://www.righttocare.org) which provides HIV and TB testing on-site via mobile clinics. • Local (within the immediate project area) HIV infection rates/ARV treatment loads must be monitored (annually) through close interaction with the local clinic. Should infections and treatment loads increase at a rate greater than the anticipated rate of increase; the Developer (or his appointed agent) must re-evaluate its HIV awareness training, take corrective action where necessary, and repeat said training.				

Aspect/ Impact pathway	Nature of potential impact/ risk	Status	Spatial Extent	Dura-tion	Conse-quence	Proba-bility	Reversi-bility of impact	Irreplace-ability of receiving environ-ment/ resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confi-dence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
Impact 3: Influx of workforce and job seekers	Increased burden on bulk services and social infrastructure	Negative	Local	Short-term	Moderate	Likely	Moderate	Moderate to low	None	Low	Low	4	Medium
Impact 4: Expectations created regarding possible employment	Increased frustration in the local community	Negative	Local	Medium to long-term	Moderate	Likely	Moderate	Moderate	• The Applicant, or Contractor, must engage the local community (within the immediate project area) on the nature, duration, number and availability of employment opportunities well in advance of any construction activities taking place. It is recommended that existing social structures be utilised for such interaction, and that the process be commenced once environmental authorisations has been granted.	Low	Very Low	5	Medium

Aspect/ Impact pathway	Nature of potential impact/ risk	Status	Spatial Extent	Dura-tion	Conse-quence	Proba-bility	Reversi-bility of impact	Irreplace-ability of receiving environ-ment/ resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confi-dence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
									• The Contractor should establish an employment desk at the construction site to facilitate employment-related queries, and maintain a register of applicants which reflects their respective expertise, skill level and contact/residential details. Whenever planned or ad hoc employment is considered, the register should be consulted to identify appropriately qualified candidates. • The existence of the employment desk, and the relevant procedures associated with the selection and appointment of workers must be communicated to the local community.				

Aspect/ Impact pathway	Nature of potential impact/ risk	Status	Spatial Extent	Dura-tion	Conse-quence	Proba-bility	Reversi-bility of impact	Irreplace-ability of receiving environ-ment/ resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confi-dence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
									• It is strongly suggested that every effort should be made to employ local residents.				
Impact 5: Limited local employment	Socio-economic benefits	Positive	Local	Long-term	Substantial	Very likely	n/a	n/a	• The Contractor should establish an employment desk at the construction site to facilitate employment-related queries, and maintain a register of applicants which reflects their respective expertise, skill level and contact/residential details. Whenever planned or ad hoc employment is considered, the register should be consulted to identify appropriately qualified candidates. • The existence of the employment desk, and the relevant procedures associated with the selection and appointment of workers	Moderate	Moderate	3	High

Aspect/ Impact pathway	Nature of potential impact/ risk	Status	Spatial Extent	Dura-tion	Conse-quence	Proba-bility	Reversi-bility of impact	Irreplace-ability of receiving environ-ment/ resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confi-dence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
									must be communicated to the local community. • It is strongly suggested that every effort should be made to employ local residents.				
Impact 6: Economic Development Plan	Contribute to local employment, local spending and human capacity development	Positive	Local	Long-term	Substantial	Very likely	n/a	n/a	• The proponent should engage with local NGOs, CBOs and local government structures to identify and agree upon relevant skills and competencies required in the Kenhardt community • Such skills and competencies should then be included in the Economic Development Plan • Where possible, align Economic development Plan with Local Municipality's IDP	Moderate	Moderate	3	High
Impact 7: Development of locally owned support indstries	Socio-economic benefits	Positive	Local	Long-term	Substantial	Very likely	n/a	n/a	None	Low	Low	4	High

Table 4 Impact Assessment Summary Table for the Decommissioning Phase

Decommissioning Phase													
Direct Impacts													
Aspect/ Impact Pathway	**Nature of Potential Impact/ Risk**	**Status**	**Spatial Extent**	**Duration**	**Consequence**	**Probability**	**Reversibility of Impact**	**Irreplaceability**	**Potential Mitigation Measures**	**Significance of Impact and Risk**		**Ranking of Residual Impact/ Risk**	**Confidence Level**
										Without Mitigation/ Management	**With Mitigation/ Management (Residual Impact/ Risk)**		
Impact 8: Decommissioning of the facility	Job losses	Negative	Local	Long-term	Substantial	Very likely	Moderate	Moderate	• The proponent should comply with relevant South African labour legislation when retrenching employees • Scatec should also implement appropriate succession training of locally employed staff earmarked for retrenchment during decommissioning • All project infrastructures should be decommissioned appropriately and thoroughly to avoid misuse	Moderate	Low	4	High

Table 5 Cumulative Impact Assessment Summary Table

Cumulative Impacts (Construction, Operational and Decommissioning Phases)													
Direct Impacts													
Aspect/ Impact Pathway	**Nature of Potential Impact/ Risk**	**Status**	**Spatial Extent**	**Duration**	**Consequence**	**Probability**	**Reversibility of Impact**	**Irreplaceability**	**Potential Mitigation Measures**	**Significance of Impact and Risk**		**Ranking of Residual Impact/ Risk**	**Confidence Level**
										Without Mitigation/ Management	**With Mitigation/ Management (Residual Impact/ Risk)**		
Cumulative impact 1: Exacer-bated in-migration	Disruption of social structures	Negative	Local	Medium to long-term	Substantial	Unlikely	Low	Moderate	n/a	Moderate	Moderate	3	Medium
Cumulative impact 2: Implementation of multiple Economic Development Plans	Contribute to local employment, local spending and human capacity development	Positive	Local	Long-term	Substantial	Unlikely	n/a	n/a	n/a	Moderate	Moderate	3	Medium

11. Impact Assessment Summary

The overall impact significance findings, following the implementation of the proposed mitigation measure are shown in Table 6 below:

Table 6 Overall Impact Significance (Post Mitigation)

Phase	**Overall Impact Significance**
Construction	Low to moderate (negative) / Moderate (positive)
Operational	Low to moderate (negative) / Moderate (positive)
Decommissioning	Low (negative)
Nature of Impact	**Overall Impact Significance**
Cumulative - Construction	Moderate (negative)
Cumulative - Operational	Moderate (negative)
Cumulative - Decommissioning	No impact

12. Legislative and Permit Requirements

No licences or permits are required in in relation the socioeconomic impact of the proposed development.

13. Environmental Management Programme Inputs

The key mitigation measures proposed by the specialist, and which needs to be included in the EMPr are listed below.

<u>Construction and Operational Phase Mitigations:</u>

- No construction workers should be allowed to sleep at the construction site;
- The construction workforce should receive HIV awareness training prior to the commencement of construction;
- HIV and TB testing and counselling should be made available to the construction workforce free of charge. This can be achieved in collaboration with the local clinic or treatment initiatives like Right to Care (http://www.righttocare.org) which provides HIV and TB testing on-site via mobile clinics;
- The Applicant, or Contractor, must engage the local community (within the immediate project area) on the nature, duration, number and availability of employment opportunities <u>well in advance of any construction activities taking place</u>. It is recommended that existing social structures be utilised for such interaction, and that the process be commenced once environmental authorisations has been granted;
- The Contractor should establish an employment desk at the construction site to facilitate employment-related queries, and maintain a register of applicants which reflects their respective expertise, skill level and contact/residential details. Whenever planned or ad hoc employment is considered, the register should be consulted to identify appropriately qualified candidates;
- The existence of the employment desk, and the relevant procedures associated with the selection and appointment of workers must be communicated to the local community;
- The Contractor should establish an employment desk at the construction site to facilitate employment-related queries, and maintain a register of applicants which reflects their

respective expertise, skill level and contact/residential details. Whenever planned or ad hoc employment is considered, the register should be consulted to identify appropriately qualified candidates;

- The existence of the employment desk, and the relevant procedures associated with the selection and appointment of workers must be communicated to the local community;
- It is strongly suggested that every effort should be made to employ local residents;
- The proponent should engage with local NGOs, CBOs and local government structures to identify and agree upon relevant skills and competencies required in the Kenhardt community;
- Such skills and competencies should then be included in the Economic Development Plan;
- Where possible, align Economic Development Plan with Local Municipality's IDP;
- The proponent should engage with local NGOs, CBOs and local government structures in the Kenhardt community to identify and agree upon relevant skills and competencies required;
- Such skills and competencies should then be included in the Economic Development Plan; and
- Where possible, align the Economic Development Plan with Local Municipality's IDP.

Decommissioning Phase Mitigations

- The proponent should comply with relevant South African labour legislation when retrenching employees;
- Scatec should also consider appropriate succession training of locally employed staff earmarked for retrenchment during decommissioning; and
- All project infrastructures should be decommissioned appropriately and thoroughly to avoid misuse.

14. Conclusion and Recommendations

Very little socio-economic data is available for the study area. Census data and information from the Kai !Garib Local Municipality Draft IDP (2015/17) was obtained; however, these only deal with the larger municipal area and offer no site specific data on socio-economic conditions within and around the town of Kenhardt. Secondary data was subsequently augmented by a site visit in 2014. The site visit suggests that Kenhardt is an area of low employment and substantial poverty and limited livelihood strategies.

The main income source among vulnerable communities appears to be government subsidies, with limited income generated from employment within industries operating in Kenhardt. Risky social behaviour (i.e. teenage pregnancy and drug abuse) is a major challenge in the area. Such deviance could threaten social capital on which much of the existing livelihood strategies depend. Unemployment seems to be the single greatest challenge and problem driver in Kenhardt. Not only does unemployment deprive community members from income, it also constrains empowerment and the subsequent ability to perceive one's subjective social reality as meaningful. This more often than not exacerbates risky social behaviour.

Vulnerable community members might be negatively impact by the proposed project through the influx of opportunistic job seekers. Such an influx might threaten existing social structures and social support networks. Risky social behaviour might also be increased as a result of the proposed project; as deviant behaviour (e.g. prostitution and teenage pregnancy) are likely to increase as more outsiders migrate into Kenhardt in search of employment. Frustrated expectations of employment, created by the proposed development, could also contribute feelings of distrust in the developer and, in isolated instances, damage to project property and potential intimidation of staff. Furthermore, the likelihood of job losses once the proposed project reaches its decommissioning phase is high.

Positive socio-economic impacts likely to result from the project are increased local spending, the creation of local employment opportunities and the proposed development of an Economic

Development Plan. These impacts will benefit the community through the creation of income generation opportunities and human development through skills development and training.

The overall significance rating of the _negative_ socio-economic impacts associated with the proposed project is ***low to moderate***; whereas the overall significance rating of the _positive_ socio-economic impacts associated with the proposed development is ***moderate***.

15. Final Specialist Statement and Authorisation Recommendation

It should be accepted that the development of the proposed project is likely to result in some form of negative social impact to the local community. However, such a negative impact needs to be weighed against the potential benefit likely to result from the same development. Given the overall low to moderate significance of potential negative impacts associated with the project, as compared to the overall medium significance positive impact of the project; it can be concluded that the prospective socio-economic benefits of the proposed project outweighs the socio-economic losses/impacts.

16. EA Condition Recommendations

From a social impact perspective, in light of the above argument, the specialist conducting this SEIA is of the opinion that the proposed projects should be authorised by the competent authority.

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TRAFFIC IMPACT STATEMENT

Basic Assessment for the proposed construction of three Solar Photovoltaic (PV) Facilities (i.e. Kenhardt PV4, Kenhardt PV5 and Kenhardt PV6) and associated electrical infrastructure, near Kenhardt, in the Northern Cape.

Report prepared for:

CSIR – Environmental Management Services
P O Box 320
Stellenbosch
7599
South Africa

Report prepared by:

WSP Group Africa (Pty) Ltd
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January 2020

COMPLIANCE WITH THE APPENDIX 6 OF THE 2014 EIA REGULATIONS

Requirements of Appendix 6 – GN R982	Addressed in the Specialist Report
1. (1) A specialist report prepared in terms of these Regulations must contain- a) details of- i. the specialist who prepared the report; and ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	Section 14.1.3 and Appendix 9.2 of this Report
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Appendix 9.1
c) an indication of the scope of, and the purpose for which, the report was prepared;	Sections 14.1.1 and 14.2, pages 14-5 and 14-6
(cA) an indication of the quality and age of base data used for the specialist report;	Section 14.3 page 14-10
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 14.5 page 14-11
d) the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	N/A
e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 14.2 page 14-6
f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	N/A
g) an identification of any areas to be avoided, including buffers;	N/A
h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	N/A
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 14.1.2 page 14-5
j) a description of the findings and potential implications of such findings on the impact of the proposed activity or activities;	Section 14.6 page 14-11 and Section 14.7 page 14-20
k) any mitigation measures for inclusion in the EMPr;	Section 14.6 page 14-11 and Section 14.7 page 14-20
l) any conditions for inclusion in the environmental authorisation;	Section 14.6 page 14-11 and Section 14.7 page 14-20
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 14.6 page 14-11 and Section 14.7 page 14-20
n) a reasoned opinion- i. whether the proposed activity, activities or portions thereof should be authorised;	Section 14.6 page 14-11 and Section 14.7 page 14-20

Requirements of Appendix 6 – GN R982	**Addressed in the Specialist Report**
(iA) regarding the acceptability of the proposed activity or activities; and ii. if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	N/A
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	N/A
q) any other information requested by the competent authority.	N/A
(2) Where a government notice by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	N/A

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14 TRAFFIC IMPACT STATEMENT

14.1 INTRODUCTION

The CSIR conducted an EIA (Environmental Impact Assessment) and prepared an Environmental Management Programme (EMPr) for three 75 megawatt (MW) solar photovoltaic (PV) facilities on the Remaining extent of Onder Rugzeer Farm 168, north-east of Kenhardt in the Northern Cape Province. The application was done on behalf of Scatec Solar Africa (PTY) Ltd. These projects were referred to as Kenhardt PV 1, 2 and 3 and received Environmental Authorisation in 2017.

The Project Applicant, Scatec, is proposing to design, construct and operate Phase 2 of this project, which consists of an additional three 100 MW Solar PV power generation facilities, referred to as Kenhardt PV 4, 5 and 6. Each 100 MW plant will cover an approximate footprint of 250 hectares, however, this footprint could be further reduced during the planning stage.

As per the Plan of Study included in Scoping Report and subsequently approved by the Department of Environmental Affairs (DEA), it was indicated that a Traffic Impact Statement (TIS) will be produced by the CSIR to show the amount of traffic that can be expected during the construction and operational phases from the development of the proposed Kenhardt PV 4, Kenhardt PV 5, and Kenhardt PV 6 solar energy projects, as well as the proposed Kenhardt PV 4 – Transmission Line, Kenhardt PV 5 – Transmission Line, and Kenhardt PV 6 – Transmission Line projects.

In this regard, the study focuses on the regional setting in which these projects are proposed and the roads that will be utilised for these projects. The report has therefore been produced for all the projects due to the scale of the assessment and the fact that all the projects are going to use the same road infrastructure.

14.1.1 Terms of Reference

The key issues associated with the construction and operational phases of the project that will be assessed as part of the TIS are:

- Increase in traffic generation throughout the lifetime of the project;
- Decrease in air quality; and
- Increase in road maintenance required.

14.1.2 Assumptions and Limitations

The TIS has been based on the traffic information provided by Scatec. The traffic information was obtained from previous projects and estimates of similar projects currently proposed by Scatec.

14.1.3 Declaration of Independence of Specialists

The declaration of independence by the specialist is provided below with a full declaration included in Appendix 9.1 of this Traffic Impact Statement. The Curriculum Vitae of Mr. Herbert Phahlane, which highlights his experience and expertise is included in Appendix 9.2 of this Report.

DECLARATION OF INDEPENDENCE

I, Herbert Phahlane, declare that I am an independent consultant and have no business, financial, personal or other interest in the proposed Kenhardt PV 4, 5 and 6 Project, application or appeal in respect of which I 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 my performing such work.

HERBERT PHAHLANE

14.2 APPROACH AND METHODOLOGY

14.2.1 Objectives

- Determine the current traffic conditions in sufficient detail so that there is a baseline against which impacts can be identified and measured;
- Identify potential impacts and cumulative impacts that may occur during the construction, operational and decommissioning phases of development;
- Provide recommendations with regards to potential monitoring programmes;
- Determine mitigation and/or management measures which could be implemented to as far as possible reduce the effect of negative impacts and enhance the effect of positive impacts; and
- Incorporate and address all issues and concerns raised by Interested and Affected Parties (I&Aps) and the public (if applicable).

14.2.2 Methodology

The key steps followed in this assessment are:

- Review of available desktop information, including the South African National Roads Agency (SANRAL) National traffic count information, google earth images and similar projects; and
- Liaison with Transnet SOC Ltd regarding access roads to be used and requirements associated with it.

14.3 AFFECTED ENVIRONMENT

During all phases (construction, operation and decommissioning) of the project, traffic will be generated. The highest traffic volumes will be created during the construction phase. This includes activities associated with:

- Site preparation and transporting the construction materials, and associated infrastructure to the site; and
- Transportation of employees to and from the site on a daily basis.

The proposed project site can be accessed via an existing gravel road (an unnamed farm road) and the existing Transnet Service Road (private). Both access routes will be considered in the design of the facility and have been included in the proposed project. The R27 extends from Keimoes (in the north) to Vredendal in the south. The R27 is 6 m wide and falls within a 45 m road reserve. This National Road is designed for minimum daily traffic exceeding 1000 vehicle units. The Transnet Service Road can be accessed from the R27. The existing gravel road can be accessed from the R383 Regional Road also via the R27 National Road. The Transnet Service Road and unnamed farm road are both 7-8 m wide, however in certain sections, the unnamed farm road is believed to be about 2-3 m wide. A further access road will be constructed from either the Transnet Service Road or the unnamed farm road to the proposed Kenhardt PV 1 to PV 6 facilities.

Should the Transnet Service Road be considered the preferred access road, it is proposed that an internal gravel road be constructed from the road to the proposed site. This internal gravel road is not expected to exceed 6 m in width. The length of the internal gravel road will be confirmed as the location, design and layout of the facility progresses; however a preliminary site layout plan has been included in Chapter 16 and Appendix J of the EIA Report. Discussions have been initiated and held with Transnet and the Project Applicant during the Scoping and EIA Process regarding the potential use of the Transnet Road and associated specific requirements. Transnet have informed the Project Applicant of their requirements that need to be met by the Project Applicant should the Transnet Service Road be used as to gain access to the site. These requirements will be considered in the design of the facility where required, and the details of the agreement will be finalised outside of this EIA Process.

A photo plate is included (Photo 14.1-14.4) to show the intersection of the Transnet Service Road with the R27 and the current condition of the roads.

Photo 14.1: R27 towards the south (taken towards Kenhardt). The board shows “Loop 14”, located to the left, which is accessed via the Transnet Service Road. (Image source: Google, 2010)

Photo 14.2: The intersection of the R27 and Transnet Service Road, going towards Kenhardt. As can be seen on this image, the R27 was being upgraded in 2010 (Image source: Google, 2010)

Photo 14.3: The intersection of the R27 and Transnet Service Road, going towards Keimoes (Image source: Google, 2010)

Photo 14.4: The access point to the Transnet Service Road (Image taken: July 2014)

The closest roads to the site for which traffic counts are available show that the R383 (road between Kenhardt and Marydale) and the R361 (between Van Wyksvlei and Kenhardt) have Average Daily Traffic (ADT) counts of 35 and 41, respectively (SANRAL, 2007). The ADTs show that the current traffic volumes are well below the maximum traffic limits for the roads discussed above. Even though traffic will be generated during the construction and operation of the solar energy facilities, given the low ADTs of the surrounding roads, it is not expected that the traffic generated by the solar energy facilities will exceed the maximum daily traffic limits for the abovementioned roads.

14.4 TRANSPORT INFORMATION

The general current limitations on road freight transport are:

- Axle load limitation of 7,7t on front axle, 9,0t on single rear axles;
- Axle unit limitations are 18t for dual axle unit and 24t for 3 axle unit;
- Gross vehicle mass of 56t. This means a typical payload of about 30t;
- Maximum vehicle length of 22m for interlink, 18,5m for horse and trailer and 13,5 for a single unit;
- Width limit of 2,6m; and
- Height limit 4,3m.

Abnormal permits are required for vehicles exceeding these limits.

14.4.1 Solar Farm Freight

Materials and equipment transported to the site comprise of:

- Building materials (concrete aggregates, cement and gravel);
- Construction equipment such as piling rigs and cranes;
- Solar panels (panels and frames); and
- Transformer and cables.

The following is anticipated:

A. Building materials comprising of concrete materials for strip footings or piles will be transported using conventional trucks which would adhere to legal limits listed above.
B. Solar Panels and frames will probably be transported in containers using conventional heavy vehicles within the legal limits. The number of loads will be a function of the capacity of the solar farm and the extent of the frames (the anticipated number of loads are discussed below).
C. Transformers will be transported by abnormal vehicles.

14.4.2 Traffic Generation

The traffic generation estimates detailed below have been determined based on a single solar energy facility and the associated electrical infrastructure (collector substation and transmission line).

- ***Construction Phase***

Approximately 1066 x 40ft containers resulting in more or less 600 double axel trucks will come to site during the construction phase (i.e. over a period of 9 to 24 months). In addition to this, more or less 26 light load trucks will come from and go to site on a daily basis during the construction phase. It is estimated that a total of 19 800 trips to the site, based on a 24 month construction phase.

In terms of water supply, the current proposal is to truck water to site via municipal water supply. It is estimated that 1 trip will be made by the water truck every 2 days. In total, this adds up to 365 trips by the water truck over a period of 24 months.

It is important to note that the construction period is likely to extend 14 months (as noted in Chapter 2 of this EIA Report), however the worst case scenario has been considered in this TIS.

- ***Operational Phase***

More or less 6 light load trucks will come from and go to site on a daily basis and 1 small single axel truck to and from site on a weekly basis. The lifetime of the project is 20 years which means that the total amount of trips would be 40 320 over this period. For water supply, the current estimate is that 2 trips per month will be made by a water truck.

- ***Decommissioning Phase***

As per the construction phase, approximately 1066 x 40ft containers resulting in more or less 600 double axel trucks will come to site during the decommissioning phase. The decommissioning phase usually takes 12 months (i.e. over a period of 9 to 24 months). In addition to this, more or less 26 light load trucks to and from site will come and go to site on a daily basis.

14.5 IDENTIFICATION OF IMPACTS

The traffic impacts that will be generated by the proposed facilities are detailed below. The impacts will largely occur during the construction phase of the project, since this is when the highest amount of traffic will be generated by the proposed facility (refer to Section 14.4.2).

The impacts identified and further assessed are:

1. Increase in traffic generation.
2. Accidents with pedestrians, animals and other drivers on the surrounding tarred/gravel roads.
3. Impact on air quality due to dust generation, noise and release of air pollutants from vehicles and construction equipment.
4. Decrease in quality of surface condition of the roads.
5. Cumulative impact of traffic generation of three projects and related projects.

14.6 ASSESSMENT OF IMPACTS AND IDENTIFICATION OF MANAGEMENT ACTIONS

This section assesses the significance of the impacts identified in Section 14.5. Appropriate mitigation and management measures to reduce the significance of the negative impacts and promote the positive impacts have been included in the EMPr.

14.6.1 Increase traffic generation

As discussed in Section 14.4 of this report, conventional trucks, conventional heavy vehicles and abnormal vehicles transporting loads will need to come to site to deliver the infrastructure required for the solar facility. The impact of this on the general traffic would be negligible as the additional peak hour traffic would be at most 3 trips.

Significance of impacts without mitigation
Although the construction phase would have the greatest impact on traffic generated by the proposed project, the increase in traffic will only result in an addition of 3 trips during peak hour traffic (worst case scenario). Based on the traffic counts discussed in Section 14.3 of this Chapter, the ADT for this area is between 35 - 41 vehicles. The R27 is designed for 1000 units per day and therefore, the additional traffic generated during the construction phase will have a **low** negative impact.

The operational phase will have a lower traffic generation since only the personnel permanently employed on site would need to go to site every day. It is not expected that this would exceed 5 trips per day. This negative impact would therefore be **very low.**

Since it is unclear at this stage what the traffic numbers will be in the Kenhardt area in 20 years' time and the amount of trucks required for decommissioning, the impacts associated with this phase of the project were based on the construction phase details given that this is the worst case scenario in terms of traffic generation. Therefore, the significance of the impact would be **low** negative.

Proposed mitigation
Even though the traffic generated would not be significant, the following requirements should still be met by the developer during the construction and decommissioning phases:

- Should abnormal loads have to be transported by road to the site, a permit needs to be obtained from the Provincial Government Northern Cape (PGNC) Department of Public Works, Roads and Transport;
- Provide a Transport Traffic Plan to SANRAL;
- Ensure that roadworthy and safety standards are implemented at all time for all construction vehicles; and
- Plan trips so that it occurs during the day but avoid construction vehicles movement on the regional road during peak time (06:00-10:00 and 16:00-20:00).

Requirements to be met during the operational phase:

- Adhere to requirements made within Transport Traffic Plan;
- Limit access to site to personnel; and
- Ensure that where possible, staff members carpool to site.

14.6.2 Accidents with pedestrians, animals and other drivers on the surrounding tarred/gravel roads

During all phases, vehicles will need to access the site via the R27 and the Transnet Service Road/alternative gravel access road. As shown in the photo plate in Section 14.3, the Transnet Service Road intersects with the R27 just outside of Kenhardt. There is the potential that should vehicles not indicate soon enough that they are turning off from the R27, an accident can occur. In addition, not adhering to the relevant speed limits may cause accidents with other drivers and collisions with animals.

Significance of impacts without mitigation
The significance of causing an accident with pedestrians, animals and other drivers would have a **high** negative impact significance since the probability of the impact occurring would be likely and could be fatal and therefore would cause irreplaceable loss.

Proposed mitigation

- Road kill monitoring programme (inclusive of wildlife collisions record keeping) should be established and fences installed, if needed to direct animals to safe road crossings;
- Adhere to speed limits applicable to all roads used; and
- Implement clear and visible signalisation indicating movement of vehicles and when turning off or onto the Transnet Service Road to ensure safe entry and exit.

Significance of impact with mitigation
By implementing the abovementioned mitigation measures the probability of the impact occurring would be lowered significantly which would reduce the significance of the impact to **moderate** negative impact during all the phases of the project.

14.6.3 Impact on air quality due to dust generation, noise and release of air pollutants from vehicles and construction equipment

During all the phases of the projects, there will be a decrease in air quality due to the noise created by and pollutants released from vehicles coming to site during all phases of the projects, construction activities occurring on site and dust created from driving on the Transnet Service Road or gravel farm road. Since the site is located in a very rural setting, no sensitive receptors are present within close proximity of the proposed project. Therefore, the extent of the impact would remain local.

Significance of impacts without mitigation
As discussed above, the decrease in air quality would be local in extent. The worst case scenario for impacts on air quality is that no dust suppression is implemented on the Transnet Service Road, gravel access road, on site or that construction activities occur throughout very windy conditions. This negative impact would be **moderate** for all phases of the project, without mitigation.

Proposed mitigation

- Implement management strategies for dust generation e.g. apply dust suppressant on the Transnet Service Road, exposed areas and stockpiles;
- Postpone or reduce dust-generating activities during periods with strong wind;
- Limit noisy maintenance/operational activities to daytime only;
- Earthworks may need to be rescheduled or the frequency of application of dust control/suppressant increased;
- Ensure that all construction vehicles are roadworthy and respect the vehicle safety standards implemented by the Project Developer; and
- Avoid using old and noisy construction equipment and ensure equipment is well maintained.

Significance of impact with mitigation
With the implementation of the mitigation measures detailed above, the probability of noise emissions and dust realised would be lowered and the impact would be of a **low** significance.

14.6.4 Change in quality of surface condition of the roads

The Transnet Service Road or gravel farm road is going to be used as the main access road to the site. As discussed in Section 14.3. The Transnet Service Road and farm road are gravel roads and would require additional maintenance to ensure that the traffic generated would not decrease the surface condition of the road.

Significance of impacts without mitigation
The Transnet Service Road is currently being maintained by Transnet and it is unclear whether any maintenance is currently being undertaken on the gravel farm road. Since the Developer is going to use these roads during all phases of the project, it is expected that, should no mitigation measures be implemented, the road's surface condition would decrease significantly. This would have a **low** negative impact on the road (due to the local spatial extent of the impact).

Proposed mitigation

- Construction activities will have a higher impact than the normal road activity and therefore the road should be inspected on a weekly basis for structural damage;
- Ensure that road network is maintained in a good state for the entire operational phase;
- Implement management strategies for dust generation e.g. apply dust suppressant on the Transnet Service Road, exposed areas and stockpiles; and
- A Road Maintenance Plan should be developed for the section of the Transnet Service Road that will addresses the following:
  - Grading requirements;
  - Dust suppressant requirements;
  - Drainage requirements;
  - Signage; and
  - Speed limits.

Significance of impact with mitigation
Provided that the above mitigation measures are implemented and agreed to by Transnet and the land owner whose farm road will be used, the impact would be a **low** positive impact since this section of the road would be well maintained.

14.6.5 Cumulative impact of traffic generation

The cumulative impact assessment assumes that all the projects outlined within the cumulative impact section occur at the same time. Even though there will most likely be overlap in the operational phases of these projects, it is unlikely that the construction phases for all these projects would occur at the same time. Since the construction phase will give rise to the most amount of trucks coming to site, this would be considered the worst case scenario in terms of traffic generation. The projects that are proposed within close proximity of each other are detailed within Table 14.1 below. The estimates detailed within the table below have been obtained from the Developers. Based on these current estimates, the total amount of additional trips that would occur on the R27 during the construction phase is 471.82, which is still below the daily average limit of 1000 units. The impact on this road is therefore not anticipated to be significant but should the Transnet Service Road be used for all the projects, a maintenance plan, agreed upon all parties involved must be implemented to ensure that the road's quality and integrity is maintained.

Significance of cumulative impacts
It is assumed that the mitigation measures discussed in Section 14.6 of this TIS and included in Table 14.2 below are implemented, that the traffic generation impacts would be suitable managed to ensure that the traffic impacts are suitably managed. Based on this, the cumulative negative impact is **low**.

Table 14.1: Cumulative daily traffic generation estimates for all PV projects proposed north-east of Kenhardt

Project name		Daily traffic generation estimates		
		Construction Phase	Operational Phase	Decommission Phase
1	Proposed construction of the 75 MW AMDA Charlie PV SEF north of Kenhardt within the Kai!Garib LM in the Northern Cape Province	20	10	20
2	Proposed construction of the 75 MW AMDA Alpha PV SEF north of Kenhardt within the Kai!Garib LM in the Northern Cape Province	20	10	20
3	Proposed construction of 75 MW Solar Photovoltaic Facility (Boven 4) on the remaining extent of Boven Rugzeer Farm 169, North East of Kenhardt in the Northern Cape Province	20	10	20
4	Proposed construction of 75 MW solar energy facility (Gemsbok PV4) on Portion 3 of Gemsbok Bult farm 120 near Kenhardt within the Kheis Local Municipality in the Northern cape province	20	10	20
5	Proposed construction of 75 MW solar energy facility (Gemsbok PV5) on Protion 8 of Gemsbok Bult farm 120 near Kenhardt within the Kheis Local Municipality in the Northern cape province	20	10	20
6	Proposed construction of 100MW Skeerhok 3 PV SEF north-east of Kenhardt within the Kheis Local Municipality, Northern Cape Province	27.49	5.52	27.49
7	Proposed construction of Gemsbok PV1 75 MW Solar PV facility	20	10	20
8	Proposed construction of Gemsbok PV2 75 MW Solar PV facility	20	10	20
9	Proposed construction of Boven PV1 75 MW Solar PV facility	20	10	20
10	Proposed development of a 75 MW Solar PV Facility (Kenhardt PV 1) and proposed development of a 132 kV Transmission Line to connect to the proposed 75 MW Solar PV Facility (Kenhardt PV 1)	20.62	4.14	20.62
11	Proposed development of a 75 MW Solar PV Facility (Kenhardt PV 2) and proposed development of a 132 kV Transmission Line to connect to the proposed 75 MW Solar PV Facility (Kenhardt PV 2)	20.62	4.14	20.62

12	Proposed development of a 75 MW Solar PV Facility (Kenhardt PV 3) and proposed development of a 132 kV Transmission Line to connect to the proposed 75 MW Solar PV Facility (Kenhardt PV 3)	20.62	4.14	20.62
13	Proposed construction of the Mulilo Solar Development consisting of seven 75 MW PV or Concentrated PV Solar Energy Facilities and associated infrastructure	140	70	140
8	Proposed development of a 100 MW Solar PV Facility (Kenhardt PV 4) and proposed development of a 132 kV Transmission Line to connect to the proposed 100 MW Solar PV Facility (Kenhardt PV 4)	27.49	5.52	27.49
9	Proposed development of a 100 MW Solar PV Facility (Kenhardt PV 5) and proposed development of a 132 kV Transmission Line to connect to the proposed 100 MW Solar PV Facility (Kenhardt PV 5)	27.49	5.52	27.49
10	Proposed development of a 100 MW Solar PV Facility (Kenhardt PV 6) and proposed development of a 132 kV Transmission Line to connect to the proposed 100 MW Solar PV Facility (Kenhardt PV 6)	27.49	5.52	27.49
	Total	**471.82**	**184.50**	**471.82**

Table 14.2: Traffic Impact Assessment Table

Aspect/ Impact Pathway	Nature of impact	Status	Spatial Extent	Dura-tion	Conse-quence	Proba-bility	Reversi-bility	Irreplac-eability	Mitigation Measures	Significance of Impact/Risk = Consequence x Probability		Ranking of Impact/ Risk	Confi-dence Level
										Without Mitigation	*With Mitigation*		
CONSTRUCTION AND DECOMMISSIONING PHASES													
Traffic gene-ration	Increase in traffic	Nega-tive	Regional	Short term	Moderate	Very likely	Yes	Replace-able	• Should abnormal loads have to be transported by road to the site, a permit needs to be obtained from the PGNC Department of Public Works, Roads and Transport. • Provide a Transport Traffic Plan to SANRAL • Ensure that roadworthy and safety standards are implemented at all time for all construction vehicles. • Plan trips so that it occurs during the day but avoid construction vehicles movement on the regional road during peak time (06:00-10:00 and 16:00-20:00).	Low	Low	4	Medium
	Accidents with pedestrians, animals and other drivers on the surrounding tarred/gravel roads	Nega-tive	Local	Long term	Extreme	Likely	No	High irreplace-ability	• Road kill monitoring programme (inclusive of wildlife collisions record keeping) should be established and fences (such as Animex fences) installed, if needed to direct animals to safe road crossings. • Adhere to all speed limits applicable to all roads used. • Implement clear and visible signalisation indicating movement of vehicles and when turning off or onto the Transnet Service Road to ensure safe entry and exit.	High	Moderate	3	Medium
	Impact on air quality due to dust generation, noise and release of air pollutants from vehicles and construction equipment	Nega-tive	Local	Medium term	Moderate	Unlikely	Yes	Replace-able	• Implement management strategies for dust generation e.g. apply dust suppressant on the Transnet Service Road, exposed areas and stockpiles. • Postpone or reduce dust-generating activities during periods with strong wind. • Earthworks may need to be rescheduled or the frequency of application of dust control/suppressant increased. • Ensure that all construction vehicles are roadworthy and respect the vehicle safety	Moderate	Low	4	Medium

Aspect/ Impact Pathway	Nature of impact	Status	Spatial Extent	Dura-tion	Conse-quence	Proba-bility	Reversi-bility	Irreplac-eability	Mitigation Measures	Significance of Impact/Risk = Consequence x Probability		Ranking of Impact/ Risk	Confi-dence Level
										Without Mitigation	*With Mitigation*		
									standards implemented by the Project Developer. • Avoid using old and noisy construction equipment and ensure equipment is well maintained.				
	Change in quality of surface condition of the roads	Posi-tive	Local	Long term	Slight	Likely	Yes	Replace-able	• Construction activities will have a higher impact than the normal road activity and therefore the road should be inspected on a weekly basis for structural damage; • Implement management strategies for dust generation e.g. apply dust suppressant on the Transnet Service Road, exposed areas and stockpiles; and • A Road Maintenance Plan should be developed for the section of the Transnet Service Road that will be used to addresses the following: – Grading requirements; – Dust suppressant requirements; – Drainage requirements; – Signage; and – Speed limits.	Low	Low	4	Medium
OPERATIONAL PHASE													
Traffic gene-ration	Increase in traffic	Nega-tive	Regional	Short term	Slight	Very likely	High	Replace-able	• Adhere to requirements made within Transport Traffic Plan; • Limit access to the site to personnel; and • Ensure that where possible, staff members carpool to site.	Very low	Very low	5	Medium
	Accidents with pedestrians, animals and other drivers on the surrounding tarred/gravel roads	Nega-tive	Local	Long term	Extreme	Likely	No	High irreplace-ability	• Road kill monitoring programme (inclusive of wildlife collisions record keeping) should be established and fences installed, if needed to direct animals to safe road crossings. • Adhere to all speed limits applicable to all roads used. • Implement clear and visible signalisation indicating movement of vehicles and when	High	Moderate	3	Medium

Aspect/ Impact Pathway	Nature of impact	Status	Spatial Extent	Dura-tion	Conse-quence	Proba-bility	Reversi-bility	Irreplac-eability	Mitigation Measures	Significance of Impact/Risk = Consequence x Probability		Ranking of Impact/ Risk	Confi-dence Level
										Without Mitigation	*With Mitigation*		
									turning off or onto the Transnet Service Road to ensure safe entry and exit.				
	Impact on air quality due to dust generation, noise and release of air pollutants from vehicles and construction equipment	Nega-tive	Local	Medium term	Moderate	Unlikely	Yes	Replace-able	• Implement management strategies for dust generation e.g. apply dust suppressant on the Transnet Service Road, exposed areas and stockpiles; • Limit noisy maintenance/operational activities to daytime only.	Moderate	Low	4	Medium
	Change in quality of surface condition of the roads	Posi-tive	Local	Long term	Slight	Likely	Yes	Replace-able	• Implement requirements of the Road Maintenance Plan.	Low	Low	4	Medium
CUMULATIVE IMPACTS													
Traffic genera-tion	Increase in traffic	Nega-tive	Regional	Long term	Mode-rate	Very likely	High	Replace-able	n/a	Low	Low	4	Medium

14.7 TRAFFIC IMPACT STATEMENT

Based on the assessment of the potential impacts that can be associated with the traffic to be generated during the construction, operation and decommissioning phases of these projects, the overall impact from traffic generation is deemed to be **low** when implementing suitable mitigation measures, discussed in Section 14.5 and 14.6 of this Statement. The highest traffic will be generated during the construction phase.

The measures included within the EMPr must be adhered to, with the main requirements outlined below:

- Should abnormal loads have to be transported by road to the site, a permit needs to be obtained from the PGNC Department of Public Works, Roads and Transport.
- Provide a Transport Traffic Plan to SANRAL.
- Ensure that roadworthy and safety standards are implemented at all time for all construction.
- Adhere to all speed limits applicable to all roads used.
- Implement clear and visible signalisation indicating movement of vehicles and when turning off or onto the Transnet Service Road to ensure safe entry and exit.
- Implement management strategies for dust generation e.g. apply dust suppressant on the Transnet Service Road, exposed areas and stockpiles.
- Construction activities will have a higher impact than the normal road activity and therefore the road should be inspected on a weekly basis for structural damage.
- A Road Maintenance Plan should be developed for the section of the Transnet Service Road.
- Ensure that road network is maintained in a good state for the entire operational phase.

APPENDIX 9.1 – Specialist Declaration

I, Herbert Phahlane as the appointed independent specialist, in terms of the 2014 EIA Regulations (as amended), hereby declare that I:

- I act as the independent specialist in this application;
- I 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;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct, and do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 (as amended) and any specific environmental management Act;
- 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 have no vested interest in the proposed activity proceeding;
- 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;
- I have ensured that information containing all relevant facts in respect of the specialist input/study was distributed or made available to interested and affected parties and the public and that participation by interested and affected parties was facilitated in such a manner that all interested and affected parties were provided with a reasonable opportunity to participate and to provide comments on the specialist input/study;
- I have ensured that the comments of all interested and affected parties on the specialist input/study were considered, recorded and submitted to the competent authority in respect of the application;
- all the particulars furnished by me in this specialist input/study are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Name of Specialist: Herbert Phahlane

Signature of the specialist: ______________________________

Date: 2020-01-14

APPENDIX 9.2 – Curriculum Vitae

HERBERT PHAHLANE, Pr Tech Eng. Technical Director

Transport Planning, Transport and Infrastructure

Years with the firm

2 Years

Years of experience

17 years

Areas of expertise

Traffic Engineering, Transportation Planning, Pavement and Materials

Languages

English, Tswana, Afrikaans, Zulu

CAREER SUMMARY

Mr. Phahlane is a professional engineering technologist with over 17 years' experience in traffic engineering and transportation planning projects as well as property development facilitation. He has extensive experience in mixed-use development precincts and multi-disciplinary master planning, land use and traffic impact studies, infrastructure planning, property development planning and execution of projects.

He oversees critical aspects of projects for clients country wide from a traffic and transportation engineering point of view. In addition, he plays a key role in building and maintaining new client relationships for WSP

He is currently studying towards a Master's degree in Business Administration, at the Tshwane University of Technology, Pretoria, Gauteng

Country of work experience is currently only South Africa.

EDUCATION

M-Tech, Transportation Engineering, Vaal University of Technology, Gauteng	2010-2012
B-Tech, Transportation Engineering, Tshwane University of Technology, Pretoria, Gauteng	2004-2006
National Diploma, Civil Engineering, Technikon Northern Gauteng, Pretoria, Gauteng	1998-2003

ADDITIONAL TRAINING

Module 1: ISO 39001 2012 Implementation, South African Auditory and Training Certification Authority	2016
Module 2: ISO 39001 2012 Lead Auditor, South African Auditory and Training Certification Authority	2016
Municipal Management Development Programme, University of Pretoria	2013
Report Writing, Business Development Centre of Excellence	2010
Project Management (NQF Level 5), Southern Business School	2009
Pavement Materials III, University of Stellenbosch	2005
Pavement Materials and Design, University of Pretoria	2003

PROFESSIONAL MEMBERSHIPS

South African Institution of Civil Engineering (202050)	
Engineering Council of South Africa (201670019)	2016

HERBERT PHAHLANE, Pr Tech Eng. Technical Director

Transport Planning, Transport and Infrastructure

PROFESSIONAL EXPERIENCE

WSP Project Experience

- Ilovo Ext 16 & 17, Wanderers, Gauteng, South Africa (2019): Project Director. Traffic Impact Assessment. Client: Investec Property (Pty) Ltd. Project Value: ZAR 442 594.00
- Golf Club Terrace, Gauteng, South Africa (2019): Project Director. Traffic Safety Assessment. Client Investec Property (Pty) Ltd. Project Value: ZA 170 558.00
- Farm Witkoppies 393-JR, Portion 8 & 10, Gauteng, South Africa (2019): Project Director. Traffic Impact Assessment. Client: Homeless People Housing Co-operative Ltd. Project Value: ZAR 150 000.00
- Sun Valley SRC, Gauteng, South Africa (2019): Project Director. Gated Community Access Management Plan. Client: Sun Valley Residents Association. Project Value: ZAR 128 350.00
- New Modder Ext 4 Township Establishment, Gauteng, South Africa (2019): Project Director. Traffic Impact Assessment. Client: Valumax Midrand (Pty) Ltd. Project Value: ZAR 137 500.00.
- Westdene/Waterfront Upgrade, Bloemfontein, South Africa (2018-2019): Project Director. Traffic Impact Assessment. Client: Lock Logan Waterfront (Pty) Ltd. Project Value: ZAR 215 200.00
- Clayville Ext 71-80, Gauteng, South Africa (2018-2019): Project Director. Traffic Master Plan and Traffic Impact Assessment. Client: Valumax Midrand (Pty) Ltd. Project Value: ZAR 285 000.00
- Blue Valley Golf Estate, Kosmosdal Ext 80, Gauteng, South Africa (2018-2019): Project Director. Access Management Plan. Client: Blue Valley Golf and Country Estate Home Owners Association. Project Value: ZAR 75 000.00
- Traffic impact assessments for various filling stations, business parks, retail centres and residential developments, South Africa (2018-2019). Project Director. Clients: Various. Project Values: ZAR 50 k to ZAR 500 k.
- Farm Hondsrivier, Portion 20 & 27, Park City Development, Johannesburg, Gauteng, South Africa (2018): Project Director. Traffic Impact Assessment. Client: Black Jills Engineers. Project Value: ZAR 165 000.00
- Naauwpoort Township, Witbank, Mpumalanga, South Africa (2018): Project Director. Traffic Impact Assessment. Client: PM de Kock. Project Value: ZAR 120 000.00
- Capital Park Ext 7 & 8, Pretoria, Gauteng, South Africa (2018): Project Director: Revision of Traffic Impact Assessment and Parking Relaxation Motivation. Client: Renico Construction (Pty) Ltd. Project Value ZAR 85 050.00
- Phillip Nel Park, Portion 1 of Erf 257. Pretoria, Gauteng (2018). Project Director. Parking Study. Client: Arch-Neer Professionals (Pty) Ltd. Project Value ZAR 45 000.00
- Builders Warehouse, Gezina, Pretoria, Gauteng (2018). Project Director. Traffic Engineering Services. Client: M & F Giuricich Developments. Project Value ZAR 65 000.00
- AB-InBev Imali & Isanti, Vereeniging, Gauteng (2018) Project Director. Traffic Impact Assessment. Client: ABI. Project Value ZAR 183 000.00
- Rosslyn Hub, Pretoria, Gauteng, South Africa (2017-2018): Project Director. Revision of Traffic Impact Assessment and a Section 7 Report. Client: Big Cedar Trading (Pty) Ltd. Project Value: ZAR 113 000.00

HERBERT PHAHLANE, Pr Tech Eng. Technical Director

Transport Planning, Transport and Infrastructure

Previous Project Experience

- Menlyn Node Precinct Plan, Gauteng, South Africa (2011 – 2012): Project Lead as client: Transport Master Plan. Client: City of Tshwane Municipality. Project Value: ZAR 2 000 000.00.
- Hatfield Master Plan, Gauteng, South Africa (2013 – 2014): Project Manager as client: Hatfield Infrastructure Master Plan. Client: City if Tshwane Municipality. Project Value: ZAR 4 000 000.00.

PUBLICATIONS AND PRESENTATIONS

Publications

— Phahlane, Motsepe Herbert. "African cities for sustainable future start with building for resilience." Engineering News. 11th June, 2018

Presentations

— Phahlane, Motsepe Herbert. "Effect of land-use change on traffic peak hour factor." 25th ARRB conference, Perth, Australia. 23 – 26 September 2012

— Phahlane, Motsepe Herbert. "Computation of traffic peak hour factor per land-use type." The 17th International conference of Hong Kong Society for Transportation Studies conference, Kowloon, Hong Kong. 15 to 17 December, 2012

PREVIOUS EMPLOYMENT

Company	Positions held	From	To
Gauteng Department of Roads and Transport	Industrial Technician	2003	2005
City of Tshwane Municipality	Engineering Technician	2005	2008
City of Tshwane Municipality	Deputy Director	2008	2018