Proposed 75 MW Kloofsig Solar PV Energy Facility, Northern Cape – Kloofsig 1

Draft Environmental Impact Assessment Report

Report Prepared for

Kloofsig Solar (Pty) Ltd

Report Number 486618/6

DEA Reference Number: 14/12/16/3/3/2/951

Report Prepared by

srk consulting

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Kloofsig Solar (Pty) Ltd

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List of Abbreviations

BID	Background Information Document
BLMC	Biodiversity Land Management Classes
CAA	Civil Aviation Authority
CAR	Civil Aviation Regulations
CBA	Critical Biodiversity Areas
CEMP	Construction Environmental Management Programme
CITES	Convention on International Trade in Endangered Species of Wild Fauna & Flora
CSP	Concentrated Solar Power
DAFF	Department of Agriculture, Forestry and Fisheries
DEA	Department of Environmental Affairs (National)
DENC	Department of Environment and Nature Conservation – Northern Cape
DM	District Municipality
DMR	Department of Mineral Resources
DOE	Department of Energy
DSR	Draft Scoping Report
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
ECA	Environment Conservation Act
EIA	Environmental Impact Assessment
EIR	Environmental Impact Report
EMF	Environmental Management Framework

EMI	Electromagnetic Interference
EMPr	Environmental Management Programme
FSR	Final Scoping Report
GHG	Greenhouse Gas Emissions
GW	Gigawatt
HIA	Heritage Impact Assessment
IAPs	Interested and Affected Parties
IBA	Important Bird Areas of Southern Africa
IDP	Integrated Development Plan
IDZ	Industrial Development Zone
IEP	Integrated Energy Plan
IPP	Independent Power Producer
IRP	Integrated Resources Plan
IUCN	International Union for Conservation of Nature
LM	Local Municipality
LTMS	Long Term Mitigation Scenario
LUPO	Land Use Planning Ordinance
MVA	Megavolt ampere
MW	Megawatt
NEMA	National Environmental Management Act
NEMBA	National Environmental Management: Biodiversity Act
NEMPAA	National Environmental Management: Protected Areas Act
NERSA	National Energy Regulator of South Africa
NGO	Non-governmental Organization
NPAES	Protected Areas Expansion Strategy Area
PPA	Power Purchase Agreement
PPP	Public Participation Process
PV	Photovoltaics
REFIT	Renewable Energy Feed – in Tariff
REIPPPP	Renewable Energy Independent Power Producer Procurement Programme
RFP	Request for Proposal
SACAA	South African Civil Aviation Authority
SAHRA	South African Heritage Resource Agency
SANBI	South African National Biodiversity Institute
SANRAL	South African National Roads Agency
SANS	South African National Standards
SDF	Spatial development Framework
SEA	Strategic Environmental Assessment
SIBIS	SANBI's Integrated Biodiversity Information System
SKEP	Succulent Karoo Ecosystem Plan
SSC	Species of Special Concern

ToR	Terms of Reference
UNFCCC	United Nations Framework Convention on Climate Change
VIA	Visual Impact Assessment
WESSA	Wildlife and Environment Society of Southern Africa
+ve	Positive
-ve	Negative

Glossary of Terms

Critical Biodiversity Areas	Areas that are considered irreplaceable or important and necessary in terms of meeting targets for biodiversity pattern and process.
Environment	The external circumstances, conditions and objects that affect the existence and development of an individual, organism or group. These circumstances include biophysical, social, economic, historical and cultural aspects.
Environmental Impact Assessment (EIA)	A study of the environmental consequences of a proposed course of action.
Geotechnical Study	A study on the physical properties of soil and rock to inform the design of earthworks and foundations
Independent Power Producer	Independent Power Producer is an entity, which is not a public electric utility, but which owns and or operates facilities to generate electric power for sale to a utility, central government buyer and end users.
Indigenous vegetation	Vegetation consisting of indigenous plant species occurring naturally in an area, regardless the level of alien infestation and where the topsoil has not been lawfully disturbed during the preceding ten years.
Interested and Affected Party	Any person, group of persons or organisation interested in or affected by an activity, and any Organ of State that may have jurisdiction over any aspect covered by the activity.
No-go Alternative	The no-go alternative assumes that the proposed development does not go ahead and the site remains in its current state
Plan of Study for EIA	A document which forms part of a Scoping Report and sets out how an Environmental Impact Assessment must be conducted.
Registered Interested and Affected Party (IAP)	An Interested and Affected Party whose name is recorded in the register opened for the application / project.
Renewable Energy Independent Power Producer Procurement Programme	As part of the rollout of renewable energy in South Africa the Department of Energy (DoE) has entered into a bidding process for the procurement of renewable energy from independent power producers. This process is known as the Renewable Energy Independent Power Producer Procurement Programme (REIPPP)
Renewable Energy Feed – in Tariff	The National Energy Regulator of South Africa (NERSA) commissioned the development of a Renewable Energy Feed-in Tariff (REFIT) for South Africa, under its authority to regulate electricity tariffs in the country. The feed-in tariff requires the Renewable Energy Purchasing Agency (REPA), in this case the Single Buyer Office (SBO) of the national electricity utility Eskom, to purchase renewable energy from qualifying generators at pre-determined prices[
Scoping	A procedure to consult with stakeholders to determine issues and concerns and for determining the extent of and approach to an EIA, used to focus the EIA.
Scoping Report	A written report describing the issues identified to date for inclusion in an EIA.

Disclaimer

The opinions expressed in this Report have been based on the information supplied to SRK Consulting (South Africa) (Pty) Ltd. (SRK) by Kloofsig Solar (Pty) Ltd. SRK has exercised all due care in reviewing the supplied information. Whilst SRK has compared key supplied data with expected values, the accuracy of the results and conclusions from the review are entirely reliant on the accuracy and completeness of the supplied data. SRK does not accept responsibility for any errors or omissions in the supplied information and does not accept any consequential liability arising from commercial decisions or actions resulting from them. Opinions presented in this report apply to the site conditions and features as they existed at the time of SRK's investigations, and those reasonably foreseeable. These opinions do not necessarily apply to conditions and features that may arise after the date of this Report, about which SRK had no prior knowledge nor had the opportunity to evaluate.

1 Background and Introduction

1.1 Background to the study

Kloofsig Solar (Pty) Ltd proposes to develop a solar photovoltaic (PV) energy generation facility and associated infrastructure on the remaining extent (portion 0) of Farm 18, Kalkpoort in the vicinity of Petrusville in the Northern Cape (Figure 1-1). SRK Consulting South Africa (SRK) has been appointed by Kloofsig Solar, as the independent environmental consultants to assess the environmental impacts of the proposed development in terms of the NEMA 2014 EIA Regulations. In accordance with the requirements of the NEMA 2014 EIA regulations the project requires a full Scoping and EIA study to be conducted.

The proposed development consists of three project phases of 75 MW each (with a total power generation capacity of 225 MW should all phases be developed), covering a total area of approximately 970 ha. A preliminary layout plan indicating the location of each phase is shown in Figure 1-1 and described below, and a layout plan for **Kloofsig 1** (the subject of this report) is provided in Figure 2-5.

- Kloofsig 1 (DEA reference number 14/12/16/3/3/2/951) is at the centre of the site and includes a 132 kV powerline (approximately 8.5 km long) and a substation to enable connection to the grid at the existing 132 kV line running to the south-east of the site. An on-site substation and short connection to the 400 kV powerline crossing the site (this infrastructure will support all phases of the development, should they be developed) is also proposed**.**
- Kloofsig 2 (DEA reference number 14/12/16/3/3/2/952) is on the northern-most portion and includes the on-site substation and connection to the 400 kV powerline crossing the site as described for Kloofsig 1.
- Kloofsig 3 (DEA reference number 14/12/16/3/3/2/953) comprises the southern-most portion, connecting to the common infrastructure described above for Kloofsig 1.

For technical reasons associated with the Renewable Energy Independent Power Producer Procurement Program (REIPPPP), each of the three phases (Kloofsig 1, Kloofsig 2 and Kloofsig 3) require a separate environmental authorisation for the bidding process. The Department of Environmental Affairs (DEA) have specified that in order to obtain separate environmental authorisations, three separate EIA applications, and the associated reports, are required (see Application Forms in Appendix A). Consequently, three separate EIA process are being conducted concurrently for each of these projects.

It is important to note that the developer wishes to implement all three of the projects in order to improve the cost effectiveness of the shared infrastructure required to feed power into the nearby 400 kV powerlines. The possibility exists that DEA might authorise only one or two of the project phases and for this reason an order of preference (Kloofsig 1 being the first, and Kloofsig 3 the last) has been applied to these three EIA applications. During the course of this EIA process, the cumulative environmental impacts will be assessed incrementally in the sense that the significance of environmental impacts for Kloofsig 2 will be a combination of the impacts for Kloofsig 1 and Kloofsig 2, and the significance of environmental impacts for Kloofsig 3 will be a combination of the impacts for Kloofsig 1, Kloofsig 2, and Kloofsig 3.

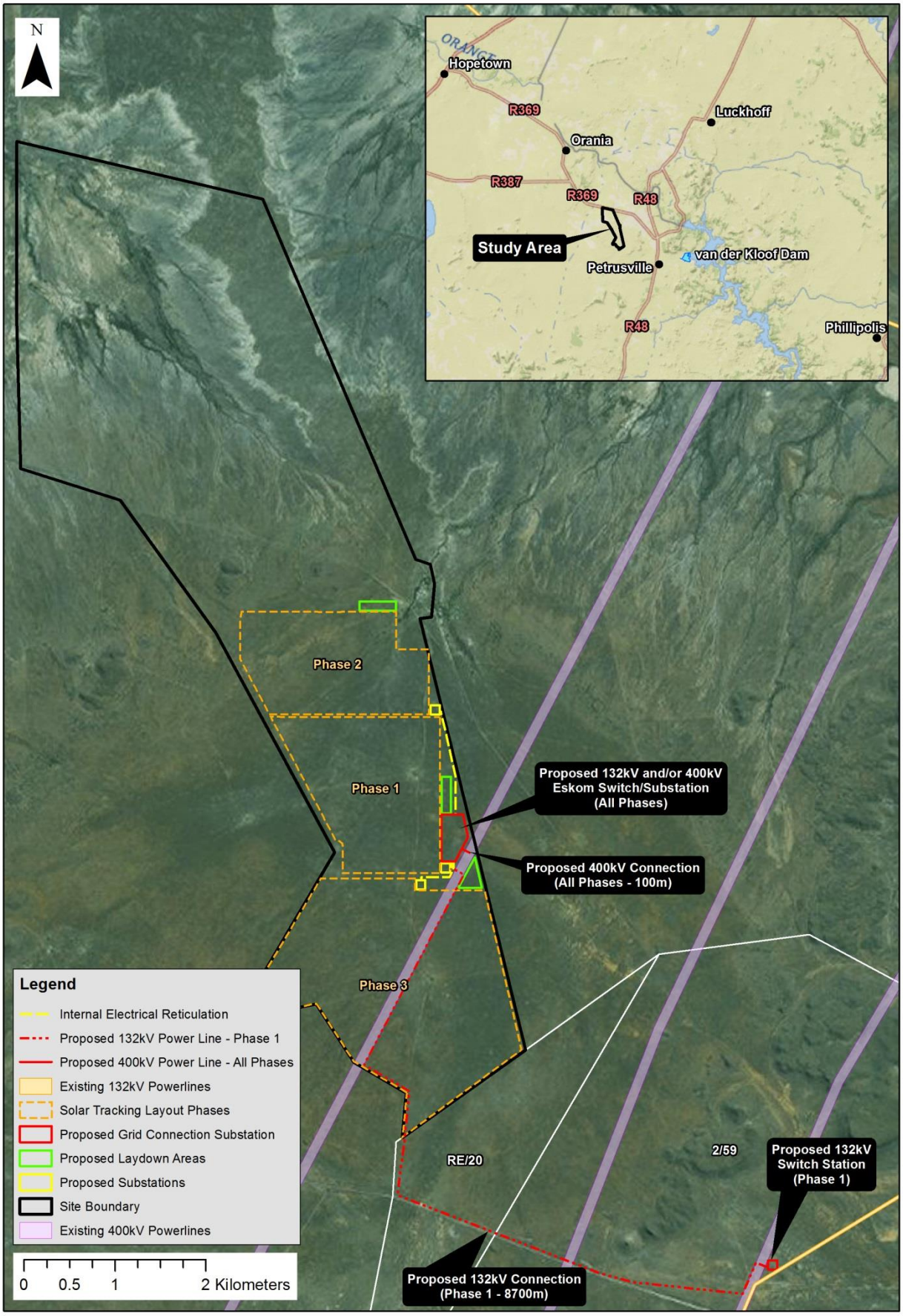


Figure 1-1: Site Locality Plan for all three phases

*This report presents the findings for **Kloofsig 1**. Similar, and almost identical, reports are also available for Kloofsig 2, and Kloofsig 3. Key differences between these reports are highlighted by means of **bold text**.*

Note that the terms Phase 1, 2 and 3 are used interchangeably with the project names Kloofsig 1, 2 and 3 in this report, as the different projects are essentially different phases of the overall Kloofsig solar project.

1.2 The environmental impact assessment process

1.2.1 2014 NEMA EIA Regulations

Sections 24 and 44 of NEMA make provision for the promulgation of regulations that identify activities which may not commence without an EA issued by the competent authority (DEA). In this context, the EIA Regulations, 2014 GN R982, which came into effect on 8 December 2014), promulgated in terms of NEMA, govern the process, methodologies and requirements for the undertaking of EIAs in support of EA applications. Listing Notices 1-3 in terms of NEMA list activities that require EA ("NEMA listed activities").

GN R982 of the EIA Regulations lays out two alternative authorisation processes. Depending on the type of activity that is proposed, either a Basic Assessment (BA) process or a S&EIR process is required to obtain EA. Listing Notice 1[1] lists activities that require a BA process, while Listing Notice 2[2] lists activities that require S&EIR. Listing Notice 3[3] lists activities in certain sensitive geographic areas that require a BA process.

The regulations for both processes – BA and S&EIR - stipulate that:

- Public participation must be undertaken as part of the assessment process;
- The assessment must be conducted by an independent EAP;
- The relevant authorities must respond to applications and submissions within stipulated time frames;
- Decisions taken by the authorities can be appealed by the proponent or any other Interested and Affected Party (IAP); and
- A draft EMP must be compiled and released for public comment.

GN R982 sets out the procedures to be followed and content of reports compiled during the BA and S&EIR processes.

The NEMA National Appeal Regulations[4] make provision for appeal against any decision issued by the relevant authorities. In terms of the Regulations, an appeal must be lodged with the relevant authority in writing within 20 days of the date on which notification of the decision (EA) was sent to the applicant or IAP (as applicable). The applicant, the decision-maker, interested and affected parties and organ of state must submit their responding statement, if any, to the appeal authority and the appellant within 20 days from the date of receipt of the appeal submission.

[1] GN R983 of 2014
[2] GN R984 of 2014
[3] GN R985 of 2014
[4] GN R993 of 2014, as amended by GN R2015 of 2015.

The competent authority that must consider and decide on the application for authorisation in respect of the activities listed in Table 1-1 is the Department of Environmental Affairs (DEA), as the Department has reached agreement with all Provinces that all electricity-related projects, including generation, transmission and distribution, are to be submitted to DEA, irrespective of the nature of the applicant. This decision has been made in terms of Section 24(C)(3) of the National Environmental Management Act (Act No 107 of 1998). The decision is effective for all projects initiated before, and up until, approximately 2015.

In addition to the requirements for an authorisation in terms of the NEMA, there may be additional legislative requirements that need to be considered prior to commencing with the activity, for example: the National Heritage Resources Act (Act No 25 of 1999), the National Water Act (Act No 36 of 1998), Civil Aviation Act (Act No 74 of 1962) as amended, National Environmental Management Biodiversity Act 10 of 2004 to name the most relevant. These are discussed in Section 1.3.7.

The proposed project includes activities that are listed in terms of the EIA Regulations, 2014 (see Table 1-1).

Table 1-1: NEMA Listed Activities (2014) Applicable to the Proposed Project

No.	Listed activity	Project activities or infrastructure triggering the activity
Listing Notice 1		
11 (i)	The development of facilities or infrastructure for the transmission and distribution of electricity –Outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts.	The development includes a 132 kV powerline from the property boundary to a 132 kV existing Eskom powerline located approximately 4 km to the east of the site. A substation adjacent to the powerline connection point is also proposed. An on-site substation (converting 132 kV to 400 kV power) and short connection line to the existing 400 kV powerline crossing the site is also proposed.
24 (ii)	The development of a road with a reserve wider than 13.5 m, or where no reserve exists, where the road is wider than 8 m.	The site access roads proposed will exceed 8 m in width.
28 (ii)	….industrial developments where such land was used for agriculture on or after 1 April 1998 and where such development will occur outside an urban area, where the total land to be developed is bigger than 1 hectare.	The site is currently agricultural and it is envisaged that a special consent to enable the use for power generation would be obtained from the municipality. This change in land use may trigger this listed activity as the development area is approximately 250 ha.
56 (ii)	The widening of a road by more than 6 m, or the lengthening of a road by more than 1 km, where the existing road is wider than 8 m.	The site access roads proposed will entail lengthening and widening of existing roads by more than the specified thresholds.
Listing Notice 2		
1	The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20 megawatts or more.	A solar photovoltaic (PV) energy generation facility of 75 MW is proposed.
15	The clearance of an area of 20 hectares or more of indigenous vegetation.	Kloofsig 1 will result in the clearing (partially of wholly) of approximately 250 hectares of indigenous vegetation to accommodate project infrastructure.

Legal Requirements for this Project

The proposed solar photovoltaic (PV) energy generation facility triggers activities listed in terms of GN R 983, GN R 984 and GN R 985, and as such the proponent is obliged to apply for environmental authorisation for the proposed activities via an Environmental Impact Assessment process in accordance with the procedure stipulated in GN R 982.

1.2.2 Objectives of the EIA

The principal objectives of the Impact Assessment Phase in accordance with the regulatory requirements are to:

- Describe the nature of the proposed project;
- Identify and assess environmental impacts associated with the proposed development;
- Formulate mitigation measures to minimise impacts and enhance benefits;
- Describe important biophysical and socio-economic characteristics of the affected environment;
- Undertake a public participation process that provides opportunities for all Interested and Affected Parties (IAPs) to be involved;
- Identify feasible alternatives; and
- Produce a Final Environmental Impact Report (FEIR), including a Draft Environmental Management Programme (EMPr), that will provide all the necessary information for DEA to decide whether (and under what conditions) to authorise the proposed development.

1.2.3 Approach to the EIA

The general approach adopted in this assessment has been guided by the principles of Integrated Environmental Management (IEM) as described in the IEM guidelines published by the Department of Environmental Affairs and Tourism in 1992 (now known as the Department of Environmental Affairs). The approach is therefore guided by the principles of transparency which is aimed at encouraging accountable decision-making. The underpinning principles of IEM are:

- Informed decision-making;
- Accountability for information on which decisions are made;
- A broad interpretation of the term “environment”;
- Consultation with IAPs;
- Due consideration of feasible alternatives;
- An attempt to mitigate negative impacts and enhance positive impacts associated with the proposed project;
- An attempt to ensure that the social costs of the development proposals are outweighed by the social benefits;
- Regard for individual rights and obligations;
- Compliance with these principles during all stages of the planning, implementation, and operations of the proposed development or activity; and
- Opportunities for public and specialist input in the decision-making process.

The EIA process followed is depicted in Figure 1-2 below.

Activities that were carried out as part of the Scoping Study included:

- Placement of two on-site posters on 14 April 2015;
- Distribution of the Background Information Document (BID) for a 30 day comment period from 24 January 2016 to identified Interested and Affected Parties (IAPs), stakeholders and neighbouring residents;
- Appointment of specialists to conduct the following baseline / screening level studies for the whole property, which were used to inform the proposed development layout (the results of these studies are presented as the site sensitivity map, Figure 2-8):
    - Archaeological screening;
    - Palaeontological screening study;
    - Ecological and Wetland screening study.
- Distribution of the BID to the Ward 4 Councillor per registered mail on 18 February 2016;
- Collation of public and IAP comments on the BID and onsite poster, including responses to these issues;
- Preparation of a Draft Scoping Report;
- Inclusion in the Draft Scoping Report (DSR) of issues that were raised);
- Submission of an application form to DEA on 17 August 2016;
- Distribution of the Draft Scoping Report to the relevant Authorities;
- Making a hard copy of the Draft Scoping Report available at a public venue (Vanderkloof Public Library) for review by IAPs;
- Distribution of the Executive Summary of the DSR to all IAPs registered for this project;
- Provision of a 30 day comment period on the Draft Scoping Report (16 August – 16 September 2016);
- Placing of a newspaper notice in 'Die Volksblad' on 18 August 2016 announcing the availability of the DSR for public review and comment;
- Collation of public and IAP comments on the DSR, and incorporation of these into the Final Scoping Report;
- Distribution of the Final Scoping Report to the relevant Authorities;
- Making the FSR available for download on the SRK 'Public Documents' webpage, for review by IAPs;
- Distribution of the executive summary of the Final Scoping Report (including comments and responses report) to registered IAPs;
- Providing the contact details of the DEA case officer to all registered IAPs for the submission of final comments on the Scoping Phase;
- Submission of Final Scoping Report and Plan of Study for EIA to DEA for a decision regarding authorisation to proceed to the Impact Assessment phase of the EIA; and
- Receipt of the letter of approval of the FSR and Plan of Study for the EIA from DEA dated 3 November 2016.

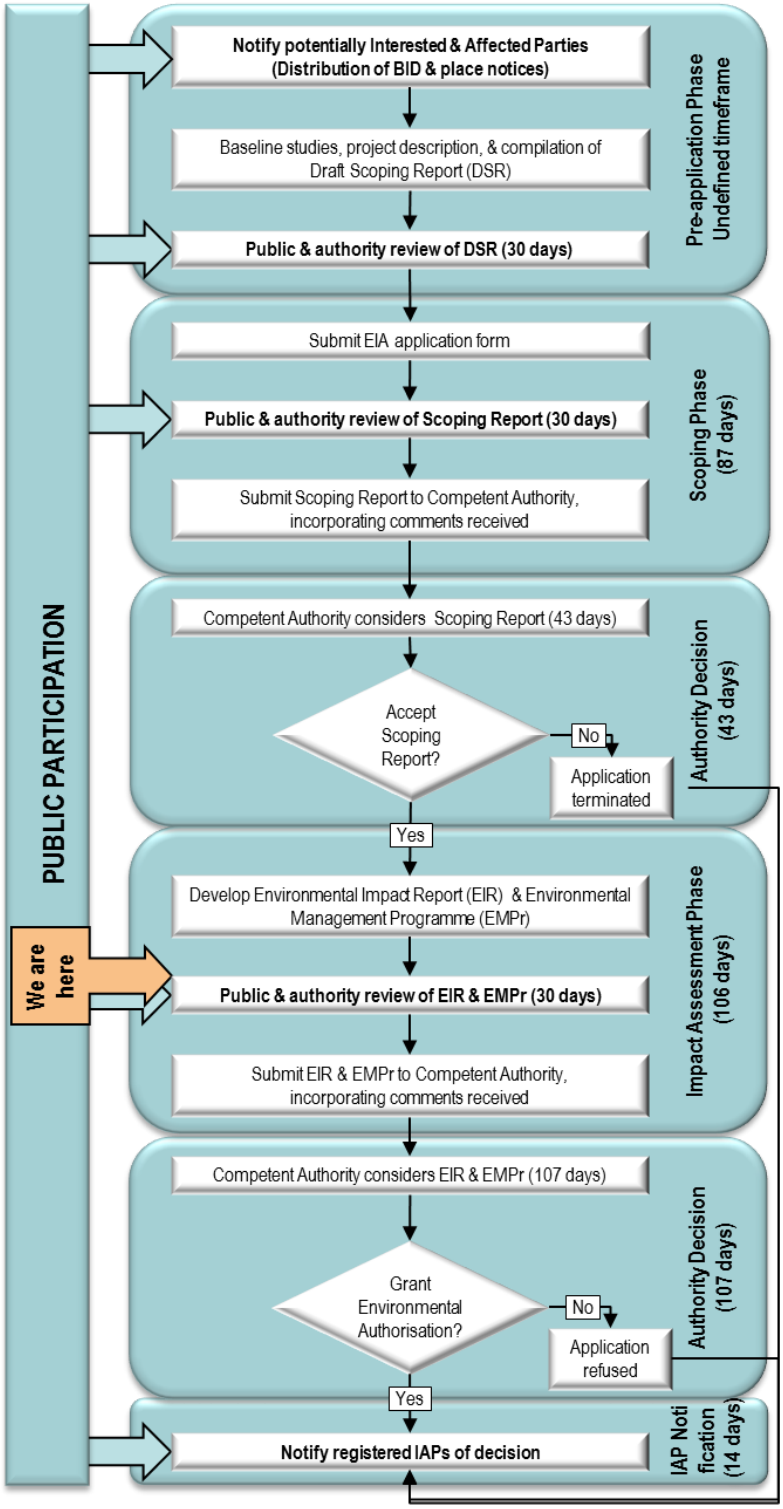


Figure 1-2: Environmental Impact Assessment (EIA) Process

Activities that have been carried out in preparation of the Environmental Impact Report included the following:

- Appointment of specialist and completion of specialist impact assessment reports (included as Appendix G to this report), as per the terms of reference included in the Plan of Study for EIA in the FSR, as well as additional requirements as specified by DEA in their approval of the FSR, and relevant comments received from IAPs;
- Preparation of the Draft Environmental Impact Report (EIR)(this report);

- Inclusion in the Draft EIR of issues that were raised (Section 4.2.2);
- Distribution of the Draft EIR on 9 January 2017 to the relevant Authorities;
- Making a hard copy of the Draft EIR available at a public venue (Vanderkloof Public Library) for review by IAPs;
- Making the Draft EIR available for download on the SRK 'Public Documents' webpage, for review by IAPs;
- Distribution of the executive summary of the Draft EIR to registered IAPs; and
- Provision of a 30 day comment period on the Draft EIR (9 January – 8 February 2017).

1.3 Relevant legislation

In addition to the EIA regulations referenced in the preceding section, a number of laws are relevant to the proposed development. Typically this is either because they have bearing on the project's need & desirability, or alternatively because define the need for the competent authority (DEA) to obtain input from other licensing / permitting authorities prior to making a decision on whether or not to authorise the proposed development.

This section provides a summary of the key legislation that is relevant to this proposed development.

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

NEMA provides for co-operative environmental governance by establishing principles for decision-making on matters affecting the environment, institutions that will promote co-operative governance and procedures for co-ordinating environmental functions exercised by organs of the State, as well as to provide for matters connected therewith. Section 2 of NEMA establishes a set of principles that apply to the activities of all organs of state that may significantly affect the environment. These include the following:

- Development must be sustainable;
- Pollution must be avoided or minimised and remedied;
- Waste must be avoided or minimised, reused or recycled;
- Negative impacts must be minimised; and
- Responsibility for the environmental health and safety consequences of a policy, project, product or service exists throughout its life cycle.

Section 28(1) states that:

"Every person who causes, has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring."

If such degradation/pollution cannot be prevented, then appropriate measures must be taken to minimise or rectify such pollution. These measures may include:

- Assessing the impact on the environment;
- Informing and educating employees about the environmental risks of their work and ways of minimising these risks;

- Ceasing, modifying or controlling actions which cause pollution/degradation;
- Containing pollutants or preventing movement of pollutants;
- Eliminating the source of pollution; and
- Remedying the effects of the pollution.

Legal Requirements for this Project

Kloofsig Solar has a responsibility to ensure that the proposed solar photovoltaic (PV) energy generation facility and associated infrastructure construction activities and the EIA process conform to the principles of NEMA. The proponent is obliged to take action to prevent pollution or degradation of the environment in terms of Section 28 of NEMA.

1.3.2 National Heritage Resources Act No. 25, 1999

The protection and management of South Africa's heritage resources is controlled by the National Heritage Resources Act (NHRA) 25 of 1999. The enforcing authority for this act is the South African Heritage Resources Agency (SAHRA).

In terms of the Act, historically important features such as graves, trees, archaeological artefacts/sites and fossil beds are protected. Similarly, culturally significant symbols, spaces and landscapes are also afforded protection. In terms of Section 38 of the National Heritage Resources Act, SAHRA can call for a Heritage Impact Assessment (HIA) where certain categories of development are proposed. The Act also makes provision for the assessment of heritage impacts as part of an EIA process and indicates that if such an assessment is deemed adequate, a separate HIA is not required.

The Act requires that:

"…any person who intends to undertake a development categorised as the ... or any development or other activity which will change the character of a site exceeding 5 000 m² in extent or involving three or more existing erven or subdivisions thereof must at the very earliest stages of initiating such a development, notify the responsible heritage resources authority and furnish it with details regarding the location, nature and extent of the proposed development..."

Legal Requirements for this Project

The proposed development triggers the requirement for an HIA in terms of the NHRA, and palaeontological and archaeological studies have therefore been completed as part of the EIA. SAHRA has been notified of the proposed project as per the requirement of the National Resources Heritage Act.

1.3.3 National Water Act No. 36 of 1998

The National Water Act 36 of 1998 provides for the promotion of efficient, sustainable and beneficial use of water in the public interest; for the facilitation of social and economic development; for the protection of aquatic and associated ecosystems and their biological diversity; and for the reduction and prevention of pollution and degradation of water resources. The Act also provides for emergency situations where pollution of water resources occurs. Section 21 of the Act describes activities that will require prior permitting before these activities may be implemented, including any changes to the river course and banks, changes to water flows and the discharge of water containing waste.

Legal Requirements for this Project

The development may include activities that are listed under Section 21 in which case Water Use Licence Applications (WULAs) would need to be prepared and submitted to the Department of Water and Sanitation for authorisation prior to development.

1.3.4 Integrated Energy Plan for the Republic of South Africa, March 2003

The former Department of Minerals and Energy (DME) commissioned the Integrated Energy Plan (IEP) in response to the requirements of the National Energy Policy in order to provide a framework by which specific energy policies, development decisions and energy supply trade-offs could be made on a project-by-project basis. The framework is intended to create a balance between energy demand and resource availability so as to provide low cost electricity for social and economic development, while taking into account health, safety and environmental parameters. In addition to the above, the IEP recognised the following:

- South Africa is likely to be reliant on coal for at least the next 20 years as the predominant source of energy;
- New electricity generation will remain predominantly coal based but with the potential for hydro, natural gas and nuclear capacity;
- Need to diversify energy supply through increased use of natural gas and new and renewable energies;
- The promotion of the use of energy efficiency management and technologies;
- The need to ensure environmental considerations in energy supply, transformation and end use;
- The promotion of universal access to clean and affordable energy, with the emphasis on household energy supply being coordinated with provincial and local integrated development programmed;
- The need to introduce policy, legislation and regulations for the promotion of renewable energy and energy efficiency measures and mandatory provision of energy data, and;
- The need to undertake integrated energy planning on an on-going basis.

Relevance to the proposed project

The proposed Solar Farm project is in line with the IEP with regards to diversification of energy supply and the promotion of universal access to clean energy.

1.3.5 Electricity Regulation Act (Act No. 4 of 2006)

The Electricity Regulation Act (Act No. 4 of 2006) became operation on 1 August 2006 and the objectives of this Act are to:

- Facilitate universal access to electricity;
- Promote the use of diverse energy sources and energy efficiencies, and;
- Promote competitiveness and customer and end user choice.

Relevance to the proposed project

The proposed Solar Farm project is in line with the call of the Electricity Regulation Act No. 4 of 2006 as it is has the potential to improve energy security of supply through diversification.

1.3.6 Astronomy Geographic Advantage areas Act (No. 21 of 2007)

In February 2010, the Minister of Science and Technology declared all land in the Northern Cape Province situated 250km from the centre of the South African Large Telescope dome as an astronomy advantage area for optical astronomy purposes and the whole of the territory of the Northern Cape Province, excluding Kimberly, as an astronomy advantage area for radio astronomy purposes.

Furthermore, those parts of the Northern Cape which are to contain the SALT dome, the MeerKAT radio telescope and the multi-billion rand Square Kilometre Array (SKA) have been declared as core astronomy advantage areas. While all land within a 3km radius of the centre of the SALT dome falls under the Sutherland Core Astronomy Advantage Area, sections of the Kareeberg and Karoo Hoogland municipal areas, consisting of three sections of farming land, constitute the Karroo Core Astronomy Advantage Area.

Relevance to the proposed project

The proposed Solar Farm project site does not fall within any of the Astronomy Advantage Areas, and is situated 125 km from the nearest Area (Karoo Central Astronomy Advantage Area 1). The site also does not fall within a SKA corridor and is situated 125 km from the corridor. The proximity of these areas to the proposed project is shown on Figure 1-3

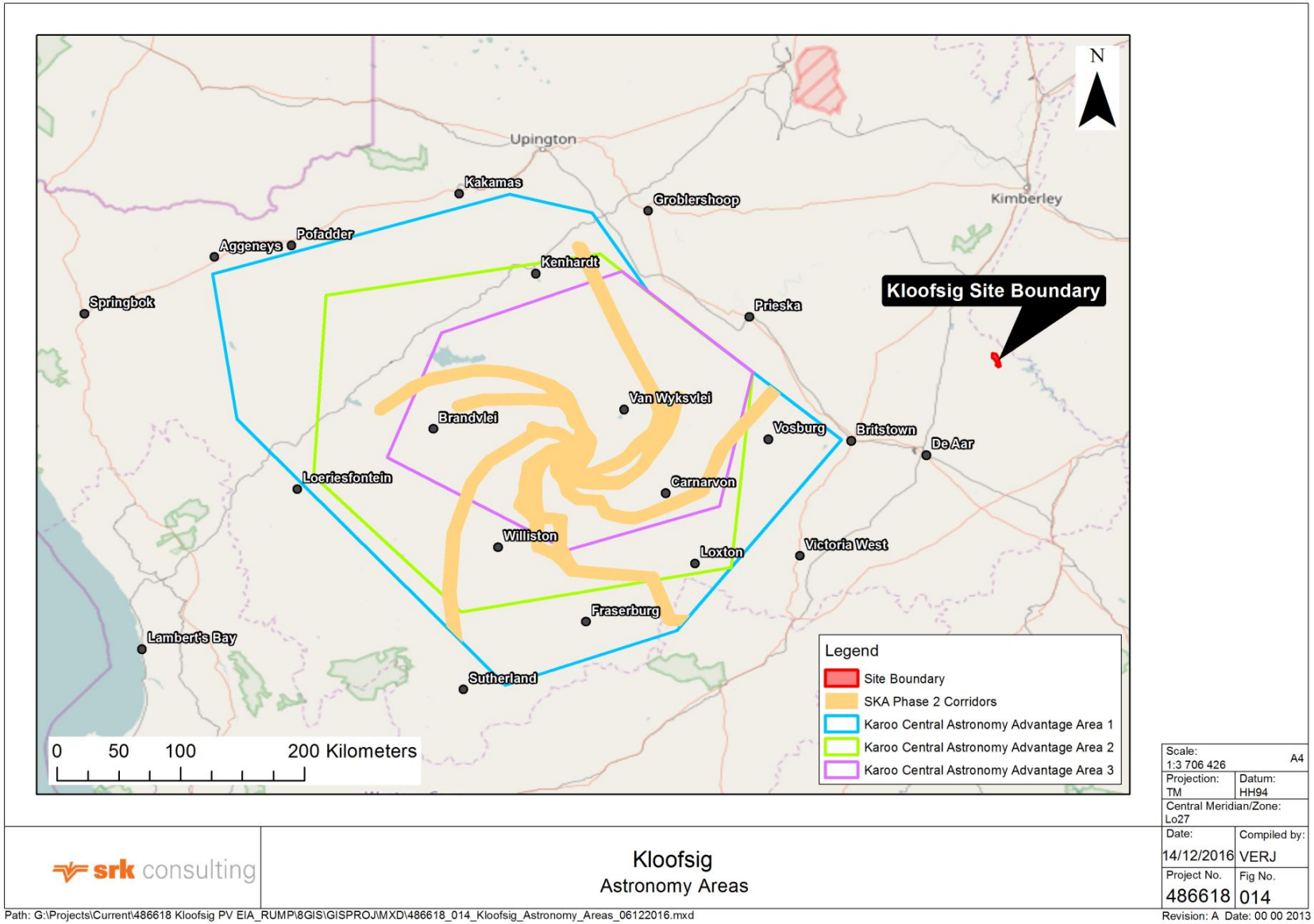


Figure 1-3: Astronomy Advantage Areas relative to the Kloofsig PV Facility

1.3.7 Other relevant environmental legislation

Other legislation that may be relevant to the proposed Kloofsig Solar Farm includes:-

- The Conservation of Agricultural Resources Act 43 of 1983 controls and regulates the conservation of agriculture and lists all regulated invasive species;
- The National Veld and Forest Fire Act (Act 101 of 1998);
- The Development Facilitation Act 67 of 1995 provides for development and planning;
- The Telecommunication Act (1966) which has certain requirements with regard to potential impacts on signal reception;
- The Physical Planning Act 135 of 1991 provides land use planning;
- The Tourism Act 72 of 1993 provides for the promotion of tourism and regulates the tourism industry;
- The Skills Development Act 97 of 1998 promotes the development of skills;
- Northern Cape Environmental Implementation Plan 3rd edition: 2015-2020
- Northern Cape Planning and Development Act No.7 of 1998;
- Northern Cape Nature Conservation Act No. 9 of 2009; and
- The Mineral and Petroleum Resources Development Act (Act 28 of 2002).

In addition to the above, aside from the environmental authorisation, there are other permits, contracts and licenses that will need to be obtained by the project proponent for the proposed project some of which fall outside the scope of the EIA. However, for the purposes of completeness, these include:-

- Local Municipality: Land Rezoning Permit. Spatial Planning and Land Use Management Bill 2012;
- National Energy Regulator of South Africa (NERSA): Generation License; and
- Eskom: Connection agreement and Power Purchase Agreement (PPA).

How the above statutory considerations are relevant to the IPP procurement and bidding process are detailed below.

Renewable Energy Independent Power Producer Procurement Programme (REIPPPP)

Under the Department of Energy's current procurement policy for renewable energy, Independent Power Producers (IPPs) have to comply with the requirements as detailed in the Request for Proposal (RFP) document that was released in August 2011. 3725 MW are to be allocated to renewable energy resources to ensure the continued uninterrupted supply of electricity. This 3725 MW is broadly in accordance with the capacity allocated to renewable energy generation in Integrated Resources Plan (IRP) 2010-2030. The RFP document underpins five rounds of a competitive bidding process.

In what is effectively a substantial vetting process, IPPs are required to meet the minimum requirements set out in six volumes of the RFP document covering legal, technical (of which the EIA process forms a part), financial and economic development criteria. Over and above the necessary

environmental authorisation for a project the aspects listed below also require review and the associated application, reporting and permitting processes to be conducted as part of the bid process.

Heritage

In terms of the National Heritage Resources Act (25 of 1999) the protection of archaeological and paleontological resources is the responsibility of a provincial (or national) heritage resources authority. All archaeological objects, paleontological material and meteorites are the property of the State. The project is required to undertake the relevant heritage permitting processes and requirements identified by the provincial heritage authority.

Water

Authorisations are needed in terms of section 21(c) & (i) of the National Water Act (36 of 1998) whenever new roads and/or cables cross watercourses (even dry headwaters), and when upgrades to existing causeways/bridges are required to allow transportation of long/heavy components and equipment: This is defined as a "water use" in terms of the Act.

Activities for the water use licensing application for development within 500 m of a wetland and groundwater abstraction (if not already accommodated through existing borehole licenses) will be applied for and submitted independently of this EIA process.

Civil Aviation Authority

In terms of the Civil Aviation Act (Act 13 of 2009) prescriptions listed above the project proponent is required to secure the relevant permits and clearances from the Civil Aviation Authority. This is expected to include a mapping exercise that applies the relevant buffer zones around aerodromes, air space, flight paths, and communication/navigation/surveillance assets. The CAA will require submission of a final layout prior to full approval being granted. Refer to Appendix J1 for the conditional approval from SACAA.

Agriculture

In terms of the Conservation of Agricultural Resources Act (43 of 1983) and the Subdivision of Agricultural Land Act (70 of 1970) all projects that impact on agricultural resources require comment from the national and/or provincial agriculture departments. This will be secured from the national and provincial departments for this project.

1.4 Details and Expertise of the Environmental Assessment Practitioners (EAPs)

SRK Consulting comprises over 1,500 professional staff worldwide, offering expertise in a wide range of environmental and engineering disciplines. SRK's Port Elizabeth environmental department has a distinguished track record of managing large environmental projects and has been practicing in the Eastern Cape since 2001. SRK has rigorous quality assurance standards and is ISO 9001 certified.

The qualifications and experience of the independent Environmental Assessment Practitioners (EAPs) undertaking the EIA are detailed below and Curriculum Vitae provided in Appendix J5.

Environmental Scientist: Karien Killian, MSc (Botany) Karien Killian is an Environmental Scientist and has been involved in environmental management for the past 2.5 years. Her experience includes Basic Assessments, Environmental Impact Assessments, Environmental Management Plans and Environmental Auditing.

Project Manager: Nicola Rump, MSc, EAPASA Nicola Rump is a Principal Environmental Scientist and EAPASA registered EAP, and has been involved in environmental management for the past 9 years working on South African and international projects including EIAs and ISO 14001 auditing for a variety of activities. Her experience includes Basic Assessments, Environmental Impact Assessments, Environmental Management Plans, Environmental Auditing and Stakeholder Engagement.

Project Director and Internal Reviewer: Rob Gardiner, MSc, MBA, Pr Sci Nat Rob Gardiner is the Principal Environmental Scientist and head of SRK's Environmental Department in Port Elizabeth. He has more than 22 years environmental consulting experience covering a broad range of projects, including Environmental Impact Assessments (EIA), Environmental Management Systems (EMS), Environmental Management Programmes (EMPr), and environmental auditing. His experience in the development, manufacturing, mining and public sectors has been gained in projects within South Africa, Lesotho, Botswana, Angola, Zimbabwe, Suriname and Argentina.

1.5 Statement of SRK Independence

Neither SRK nor any of the authors of this Report have any material present or contingent interest in the outcome of this Report, nor do they have any pecuniary or other interest that could be reasonably regarded as being capable of affecting their independence or that of SRK.

SRK's fee for conducting this EIA process is based on its normal professional daily rates plus reimbursement of incidental expenses. The payment of that professional fee is not contingent upon the outcome of the Report(s) or the EIA process.

As required by the legislation, SRK has completed and submitted a declaration of interest, as part of the EIA application form (Appendix A), and an affirmation relating to the content of this report is included in Appendix J4 and the qualifications and experience of the individual practitioners responsible for this project are detailed above.

1.6 Assumptions and limitations

As noted in the Final Scoping Report, this report is based on currently available information and, as a result, the following limitations and assumptions are implicit in it:

- That, due to the cost of preparing detailed designs and plans, such detailed design/ planning information would only be developed in the event of environmental authorisation being granted. As such, it is anticipated that, as is typically the case in an EIA process, the EIA will assess broad land uses;
- That the comments received in response to the public participation programme so far, are representative of comments from the broader community;
- Additional permitting or licensing requirements that may be required (including but not limited to Water Use Licenses, licensing of borrow pits, vegetation destruction permits) are outside the scope of this EIA process. It is assumed that the legal requirements in this

regard will be followed and that the relevant permissions will be in place prior to commencement of construction.

Notwithstanding these assumptions, it is our view that this Draft Environmental Impact Report provides an accurate assessment of the proposed development and the significance of potential environmental impacts.

Relevant assumptions and limitations listed by each of the specialists in their studies are listed below.

1.6.1 Archaeology

- During the survey for the baseline study (Tusenius 2015), the areas of the present three phase study were identified as being of low archaeological significance so less attention was paid to these than to the areas of medium to high significance described in the relevant report, and given in the archaeological background section. However, the author feels confident that the conclusions reached about the Phase 1 study area are reasonable and in line with what was observed in other parts of the farm, as well as in accordance with what has been recorded in other AIA and academic studies in the area.

1.6.2 Avifauna

- The primary data for this assessment came from the distribution and status information collected for southern African birds during the SABAP1 atlas project, comparison with the incoming data for the on-going SABAP2 atlas project, and is therefore only as accurate and reliable as the limitations and assumptions described for those exercises (Harrison et al. 1997; www.sabap2.org.za; Bonnevie 2011, Retief 2013), and an earlier atlas for the adjacent Free State (Earlé & Grobler 1987).
- The specialist had access to suitable databases, information and identification resources, and did not consider that the present assignment warranted a more detailed (and expensive) survey, even though summer migrants were absent.
- Even a report based on field sampling and observation over several years and seasons to account for fluctuating environmental conditions, nomadism and migrations, may be insufficient, since one deals with dynamic natural systems, especially in the Karoo and for birds that have such a mobile response to changing conditions.
- The specialist offers this EIA in good faith, based on the information available to him at the time, but he cannot accept responsibility for subsequent changes in knowledge or conditions.

1.6.3 Ecological

- The team has sufficient experience and ample access to information sources to confidently compile lists of biota such as presented herein to support conclusions and suggested mitigation measures based on site visits. In instances where doubt exists, a species is assumed to be a possible occupant (viz. shrews) -this approach renders the conclusions to be robust.
- In instances where the possible occurrence has significant ecological implications, further investigations are recommended. In view of the latter, it is highly unlikely that an intensive survey (trapping, netting, drift fences) to augment this site visit will add significantly to the data base, and the additional costs are unlikely to warrant the benefit.

- Even though every care is taken to ensure the accuracy of this report, environmental assessment studies are limited in scope, time and budget.
- Discussions and proposed mitigations are to some extent made on reasonable and informed assumptions built on bona fide information sources, as well as deductive reasoning.
- Deriving a 100% factual report based on field collecting and observations can only be done over several years and seasons to account for fluctuating environmental conditions and migrations.
- Since environmental impact studies deal with dynamic natural systems, additional information may come to light at a later stage. EcoAgent can therefore not accept responsibility for conclusions and mitigation measures made in good faith based on own databases or on the information provided at the time of the directive. This report should therefore be viewed and acted upon with these limitations in mind.

1.6.4 Socio-economic

- The secondary data sources used to compile the socio-economic baseline (demographics, dynamics of the economy) although not exhaustive, can be viewed as being indicative of broad trends within the study area;
- The study was done with the information available to the specialist within the timeframes and specified budget;
- Possible impacts and stakeholder responses to these impacts cannot be predicted with complete accuracy, even when circumstances are similar and these predictions are based on research and years of experience, taking the specific set of circumstances into account;
- It is assumed that the motivation and ensuing planning for the project were done with integrity and that all information provided to the specialist by the project proponent and its consultants to date is accurate;
- It is assumed that the project description and infrastructure components as discussed above, are reasonably accurate. These details were used to assess the potential impacts;
- With regard to the telephonic interviews undertaken, the following assumptions are made:
    - Questions asked during the interviews were answered accurately;
    - The degree of the perceived possible significance of concerns raised by some of the respondents was truthfully rated by the respondents; and
    - That the attitude of the respondents towards the project will remain reasonably stable over the short- to medium- terms.
- Attempts were made to contact the land owner of Portion 00011 of Farm Taaiboschpoort No.10; however, there was no timely response. The assumption is that no significant concerns will exist as the farm is located on the north-westerly side of Kloofsig 1 Solar PV energy facility. Considering the information obtained through primary as well as secondary sources, it can be concluded that the level of risk to the project associated with this knowledge gap is low; and
- It is also assumed that the general concerns and opinions raised by all other land owners interviewed, such as security concerns, would also apply to the land owners not consulted with for whatever reason.

1.6.5 Visual

- It is assumed that the drawings (including the designs of the structures, site layout and height of the structures) supplied to the specialist remain unchanged.
- The contour interval used in the analysis was between 2 and 10 metres (m). This has resulted in a confidence rating of medium for the impact significance ratings.
- The viewshed illustrates the area from which the proposed development is likely to be visible. It does not take local undulations, existing vegetation and man-made structures into account. Due to the large interval of the contours, many of the undulations or natural landscape features smaller than between 2 and 10 m high in surrounding areas could be lost. This means that the proposed development may not be visible from everywhere within the viewshed, as the development may be obscured by other existing infrastructure, vegetation or small/localised variations in the topography.
- A VIA, by nature, is not a purely objective or a quantitative process, but is dependent on the subjectivity of the judgments made. Where subjective judgments are required, appropriate criteria and motivations have been clearly stated.
- The significance of the impact has been calculated using a combination of the Hassell Matrix4 impact rating methodology for the project.

1.6.6 Traffic

- No visual road assessments have been done of the proposed Transport Routes from the point of import or manufacture, to the location of the new Solar Farm development.
- No detail designs have been done yet, and only a preliminary Site Development Plan (SDP) was compiled to date. This report therefore does not present or discuss any detail designed infrastructure, and is limited to highlight concepts related to transport management and traffic impacts, which need to be addressed during the Detail Design Stage. No detail road layouts, horizontal alignments or vertical profiles, turning radii or sight distances at intersection, etc. have yet been calculated.
- Aspects that will influence the final Transport Management recommendations in this report are:
    - The specific Transport Operator and Crane Erection company that will be appointed and the number off and availability of specific types of trucks and cranes or a combination of different truck and crane types, will determine the final transport cost and hence the success of the transportation operations, and financial impact on the development costs of this solar farm. See Section 3.2 on typical Transport Trucks and Crane Types.
    - Transport route alternatives were not analysed and compared on an economical basis (rand per kilometre travelled). This should be done once transport truck types and transport rates are available, in order to optimise the final recommended route, ensuring the most economical alternative.

1.7 Structure of this report

This report is divided into nine chapters:

Chapter 1 Background and Introduction

Introduces the EIA and the legal context for the proposed photovoltaic energy facility.

Chapter 2 Description of Development Proposal

Describes the various components of, and the motivation for, the proposed photovoltaic energy facility.

Chapter 3 Description of the Affected Environment

Provides an overview of the affected biophysical and socio-economic environment in the Petrusville area.

Chapter 4 Public Participation

Describes the Public Participation Process (PPP) followed, and the issues & concerns that have been raised by Interested and Affected Parties (IAPs).

Chapter 5 Assessment of Environmental Impacts

Identifies and rates environmental impacts associated with the proposed project and recommends mitigation measures.

Chapter 6 Findings, Evaluation and Recommendations

Concludes and summarises the findings and recommendations of the Environmental Impacts Study.

Chapter 7 Draft Environmental Management Programme

Stipulates the environmental management guidelines that should be implemented in the planning, design, pre-construction, construction and operation stages of the proposed development.

Chapter 8 The Way Forward

Describes the next steps in the EIA process.

Chapter 9 References

Cites any texts referred to during preparation of this report.

Appendices – see separate volume of appendices

Supporting information is presented in various appendices.

2 Description of Development Proposal

This chapter identifies the location and size of the site of the proposed Kloofsig PV Energy Facility, and provides a description of its various infrastructure components and arrangements on the site.

2.1 Need and Desirability

2.1.1 Electricity Supply

Two of the main rationales for the proposed solar facility are the need for additional energy generation as a result of increasing energy demand, as well as the contribution to the establishment of South Africa's renewable energy sector.

The White Paper of Renewable Energy (November 2003) recognises that South Africa's energy generation is predominately supported by coal-based energy generation (as a result of our large coal reserves) and has an extremely low market share of renewable energy generation. However, it is also recognised that the emissions of greenhouse gases, such as carbon dioxide, from the use of fossil fuels has led to increasing concerns about global climate change. The advancement of renewable energy resources is therefore recognised as a major contributor in countering climate change, protecting our natural resources, the biophysical environment as well as providing a range of environmental, economic and social benefits that will contribute towards long-term sustainability.

As reflected in the White Paper, the diversification of supply is an important element of improved energy security. South Africa is also well endowed with renewable energy resources, that can be sustainable alternatives to fossil fuels, but so far these have remained largely untapped.

According to the project proponent, the establishment of the proposed Kloofsig PV Energy Facility will aid the government in achieving its goal of a 30% share of all new power generation being derived from Independent Power Producers (IPPs). In addition to the above-mentioned potential benefits, the proposed project site was selected due to:

- Topographic suitability - the flat, generally level topography of the site;
- Existing power infrastructure in the area – 132 kV, 400 kV, and 765 kV powerlines run across and close to the site, allowing for relatively economical connection to the national power grid;
- The site is situated within a Central Transmission Corridor in terms of the Renewable Energy Development Zones (REDZ) and Transmission Corridors map published as part of the CSIR Strategic Environmental Assessment for Wind and Solar PV Energy in South Africa - Renewable Energy Development Zones (REDZs) (see Figure 2-1);
- Existing road access – the site can be accessed from two existing access route options, with minimal upgrades required;
- Most of the land comprising Kloofsig 1 has been previously disturbed;
- Low agricultural potential of the land;
- Relatively low environmental sensitivity of the land;
- There is a high need for economic development in the area;
- Good solar resource in the area and suitable climate; and
- High suitability for the technological solution of solar PV.

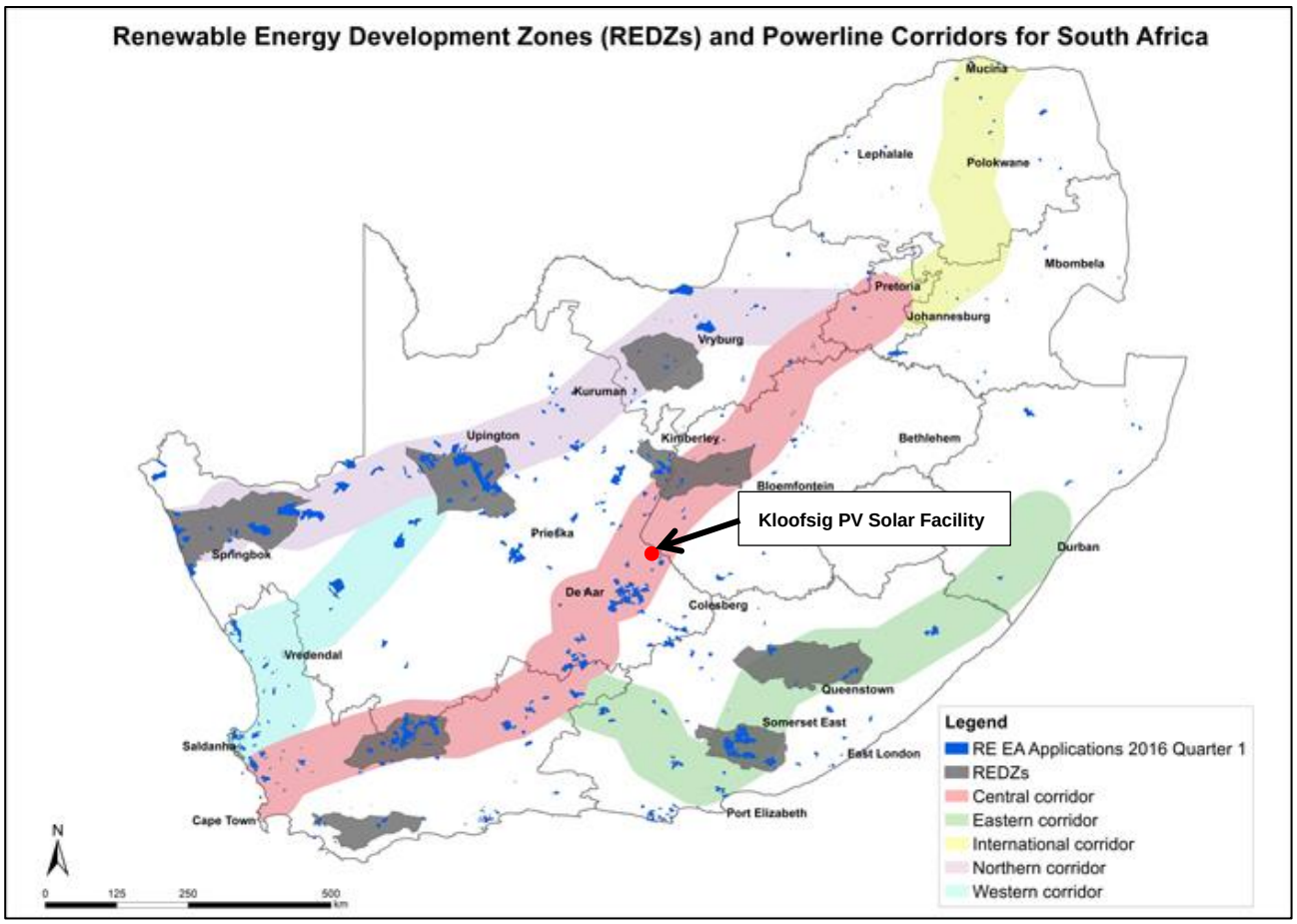


Figure 2-1: Map showing REDZ and transmission corridors (Source: https://redzs.csir.co.za/, 2016)

2.1.2 Social and Economic Development

Kloofsig PV Energy Facility intends to promote local economic growth and development through direct and indirect employment, as well as the identification and implementation of social development schemes during the projects operational phase.

The project will be subject to the REIPPPP bidding process, one of the key assessment criteria of which is likely to be a local economic development plan. This plan is currently not available.

2.1.3 Climate Change

Most of South Africa's energy comes from non-renewable sources like coal, petroleum, natural gas, propane, and uranium; however the proponents of renewable energy sources like biomass, geothermal energy, hydropower, solar energy, and wind energy is a major factor that the South African sector need to consider. It is estimated that approximately only 1% of the country's electricity is currently generated from renewable energy sources. The energy sector in South Africa alone emits approximately 380,988.41[5] Green House Gases (GHGs) (Eastern Cape Climate Change Conference, 2011). South Africa's total emissions was estimated to be 461 million tonnes CO_2

[5] It is assumed this refers to carbon dioxide equivalents per annum. No attempt has been made to check this against the reference.

equivalent in the year 2000. Approximately 83% of these emissions were associated with energy supply and consumption, 7% from industrial processes, 8% from agriculture, and 2% from waste. Eskom currently generates 95% of the electricity used in South Africa with an approximate 40.87 GW net maximum installed capacity.

By the year 2020 an additional 20 GW generation capacity would be required and up to 40 GW by 2030 to sustain the energy demands in the country. National energy policy has called for a change in the energy mix to reduce the dependency of the economy on fossil fuels and facilitate the uptake of renewable energy resources. This is in accordance with the prescriptions of the United Nations Convention on Climate Change 1994 (UNFCCC) and its associated Kyoto protocol of 1997, South Africa has put in place a long term mitigation scenario (LTMS) by which the country aims to develop a plan of action which is economically viable and internationally aligned to the world effort on climate change. During this period (2003-2050) South Africa will aim to take action to mitigate GHG emissions by 30% to 40% by the year 2050. This is a reduction of between 9000 tons and 17 500 tons of CO_2 by 2050. In January 2010, South Africa pledged to the UNFCCC, a 34% and 42% reduction against business as usual emissions growth trajectory by the year 2020 and 2025 respectively.

Due to concerns such as climate change, and the on-going exploitation of non-renewable resources, there is increasing international pressure on countries to increase their share of renewable energy generation. The South African Government (White Paper on Renewable Energy, 2003) has recognised the country's high level of untapped renewable energy potential and the equally high level of current fossil-fired power generation, and has placed targets of 10,000 GWh of renewable energy (biomass, wind, solar and small hydro) by 2013 in order to begin to redress the balance.

2.1.4 Planning Policy Framework

This section discusses a number of key formal planning policies relevant to the project. The policies and plans briefly discussed below include regional and local development and spatial plans, including the:

- Northern Cape Provincial Growth and Development Strategy (PGDS) (2011);
- Northern Cape Provincial Spatial Development Framework (SDF) (2012);
- Integrated Development Plans (IDPs) for the Pixley Ka Seme District and Renosterberg Local Municipalities, which formulate the specific needs in, and desirable developments for, municipalities; and
- SDF for the Renosterberg Local Municipality, which translates the aims of the IDP into a spatial dimension and, together with the IDP, aim to give effect to the national imperative to increase economic growth and promote social inclusion whilst ensuring that such growth is environmentally sustainable (DEA&DP, 2009).

This section examines the extent to which the proposed project is consistent with relevant plans.

Northern Cape Provincial Growth and Development Strategy (2011)

The PGDS (Northern Cape Provincial Government, 2011) is a guiding tool for future development in the Northern Cape and identifies poverty as the most significant challenge facing the province. Long-term sustainable economic growth and development is recognised as a priority in order to ensure that challenges associated with poverty are addressed. The PGDS aims to guide and coordinate the

allocation of government resources and private sector investment in order to facilitate sustainable development.

The PGDS defines a vision for the Northern Cape: 'building a prosperous, sustainable growing provincial economy to eradicate poverty and improve development for a caring society'. The overarching objective of the PGDS is to ensure the integration of development processes and, in particular, to facilitate sustainable development throughout the province.

Northern Cape Provincial Spatial Development Framework (2012)

The Northern Cape Provincial SDF (Northern Cape Provincial Government, 2012) is a spatial planning document that guides district and local spatial initiatives such as IDPs and SDFs. The Provincial SDF is based on the principles of the PGDS and one of its overarching functions is to serve as a spatial land-use directive that aims to promote environmental, economic and social sustainability through sustainable development.

The SDF identifies a number of objectives, including the following:

- Provide a spatial rationale and directive for future development in terms of the principles of sustainability as advocated by the National Strategy for Sustainable Development;
- Give spatial effect to the provisions of the PGDS and guide the implementation of key projects;
- Provide guidance to public and private infrastructure investment in the province, taking cognisance of the growth and development potential of the various regions and settlements in the province; and
- Spatially co-ordinate and direct the activities and resources of provincial government departments.

The Provincial SDF identifies a number of Spatial Planning Categories (SPCs). These SPCs were formulated in terms of bioregional planning principles and collectively illustrate the desired matrix of land-use throughout the province. The SPCs are used to define a spatial vision for the province and are illustrated in a composite spatial vision of the Northern Cape Province (see Figure 2-4 for the south-eastern portion of the Province). The SPCs also provide a framework to guide decision-making regarding land-use at all levels of planning.

The proposed development area lies within the agriculture SPC. The agricultural areas in the project area are considered to be suitable for grazing with low to moderate grazing potential. According to the composite spatial vision for the Province, the N1 is identified as an important development corridor, located ~40 km to the north-west of the project site.

The site does not fall within a Buffer Area (i.e. areas that serve as buffers between core conservation areas and the intensive land uses (e.g. agriculture)). Buffer Zones provide an appropriate interim classification for conservation-worthy areas that do not have statutory protection, including ecological corridors, Critical Biodiversity Areas (CBAs), irreplaceable habitats and major wetland and catchment systems. The closest Buffer / Critical Biodiversity Area to the proposed site is approximately 200 km to the west (Figure 2-4 and CBA Map in Appendix F).

The Provincial SDF identifies a general approach to the investment of public and private funds. This is based on the business principle that investment should be directed where the best return on such investment can be generated. The Renosterberg Local Municipality, in which the Kloofsig

development is located, is identified as having a generally high human needs index and a low development potential (NCPSDF, 2011). The surrounding area is therefore considered a high priority area for public and private investment and social development. Investment into social capital, infrastructure development and large scale capital investment, producing secondary economic and social benefits, are deemed appropriate in this area.

The closest settlement to the development, Petrusville's, economic base is categorised as a Service Centre which serves the daily needs of a surrounding farming community, e.g. providing educational, religious, shopping and professional services. The area has a medium development potential and medium human need and the investment types required are social and infrastructure.

Renewable energy projects are a high priority on the provincial agenda (Dennis Moss Partnership, 2012) and several targets have been put in place for the generation of electricity using renewable sources. As a result of this, 25% of the Province's energy generation capacity is set to be acquired from renewable energy products such as wind, solar, thermal, biomass and hydroelectricity by the year 2020 (Dennis Moss Partnership, 2012). Focusing on renewable energy development will not only assist in diversifying the economy of the Province, but it will also be of benefit in aligning regional goals with national goals as it will add to the promotion and growth of green industries. The socio-economic specialist has confirmed that review of the Northern Cape SDF, and specifically the area in which the project site is located, reveals that the proposed Kloofsig PV project will not have any spatial development conflicts with provincial plans.

Pixley Ka Seme District Municipality Integrated Development Plan (2011-16)

The Pixley Ka Seme District Municipality's IDP (Pixley Ka Seme District Municipality, 2011) is a strategic plan that is used to guide the development of the District for a specific period, in this case 2011-2016. It guides the planning, budgeting, implementation, management and future decision making processes of the District Municipality (DM). As district municipalities play an important role in the coordination of government actions across national, provincial and local government, the District IDP provides for strategic guidance, coordination and alignment of local municipality initiatives and national and provincial departments active in the district.

The main aims of development in the Pixley ka Seme District identified in the IDP are improving the quality of life of all people, promoting sustainable development in the region through effective and efficient service delivery, improving the health and living conditions of the poor and promoting local economic development and job creation. Addressing the following issues was identified as key to the long-term economic prospects of the District:

- Backlogs in the provision of basic services in rural areas and informal settlements;
- Limited availability of water in the district and its impact on economic and social activities;
- HIV/AIDS and its impact on regional demographics;
- Attracting international capital;
- Preservation of a pristine environment;
- Release and distribution of land to facilitate development;
- Spatial inequalities; and
- High levels of unemployment and poverty.

The IDP also identified opportunities in the region's location between South Africa's major cities (Bloemfontein, Cape Town, Johannesburg and Pretoria) and along several major national highways (N1, N12, N9 and N10) as well as in the rapid recent growth of renewable energy projects in the region.

The Pixley ka Seme DM declares itself as a Renewable Energy Hub that seeks direct foreign investment in solar, wind, hydro and biomass projects (Pixley ka Seme IDP, 2015). The distribution of renewable energy projects throughout South Africa is shown on Figure 2-2.

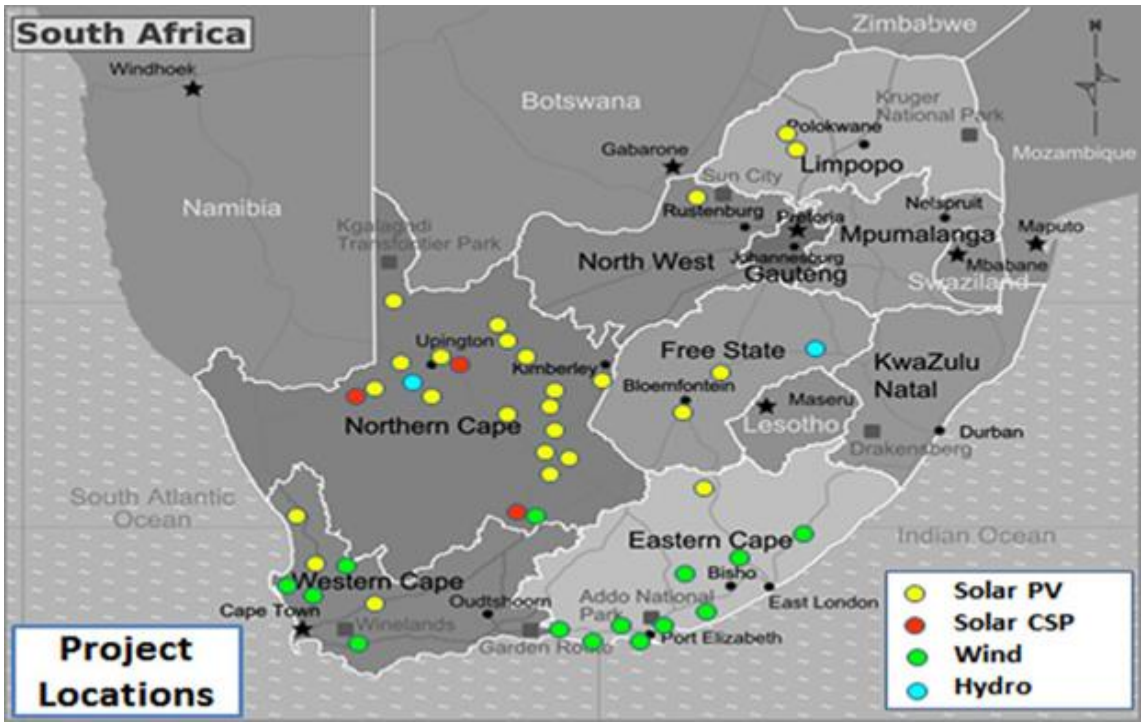


Figure 2-2: Renewable energy projects distribution (Pixley ka Seme IDP, 2015)

Renosterberg Local Municipality Integrated Development Plan (2015-16)

According to its IDP, the Renosterberg Local Municipality (LM) experiences economic development deficits. Due to this, the upliftment of the local economy is a priority. The economy of the region has a long history as a provider of migrant labour, as most people leave the area in search for better employment opportunities (Renosterberg IDP, 2015). Therefore, any development that would allow retention of its labour force and creation of sustainable employment opportunities, which will assist in alleviating local households' living standards, will be desirable in the area.

The Renosterberg Local Municipality's IDP for 2015 – 2016 identifies various developmental needs. Key issues identified in the IDP from a municipal perspective include the following:

- Development of sites and building of subsidised housing in Phillipstown and Keurtjieskloof;
- Construction of roads;
- Upgrading of gravel streets in Phillipvale;
- Upgrading of sports grounds in Philiipstown;
- Upgrading of the water network in Vanderkloof;
- Development of a taxi rank in Petrusville;

- Development of new erven in Petrusville;
- Ablution facilities in graveyards in Petrusville and Philipstown;
- Traffic testing station on Philipstown;
- Construction of libraries in Petrusville and Philipstown;
- Upgrading of sports facilities in Vanderkloof;
- Resurfacing of roads in Vanderkloof;
- Development of parks and open areas;
- Development of solar parks in Petrusville and Philipstown;
- SMME development training;
- Vanderkloof Holiday resort;
- Clay brick making in Petrusville;
- Poultry farming in Petrusville; and
- Aquaculture in Vanderkloof.

Renosterberg Local Municipality Spatial Development Framework

The SDF for the Renosterberg Local Municipality provides an overview of local socio-economic conditions and needs and largely re-affirms the planning principles and strategies expressed in the Pixley Ka Seme District SDF pertaining to the local municipality. Key spatial principles noted in the local SDF are:

- Give effect to the principles contained in Chapter 1 of the Development Facilitation Act, 1995 (Act No 67 of 1995).
- Preferential and focus areas for certain types of land uses.
- The location of projects identified as part of the integrated development planning process.
- Reflect the spatial objectives and strategies contained in the IDP.
- Indicate the desired direction of urban expansion and the most appropriate use of vacant land where appropriate and desirable.
- A business plan for implementation of the spatial development framework.

In a rural context it will be necessary also to deal specifically with:

- natural resource management issues,
- land rights and tenure arrangements,
- land capability,
- subdivision and consolidation of farms, and
- the protection of prime agricultural land.

Within the Renosterberg LM, the primary delineation and description of the land is earmarked as agricultural land, however there is no other indication of a potential conflict between this land use and the proposed development. This is so because the project site as well as the adjoining farm portions are not reserved as high agricultural potential areas nor are they reserved as potential

irrigated agricultural land (see Figure 2-4 below). The project area is also situated far from any of the development nodes that form part of the spatial vision of the local municipality.

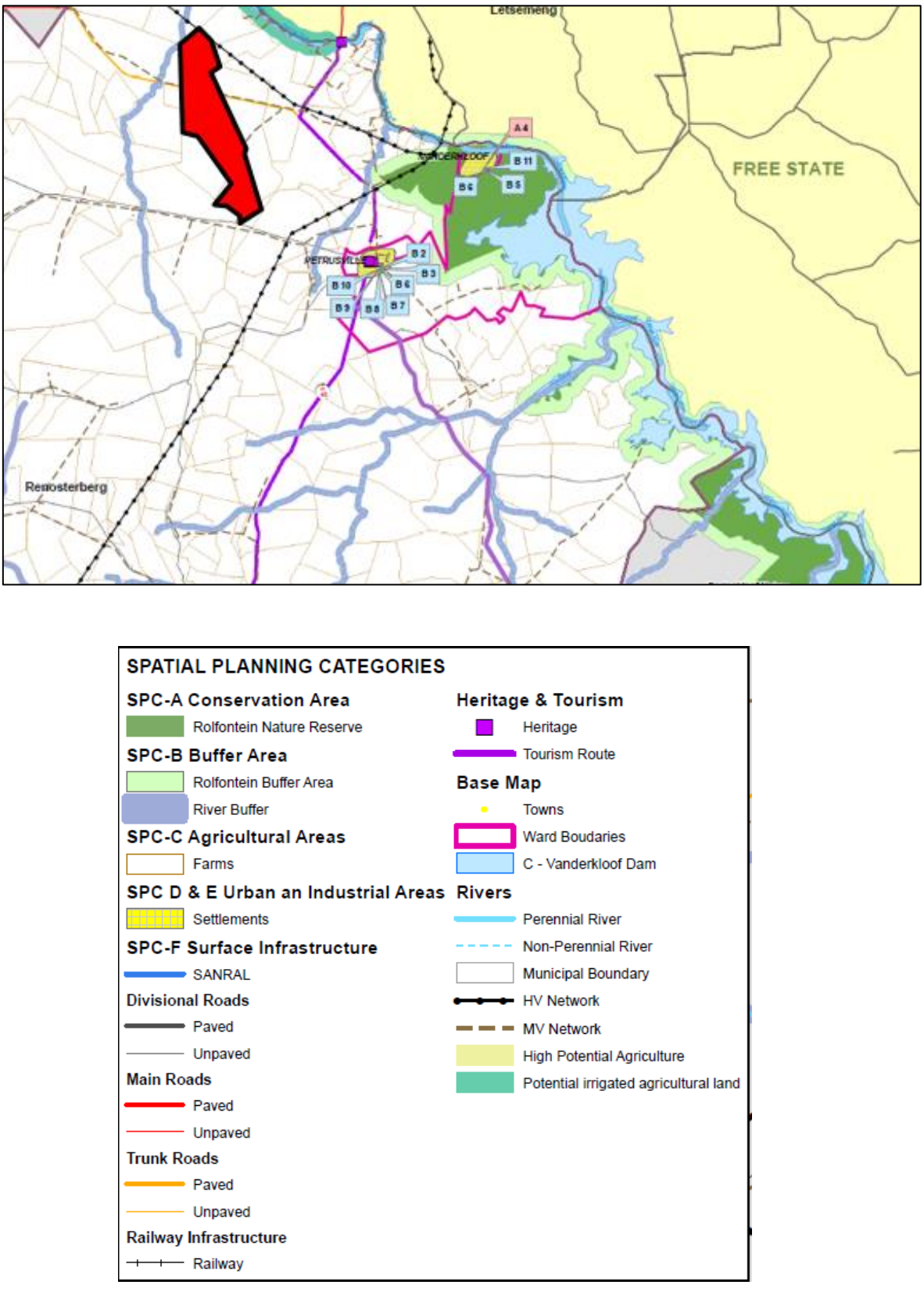


Figure 2-3: Renosterberg LM Spatial Development Framework (Renosterberg LM SDF, 2012)

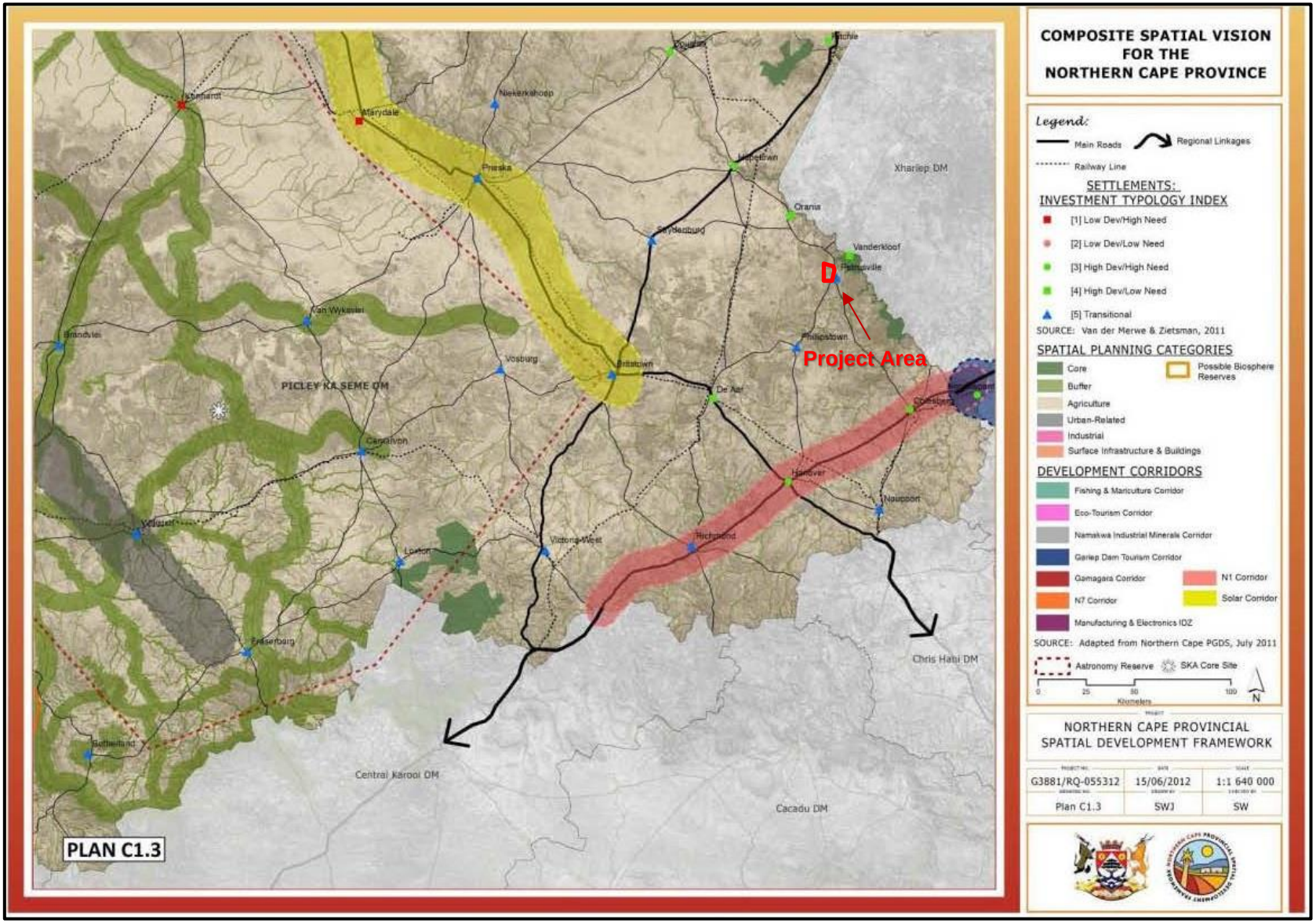


Figure 2-4: Provincial SDF Composite Spatial Plan for the project area (Source: SDF for the Northern Cape Province, 2012)

2.2 Location and Site Description of the Proposed Project

The proposed solar farm is located on Portion 0 (Remaining Extent) of Farm 18, Kalkpoort in the Renosterberg Local Municipality within the Pixley Ka Seme District Municipality, Northern Cape Province, South Africa (Figure 1-1). The project has a total study area (for all three phases) of approximately 970 ha located on the remaining portion of Farm 18, Kalkpoort. The closest towns to the proposed site are Petrusville, 11 km to the southeast, and Van Der Kloof, 16 km to the east. The Rolfontein Nature Reserve is situated approximately 20 km from the proposed site. The reserve covers an area of 8 400 ha and is located on the southern bank of the Vanderkloof Dam, on the Orange River.

Kloofsig 1 is located in the centre of the site and includes a 400 kV on-site substation and a 132 kV overhead powerline connection of approximately 8.6 km (crossing portion 0 of Farm 20, Alwyn Vlakte) connecting to a 132 kV substation on Portion 2 of the Farm 59, Doornfontein. This allows connection to the 132 kV Eskom powerline running to the south-east of the site, as shown on Figure 2-5. Relevant property details are provided in Table 2-1.

Table 2-1 Property details for Kloofsig 1

Farm Name/ Erf Number	Portion 0 (Remaining Extent) of Farm 18, Kalkpoort	Portion 0 (Remaining Extent) of Farm 20, Alwyn Vlakte	Portion 2 of Farm 59, Doornfontein
SG 21 Digit Code	C05700000000001800000	C05700000000002000000	C05700000000059000002
Physical Address	Kloofsig Petrusville 8770	Aalwyn Vlakte Petrusville 8770	Doornfontein Petrusville 8770
Coordinates	24° 32' 31.783" E ; 29° 59' 25.797" S	24° 33' 49.248" E; 30° 3' 7.366" S	24° 35' 31.729" E; 30° 3' 35.362" S

2.3 Detailed Description of the Proposed Project

2.3.1 Proposed Activities

The proposed development consists of three project phases of 75 MW each (with a total power generation capacity of approximately 225 MW should all phases be developed), each including a small on-site substation (converting 33 kV to 132 kV), and covering a combined area of approximately 970 ha.

This report ('Kloofsig 1') is for the first of these three phases and includes a 132 kV overhead powerline (approximately 8.5 km) and a substation to allow connection to the existing 132 kV powerline running to the south-east of the site as well as a 132 kV switching station at the Eskom connection point. An additional on-site substation (converting 132 kV to 400 kV power) and short connection line to the existing 400 kV powerline crossing the site is also proposed, due to uncertainty regarding the future capacity of the 132 kV Eskom line to accept the connection from the proposed project at the time of development (capacity is however currently available). Although authorisation for both of the powerline connections described above is sought for Kloofsig 1 by the applicant, the intention is that only one of these would be developed, depending on the available grid capacity at the time of development. The total footprint of Kloofsig 1 is in the order or 270 ha and includes the 31 m servitude of the 132 kV powerline to the south of the site.

The main components of the proposed solar energy facility, which will be similar for each of the proposed phases (Kloofsig 1, 2 and 3) are listed as follows (as shown on Figure 2-5):

- Solar panels (fixed or tracking), mounted in arrays/modules;
- Arrays/modules of solar panels arranged in clusters;
- Underground low voltage cables linking solar panels within a cluster to an inverter (for converting DC to AC current);
- Substations – a 132 kV collector / step up substation for each phase (covering an area of 1 ha), as well as a central switching substation (covering an area of approximately 12.4 ha) servicing all three phases and allowing for connection to the nearby 400 kV Eskom overhead powerline. **Kloofsig 1 will also include a second switching substation to the south-east of the site;**
- Underground power cables (of a medium voltage) from inverter substations to a central collector/ step-up substation for each phase;
- A 132 kV above ground powerline with maximum tower height of 24 m, connecting the step-up substations with the switching substations (both on-site and **to the south-east of the site for Kloofsig 1**);
- A 33 kV below ground powerline with Supervisory Control and Data Acquisition (SCADA) (a system for remote monitoring and control);
- Laydown areas and construction camp– a laydown area has been set aside for each phase;
- Offices, ablution facilities, store room- permanent office, ablution and store room facilities will be situated at the 1 ha on-site substation buildings for each phase.

Table 2-2 Technical details for the proposed Kloofsig 1 facility

Component	Description / dimensions
Height of panels	2 m
Structure orientation	• Fixed PV panels will be installed to face true north. • Tracking PV panels will be installed to follow the sun (facing the sun) from east to west.
Area of PV array	• Kloofsig 1 – 212.1ha
Number of inverters required	• 38 invertors for each 75MW phase (Kloofsig 1/2/3) • Invertor height is 2.1 m
Area occupied by inverter / transformer stations / substations	• Substation per phase – 1ha • Eskom Switch/Substation all phases 12.4ha
Capacity of on-site substation	• 400 kV Substation - 240MVA • 132 kV substations - 80MVA each
Area occupied by both permanent and construction laydown areas	• Construction laydown areas - 4 ha per 75MW phase • No permanent laydown area
Area occupied by buildings	• 0.5 ha
Length of internal roads	Unknown – exact alignment of internal roads not yet determined but will be within the development footprint
Width of internal roads	<6m
Proximity to grid connection	8.7 km
Height of fencing	Typically 2.4m, but to be determined during detail design.
Type of fencing	Typically mesh security fencing, but to be determined during detail design.

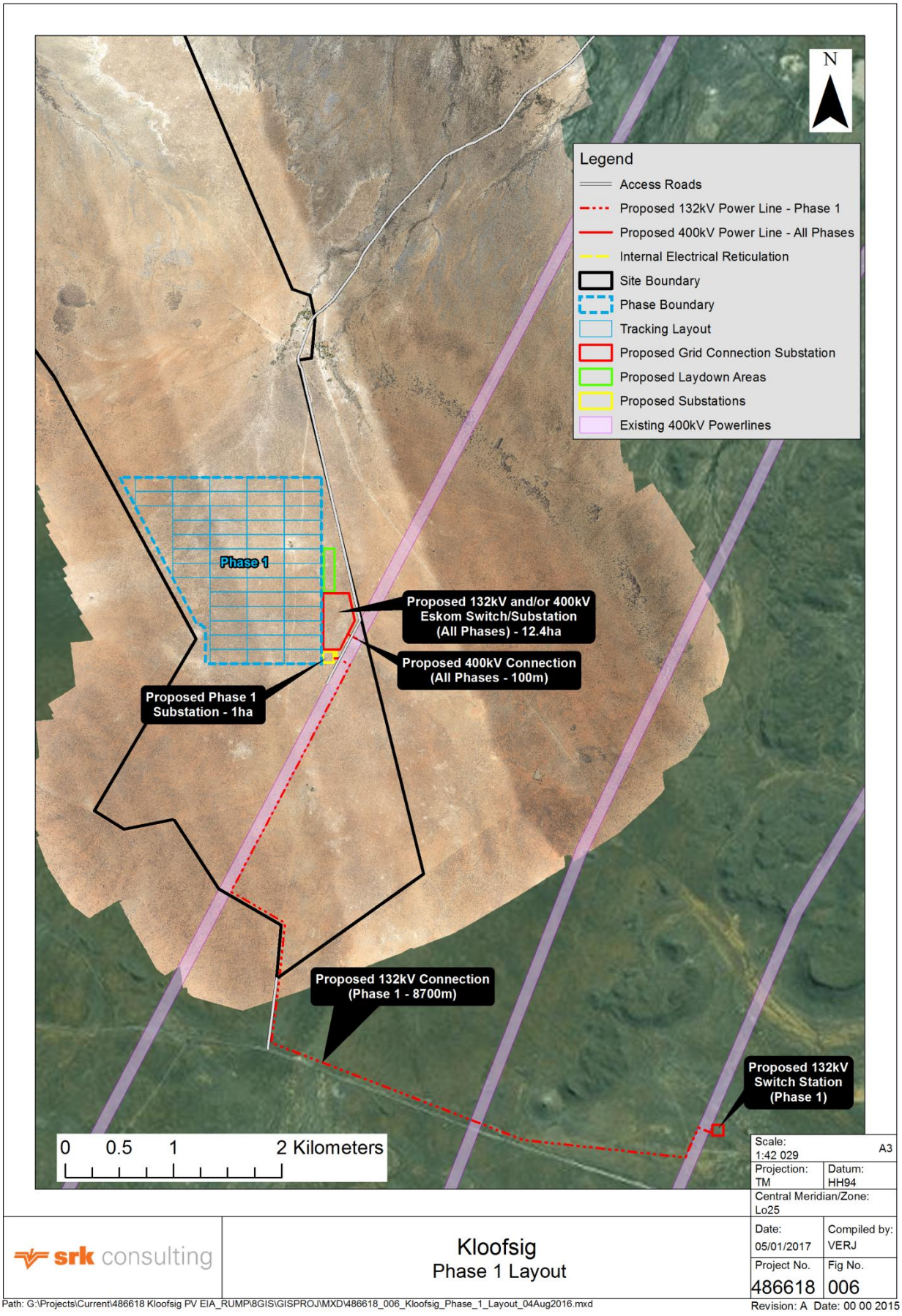


Figure 2-5: Preliminary layout plan for Kloofsig 1

2.3.2 Employment

Approximately 300 direct employment opportunities will be created during the construction phase of the project (a maximum of 500 workers on site at any time is allowed for), workers for which will be sourced from the surrounding residential areas where possible and transported to the site on a daily basis. During operation, approximately 15 direct employment opportunities will be created. These will consist of permanent security staff as well as operational and maintenance crews, with up to 10 staff being on site at any time. Staff for the construction and operational phases will not be accommodated on the site.

2.3.3 Associated Infrastructure/Services

In addition to the main components of the development proposal as listed in Section 2.3.1, a number of related infrastructure/services are required as discussed below.

Roads (Access and Internal)

Access to the site from the R 369, between Van der Kloof and Orania, is via the existing Kalkpoort gravel road to the northeast of the site. The Kalkpoort gravel road will require maintenance (e.g. re-gravelling, and refurbishment of culverts) and expansion (both in length and width) to extend the road to the southern side of Kloofsig 1. A second access road (approximately 500 m long) to the south of the site, connecting to the existing secondary road running south of the site is also proposed. A network of internal roads (i.e. on the farm) would be required, and these are envisaged to be 4- 5 m in width. The alignments for these roads are not yet available, but they will be within the development footprint area. Gravel for roads will be sourced commercially from nearby quarries.

Water Supply

It is proposed that the water requirements for the development are supplied by existing or new (locations yet to be determined) boreholes on the property. During the construction phase water may be needed for dust suppression and building requirements. Water will be required for washing panels during the operational phase.

The anticipated water demand during construction is 53 m³/day, and during operation with fire suppression it is estimated to be 18 m³/day, and without fire suppression 11 m³/day. Water will be pumped from the boreholes into storage tanks until required.

Wastewater

Minor quantities of domestic sewage (this includes toilet effluent and grey water) would be generated during the construction & operational phases. During construction, portable chemical toilets will be used on site. During operation, when a total of up to 10 people are expected to be present on site, it is proposed that wastewater would be discharged to a septic tank & soak away system.

Solid Waste Management

A number of waste streams are anticipated. These include:

- Considerable amounts of solid waste (mainly packaging material) during the construction phase. This waste stream, and the storage thereof, would be temporary and inert;
- Small quantities of domestic waste associated with the staff facilities during the construction and operational phases;

- Occasional scrapped equipment during the operation of the site (e.g. defective panels, tracking systems, etc.).

It is anticipated that these, and other waste streams can be readily managed, including any temporary on site storage, and transportation for off-site disposal to the nearest registered landfill site. A considerable amount of the waste generated would be recyclable, and some of this would have high economic value.

Hazardous Waste Management

During construction, small amounts of hazardous waste will be generated, as a result of general construction related activities. These could include used oils, paints, and solvents. During operation, transformer oils will periodically need to be replaced as part of routine maintenance. All hazardous waste will be collected and disposed of at an appropriate facility offsite by a contractor who deals with disposal of hazardous waste.

2.4 Project Development Phases and Associated Physical Activities

The construction phase is expected to start within one year of successful application for preferred bidder status in the Department of Energy's REIPPPP programme, and take 12 to 18 months to complete. The operational phase is expected to have a lifespan of approximately 20 years after which the facility would either be decommissioned or refurbished for an additional 20 year operating period.

The main physical activities that will take place during each of the phases of the development are summarised below.

2.4.1 Construction Phase (12 – 18 Months)

The following activities will take place during the construction phase:

- Conducting of surveys prior to construction (typically a hydrogeological survey, geotechnical survey, a site topographical survey etc.);
- Clearing of vegetation in selected areas (e.g. for roads and substations) and possible removal of topsoil that will be stock piled and backfilled/ spread on site after construction;
- Construction of internal access roads as well as maintenance/upgrading / extension of access road from the nearest provincial road;
- Transportation of equipment – most of the equipment could be transported in modules and would not need special arrangements, except for the transformers, which may be classified as abnormal loads;
- Construction of camp and temporary equipment lay down areas – equipment will be temporarily stored in the lay down area before installation;
- Installation of PV panels, which entails the drilling of holes into the ground in order to install round galvanised steel posts upon which modular frames (with the solar photovoltaic panels) are to be attached to;
- Installation of a security fence around the boundary of the site and access control;
- Construction of inverter substations;

- Construction of a step-up substation. The substation will have transformers to step up the medium voltage (33 kV) to high voltage 132 kV. Switchgear and metering equipment will also be established in the substation;
- Installation of internal medium voltage underground power lines from the inverter substations to a central collector/ step-up substations;
- **Construction of a 132 kV overhead power lines (approximately 8.5 km long) - if the 132 kV connection south of the site is used - running from the on-site step-up substation to the Eskom 132 kV proposed switching substation**;
- **Construction of an Eskom 132 kV switching substation (off-site) and associated powerline grid connection, if this connection option is available;**
- Construction of a 400 kV Eskom step-up substation (on-site, **if the 132 kV connection south of the site is not available)**. The substation will have transformers to step up the high voltage (132 kV) to high voltage 400 kV. Switchgear and metering equipment will also be established in the substation;
- Construction of a 400 kV powerline between the 132 kV step-up substation and 400 kV substation on site **(if this connection option is required).** An additional short 400 kV connection line will also be constructed between the 400 kV substation and the existing Eskom 400 kV line;
- Construction of Control room for the operation, maintenance personnel and equipment storage; and
- Site rehabilitation.

2.4.2 Operation and Maintenance Phase (± 20 years)

The PV panels are designed to operate continuously for more than 20 years, unattended and with low maintenance.

The following activities will take place during the operation and maintenance phase:

- Cleaning of panels – Staff will be on site to clean PV panels four times a year (in 90 day cycles), using water with a small amount of biodegradable detergent. Approximately 11 m^3 of water per day will be required for this (per project phase);
- Security staff will be permanently on site; and
- Control/ maintenance staff will be on site as required to undertake routine repairs and maintenance to facilities and equipment.

2.4.3 Decommissioning Phase

The following activities will take place during the decommissioning phase:

- Site preparation – a laydown area will be required when disassembling the equipment;
- Disassembling and removal of equipment and infrastructure that does not have an ongoing use on the site, for re-use or recycling; and
- Rehabilitation of the site.

2.5 Transportation of equipment and materials to site

It is anticipated that the PV panels and associated equipment will be imported in containers via ship, and thereafter transported on flatbed trucks to the site, via Petrusville. Between 980 and 1200 standard 40 foot containers (for each phase of the proposed development) are expected to be required, and no abnormal loads are foreseen. The preferred port of import (and shortest distance) will be the Ngqura Harbour near Port Elizabeth, to Petrusville (530km), with route details as follows:

- take the N2 eastwards from Neptune Road when exiting the harbour, for approximately 30km;
- follow the N10 northwards via Cradock and Middelburg for 410km to Hanover;
- turn right / northwards at Hanover onto the R389 towards Philipstown;
- travel 75km to Philipstown and continue straight on the R48 for 40km to Petrusville.

Alternative ports considered are Cape Town or Saldanha Bay harbour, both of which would entail longer transportation routes. The roads involved are surfaced and in a relatively good condition, and no road upgrades or width or height limitations are foreseen along either of the routes considered.

Any components that will be manufactured locally, can safely be transported to site by standard trucks on the existing national and provincial road network, without any limitations or obstacles foreseen. Local access roads to the site from Petrusville are shown on Figure 2.6, with the following two route options shown (to accommodate any road closures etc.), each approximately 20 km:

1) Northern access - mainly surfaced roads :
   Follow the R48 from Petrusville to the R369, to the northern entrance “Access No.2 to Site
   Follow the gravel Kalkpoort Road (North) from Farm entrance to Kloofsig 1 laydown area

2) Southern access - only gravel roads :
   Follow the Provincial District Road from Petrusville to the Kalkpoort Road (South)
   Follow the Kalkpoort Road (South) to the Farm buildings and southwards to Kloofsig 1

For Kloofsig 1, it is assumed that 70% of construction and transportation vehicles will use option 1 above and only 30% will use option 2. Details of the various roads involved and any maintenance or upgrade requirements to accommodate the proposed development are provided in Table 2-2.

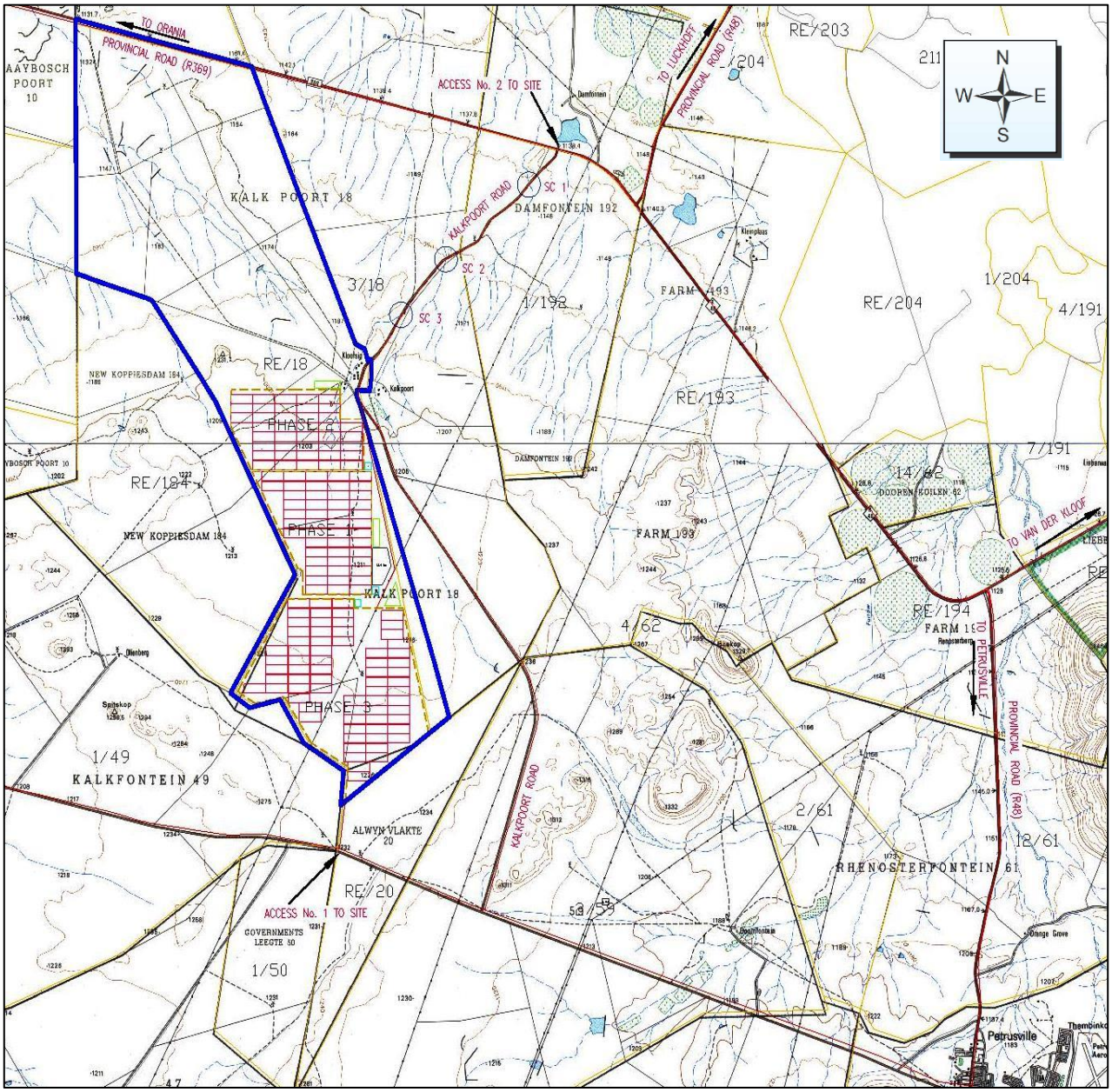
During construction, it is anticipated that approximate average daily volumes of heavy vehicles will be 7 for option 1 and 3 for option 2 (for Kloofsig 1 / 2). Volumes of standard vehicles for each route are estimated to be 21 and 9 respectively. During operation of Kloofsig 1 a daily average of 19 light vehicles (including water trucks, standard vehicles and plant) for option 1 and 8 for option 2 are expected.

2.6 Project Alternatives

One of the objectives of an EIA is to investigate alternatives to the proposed project. The no-go alternative is included as the baseline against which the impacts of the other alternatives are assessed. Further discussion and comparison of the environmental and social advantages and disadvantages of the alternatives described below is provided in Section 5.16.1.

Table 2-2: Details of access roads to the site

No	Road Name	Road Category	Description		Distance (km)	Road Condition	Improvements required
			(From)	(To)			
1	R48	Provincial Main Road	Petrusville	R396 / R48 (to Luckhof & Koffiefontein) intersection	15.1	Surfaced Single carriageway (gravel shoulders / no lines)	Minor surface repairs (potholes and surface cracks)
2	R396	Provincial Main Road	R396 / R48 (to Luckhof & Koffiefontein) intersection	Access No.2 : Intersection at R369	1.5	Surfaced Single carriageway (gravel shoulders / no lines)	Minor surface repairs (potholes and surface cracks)
3	Unknown	Provincial District Gravel Road	Petrusville town centre (intersection with Main Road R48)	Kalkpoort Road (South)	7.97	Gravel Road (approx 6,6m wide)	Wet blading & Routine Maintenance
4	Unknown	Provincial District Gravel Road	Kalkpoort Road (South)	Access No.3 : New Access Road for Phase 3 at south of Solar Farm	2.43	Gravel Road (approx 6,6m wide)	Wet blading & Routine Maintenance
5	Kalkpoort Road (North)	Provincial Minor Gravel Road	Access No.2 : Intersection at R369	Existing Farm House and buildings	4.9	Narrow gravel road	Rip, widen, regrade and compact & improve drainage
6	Kalkpoort Road (South)	Provincial Minor Gravel Road	Access No.1 : Provincial District Gravel Road from Pertusville (at ch=7,97km)	Existing Farm House and buildings	8.1	Narrow gravel road	Rip, widen, regrade and compact & improve drainage
7	New Access Road for Phase 3	New Private Access Road	Access No.3 : Provincial Gravel District Road from Pertusville (at ch=10,4km)	Kloofsig PV Solar Farm Boundary (south of Phase 3)	0.67	Greenfield strip on farm Kalkpoort RE/20 (Remainder of Farm 20)	New Servitute (private land) and New Gravel road approx 6,6m wide
8	Internal Main Road	New Private Internal Road	Kalkpoort Road	Existing Farm House and buildings	3.0	Partially on farm roads (Jeep Tracks) / Greenfields on farm Kalkpoort RE/18	New Gravel road approx 6,6m wide
9	Internal Ring Roads	New Private Gravel Ring Roads	New Internal Main Road	Various Groups of PV Solar Panel installations	tbc	Partially on existing farm roads (Jeep Tracks) / Greenfields on farm Kalkpoort RE/18	New Gravel road approx 3,5m wide
10	Internal Minor Service Roads	New Private Minor Service Roads	Internal Ring Roads	Various Groups of PV Solar Panel installations	tbc	Partially on existing farm roads (Jeep Tracks) / Greenfields on farm Kalkpoort RE/18	New Gravel roads approx 2,2m wide



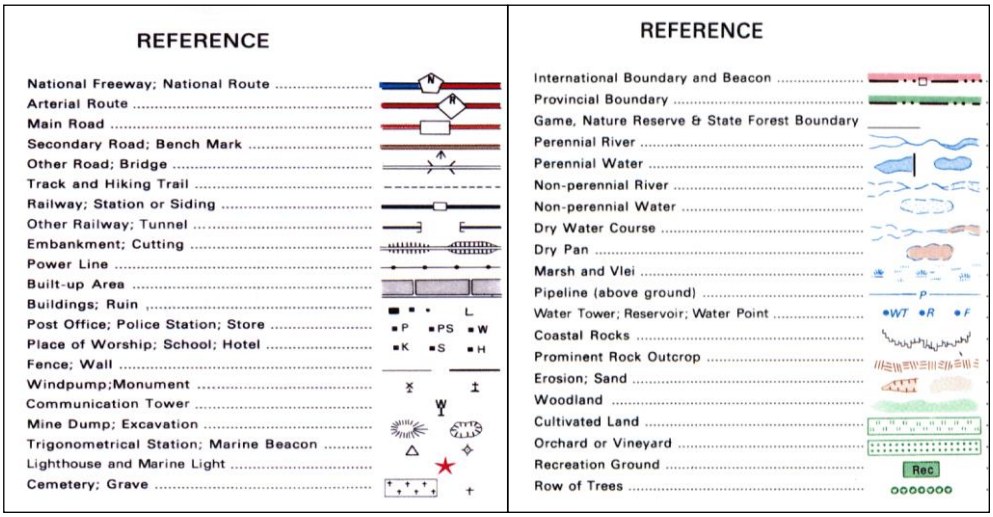


Figure 2-6: Topographical map showing route options to the site (Source: AfriCoast, 2016)

2.6.1 Activity Alternatives

The current zoning and land use for the property is agriculture (livestock farming). This is however becoming less economically viable due to the low carrying capacity of the land and factors such as drought, etc. The current development proposed is the production of renewable energy. Various key advantages and disadvantages of this alternative (which is also the no-go activity alternative, i.e. continue with current activities) for the site are discussed in Table 2-3 below, relative to the proposed activity (solar PV). Both alternatives will however be assessed as part of the EIA.

Table 2-3: Key advantages and disadvantages of activity alternatives considered

Activity alternative	Advantages	Disadvantages
Livestock farming (no-go alternative)	• Employment of semi-skilled local labour • Contribute towards food security	• Limited economic viability due to low carrying capacity of land • Subject to risks such as drought, disease
Solar PV (proposed alternative)	• Good solar resource available • Not affected by drought • Compatible with livestock farming • Contribute towards energy grid stability	• Limited employment opportunities during operation • High capital outlay • Clearing of land required

2.6.2 Site and Layout Alternatives

The proposed site for the Kloofsig development was identified based on its favourable climatic conditions for a solar facility, large, flat expanse of available land, close proximity to the existing 400 kV powerlines for connection to the Eskom grid, existing transport access onto the site, and availability of water (through existing boreholes). The scope of this EIA process does not include an assessment of additional properties as alternative sites but rather outlines the site selection process that has been undertaken to identify the most feasible (from a design and environmental sensitivity perspective) areas of the property for the project. This process has informed the currently proposed layout and is described below. As the EIA process progresses, further amendments to the proposed layout may be made in response to additional sensitivities identified.

Consideration was initially given to the development of the full extent of the Farm, consisting of approximately 2,606 hectares (see layout presented in Figure 2-7). A site sensitivity screening study (based on heritage and ecologically sensitive features), was undertaken prior to the scoping stage of the project and was used to identify the most suitable portion of the Farm for development. The input of specialists has been used in defining preferred no-go and buffer areas from environmentally sensitive areas (water courses, sensitive plants/species, heritage features, etc.). Based on the findings of the sensitivity screening, the proposed area for development has subsequently been reduced to approximately 970 hectares in the southern portion of the Farm (see environmental sensitivity map with revised and currently proposed layout for Kloofsig 1, 2 and 3, so as to avoid sensitive areas in Figure 2-8). Other considerations such as visibility and agricultural potential will also be taken into account in further refinements to the layout as required, once these studies have been completed.

2.6.3 Technology Alternatives – PV panels

The two main technology options available with regard to solar energy generation are solar photovoltaic (PV), and concentrated solar power technology (CSP). CSP is not proposed for this development and therefore will not be assessed further in this EIA.

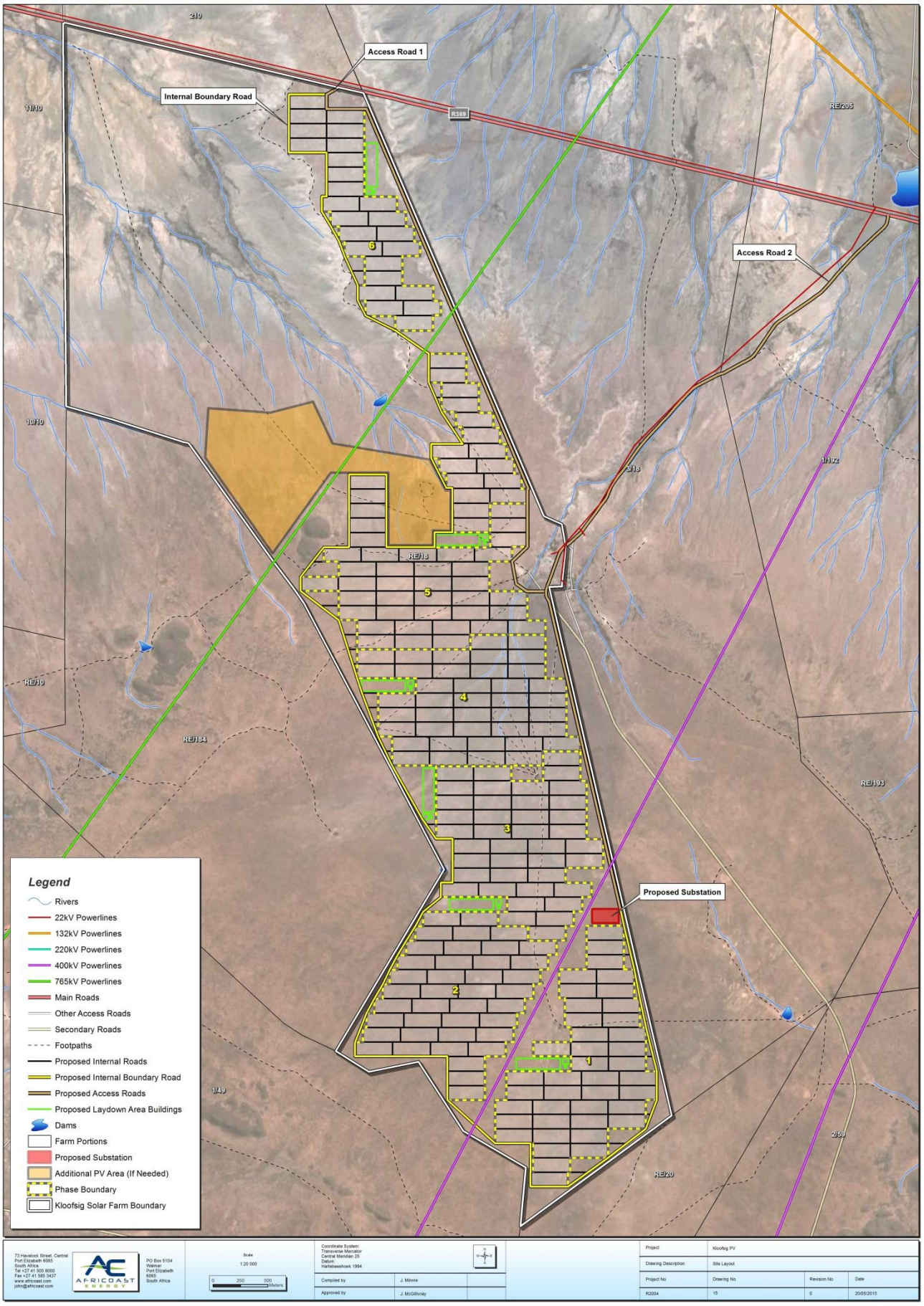


Figure 2-7: Initial proposed site layout for Kloofsig PV project, prior to sensitivity screening

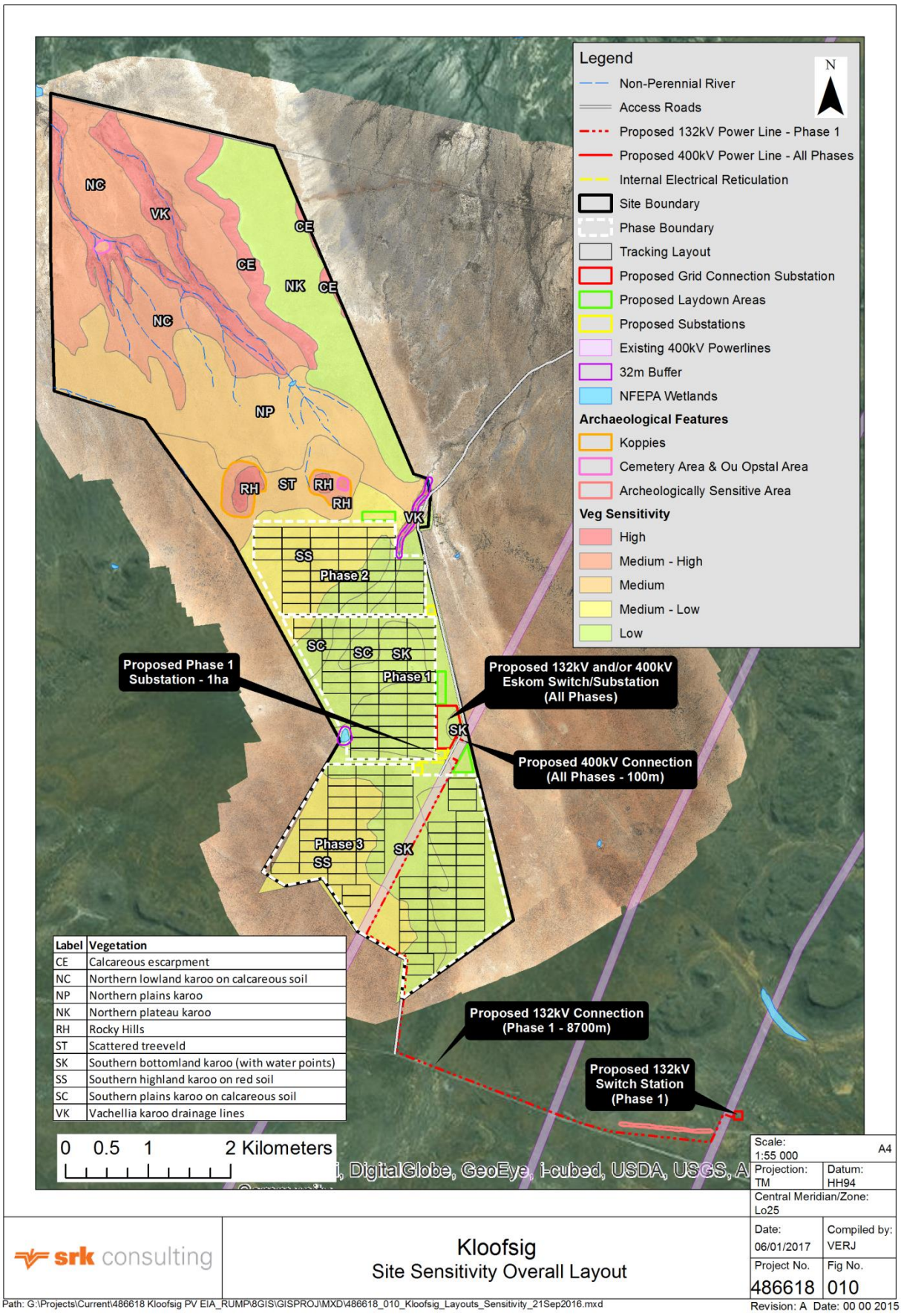


Figure 2-8: Site sensitivity map showing how the proposed layout for Kloofsig 1, 2 and 3 has taken these areas into account

A PV cell is made of silicon that acts as a semi-conductor used to produce electricity, and is positively charged on one side and negatively charged on the other, with electrical conductors attached to either side to form a circuit. A PV panel consists of a number of linked PV cells placed behind a protective glass sheet. An inverter must be used to change the direct current (DC) from the PV cells to alternating current (AC) to feed into a power line.

The following two PV technology alternatives, as determined by the panel mounting system, will be considered for the proposed project:

- Fixed mounted PV panels (static/ fixed-tilt panels); and
- Tracking PV panels (panels that follow the sun's movement through rotation on a fixed axis).

The precise layout of the facility is dependent on the environmental and technical factors associated with the site, as well as the type of technology used (fixed or tracking panels). Apart from slight differences in layout, these two technologies are not expected to result in significant differences in potential environmental or social impacts or mitigation measures required. Further discussion and comparison of the environmental and social advantages and disadvantages of these alternatives is provided in Section 5.16.1.

The preliminary layout presented in this report could accommodate either of two technology alternatives proposed – namely tracking or fixed panels, with relatively little adjustment. During final design the layout for the project will be refined based on the sun tracking technology alternative selected (taking into account site-specific sensitivity information).

Figure 2-9: Examples of what typical PV arrays might look like

Alternative 1: Fixed Panels

In a fixed mounted PV system (fixed-tilt), PV panels are installed at a pre-determined angle, which does not change. Advantages of this system include:

- Lower maintenance and installation costs compared to a tracking system, which is mechanically more complex given that PV mountings include moving parts;
- Established technology with proven reliability, and easier and more economical replacement of parts compared to tracking systems;
- Robust system that is designed to withstand greater exposure to winds than tracking systems;
- Occupy less space than tracking systems.

Under this alternative, modules of solar panels are supported on galvanised steel frames mounted into the ground. The proposed solar facility will be constructed in clusters, with a certain number of rows of solar panels per cluster, determined by the technology and power of the panels. Clusters will be connected by underground cables to inverter substations.

An array is the arrangement of fixed panels, typically two or three panels in each row, with a separation between arrays (see Figure 2-11). The area required for fixed systems is less than tracking, but the yield from each fixed panel is less than that obtained by means of tracking panels (tracking panels have a 20% higher yield). Fixed panels are thus advantageous in the extent of land required, but are not preferred economically. In this arrangement, panels are orientated along an east / west axis, facing to the north.

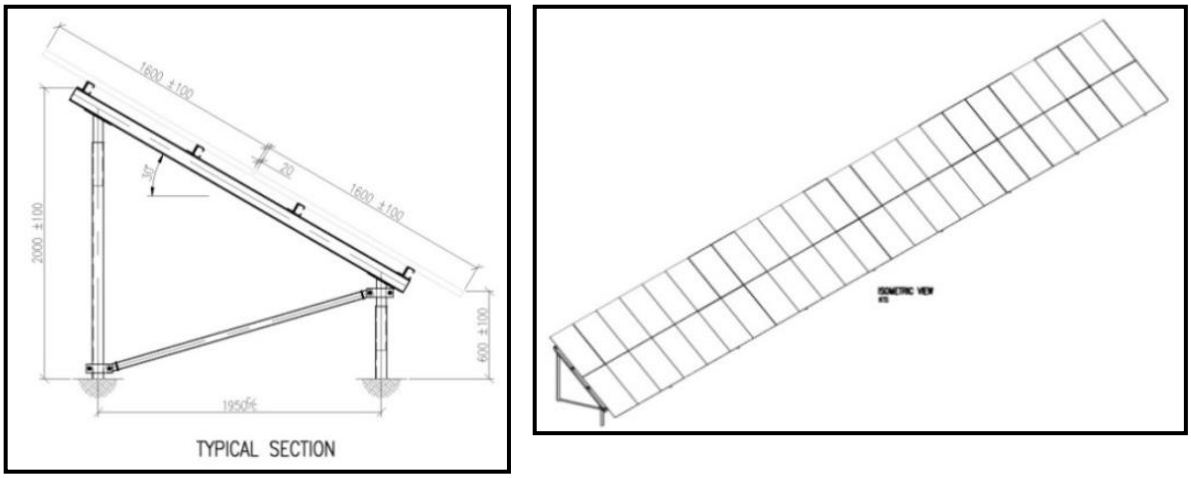


Figure 2-10 Typical section of fixed panels

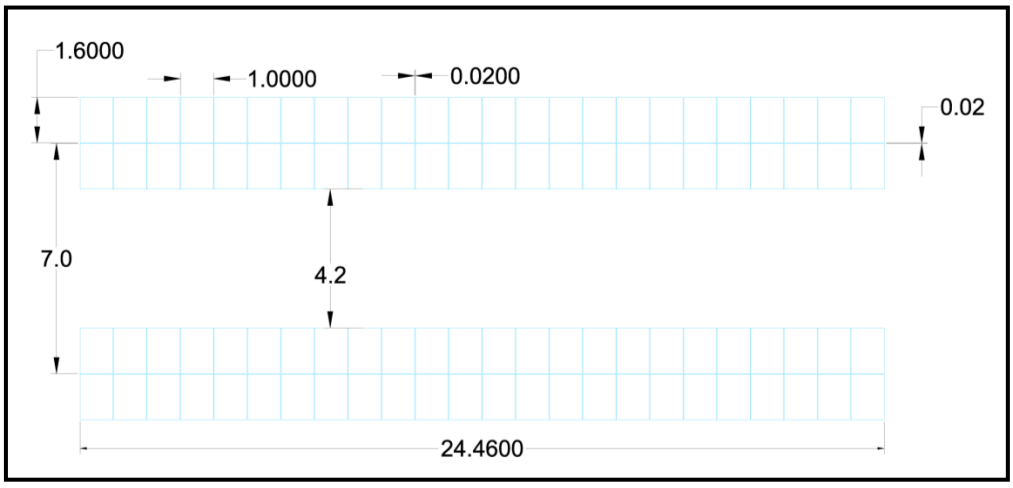


Figure 2-11 Typical arrangement of fixed panels

Alternative 2: Tracking Panels

Tracking PV Systems (single axis or dual axis trackers) are fixed to mountings which track the sun's movement, optimising panel orientation and thereby enabling it to maximise output power. A 'single axis tracker' tracks the sun from east to west, while a dual axis tracker is also equipped to account for seasonal waning of the sun. These systems utilise moving parts and more complex technology than fixed systems, which may include solar irradiation sensors to optimise the exposure of PV panels to sunlight. Tracking PV panels follow the suns rotational path all day, every day of the year giving it the best solar panel orientation and thereby enabling it to generate the maximum possible output power.

This layout alternative is also determined by the space and orientation requirements for the tracking system. Under this alternative, panels are arranged in continuous lines on a north-south axis and rotate around this axis to maintain a constant angle of incidence with solar radiation.

A typical arrangement of tracking frames is shown in Figure 2-12 and of each cluster in Figure 2-13. Clusters will be connected by underground cables to inverter substations, and separated from each other by a ±5 m wide road.

The tracking PV system offers the following advantages over fixed panels:

- Higher yield from panels (approximately 20% higher);
- Less shade under the panels, i.e. for any point of the surface, the amount of time that such a point is in the shadow of a panel is less than for fixed panels; and
- Less possibility of reflections to nearby receptors.

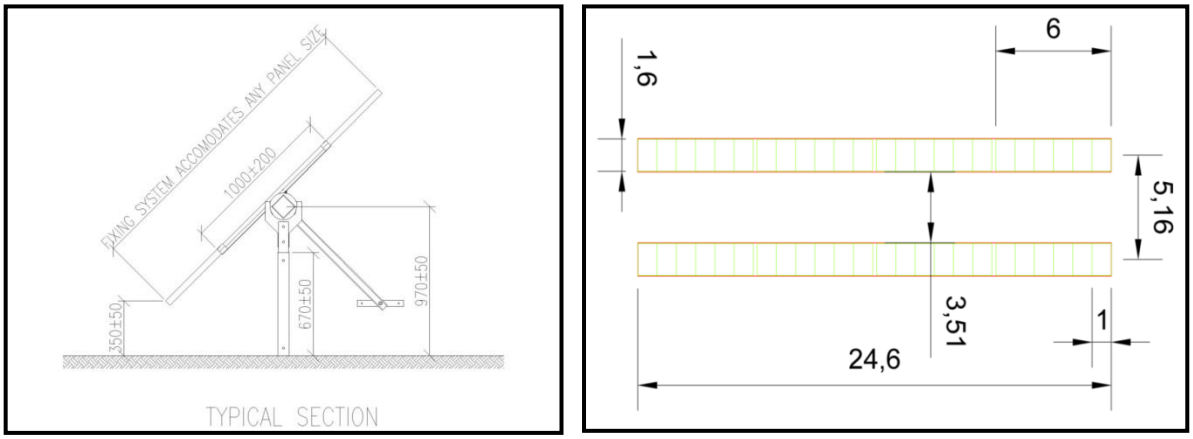


Figure 2-12 Typical section and arrangement of tracking panels

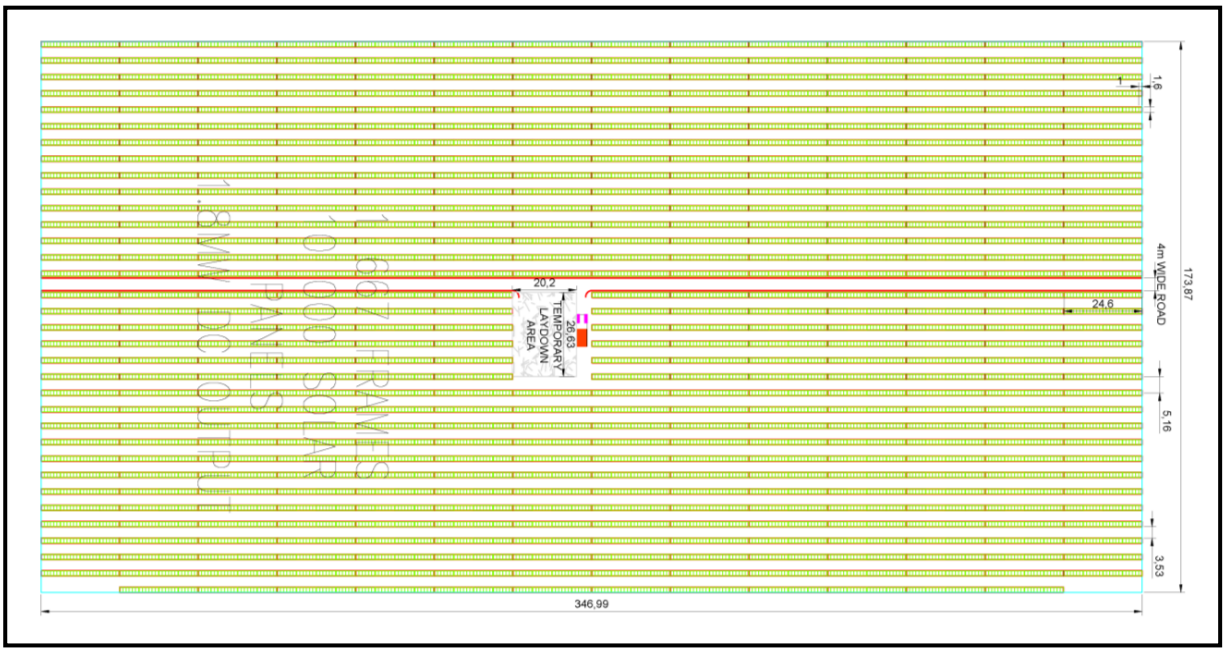


Figure 2-13: Typical block layout of tracking solar panels

2.6.4 Technology alternatives - 132 kV Power Lines

Generated electricity will be collected via a system of underground medium voltage cables, and then transformed into high (132 kV) voltage and reticulated to the point of connection on the 400 kV or 132 kV line. The length of the 132 kV line depends on the final layout, and the position of the internal substation, which is most energy efficient if in the centre of the PV panels. For Kloofsig 1, the length of the 132 kV connection line to the South of the site will be in the order of 8.5 km, and for the on-site 400 kV connection option (if required for Kloofsig 1) this length will be substantially less. The connection lines may require multiple strings of conductor. Above ground transmission is proposed due to its lower initial cost, ease of maintenance, and ability to span environmentally sensitive areas and servitude areas. The following alternatives are considered for this 132 kV overhead line:

Alternative 1: Lattice Masts

The most economical; easiest to install and technically preferred alternative is a 24 m high lattice mast. This design is similar to the existing Eskom lines used throughout South Africa.

Alternative 2: Monopoles

Monopoles are self-supporting steel structures with a much smaller footprint (between 0.5 m² and 8 m²) compared to lattice masts (between 36 m² and 64 m²). But these are more costly and difficult to install.

2.6.5 Operational Alternatives

Cleaning of the panels (to optimise their operation) would be necessary from time to time (depending on the amount of dust in the air), and would require water.

For **Kloofsig 1**, panels will be washed with water, including small amount of biodegradable detergent, four times a year (90 day cycles). Approximately 11 m^3 of water per day (increased to 18m^3 with the inclusion of water for fire suppression) will be required to achieve this (per phase of the development). It is anticipated that existing or new boreholes within close proximity to the facility

be used as the primary water source. The suitability of the potential yield and water quality from these boreholes will be confirmed later in the project planning process. No alternative water sources are proposed at this stage.

2.6.6 Decommissioning or repowering

Current solar panels are designed to last for over 25 years and this is the figure that has been used to plan the life span of a modern solar farm, after which the facility could either be decommissioned, or repowered. Should the repowering of the facility be financially, environmental and socially viable, the life span can be extended by another 25 years.

2.6.7 No-Go Alternative

The no development option assumes the site remains in its current state, i.e. agricultural land. The no-go alternative will be used as a baseline throughout the assessment process against which potential impacts will be compared.

Not implementing the activity would have the following socio-economic and environmental implications:

- Comparatively low value agricultural activity would continue;
- No power generation by means of renewable energy would mean that the benefits in terms of energy security at a national level would not be realised;
- The potential for job creation associated with the project would not be realised; and
- Additional social benefit schemes (such as job training and skills programs), linked to the development would not materialise.

3 Description of the Affected Environment

This chapter provides a description of the biophysical and socio-economic environments that could potentially be impacted by the proposed Kloofsig PV development.

Descriptions of the environment are based on a combination of on-site observations, GIS information, specialist studies, and a survey of the relevant literature to determine what could be expected on or near the site of the proposed development.

3.1 Biophysical Environment

3.1.1 Regional Planning Context

A map showing regional geographical information potentially relevant to the project site, based on the available information on SANBI's biodiversity information mapping tool, BGIS, is provided as Figure 3-4, and does not reveal any sensitivities relating to the site apart from the possible presence of watercourses.

According to the Birdlife South Africa and SANBI BGIS website, the entire farm (Kalkpoort) falls within the Platberg–Karoo Conservancy Important Bird Area (IBA), spanning approximately 1,250,000 ha (Figure 3-5). Important Bird and Biodiversity Areas (IBAs) are sites of international significance for the conservation of the world's birds and other biodiversity. They also provide essential benefits to people, such as food, materials, water, climate regulation and flood attenuation, as well as opportunities for recreation and spiritual fulfilment (South Africa's Important Bird and Biodiversity areas Status Report, 2015). The Platberg–Karoo Conservancy IBA is important because it provides habitat for a number of globally threatened large terrestrial species and raptors, such as the blue crane, various bustard species, secretary bird, black harrier and martial eagle (Birdlife SA website, accessed August 2016).

Critical Biodiversity Areas (CBAs) in terms of the Northern Cape Spatial Development Framework 2012 are also shown in Figure 3-5, confirming that the proposed project site does not fall within or close to any CBAs or conservation corridors. CBAs are areas required to meet biodiversity targets for ecosystems, species and ecological processes, as identified in a systematic biodiversity plan, and are intended to guide decision-making about where best to locate development. It should inform land-use planning, environmental assessment and authorisations, and natural resource management, by a range of sectors whose policies and decisions impact on biodiversity. It is the biodiversity sector's input into multi-sectoral planning and decision-making processes (SANBI, 2016). The closest CBA corridor is approximately 200 km west of Kalkpoort farm.

3.1.2 Site Sensitivity Assessment

Phase 1 archaeological, palaeontological, and biodiversity (including aquatic ecology) impact assessments were undertaken of the whole property, full specialist reports of which are included as appendices to this Report (Appendix G). The summary baseline description provided below of the baseline environment relating to heritage, ecology and aquatic resources has been extracted from the specialists' reports. A sensitivity map indicating the locations of all sensitive features reported by the specialists (including wetlands, vegetation types and heritage features) is included as Figure 3-63-7, and was used to inform the site layout at an early stage in planning, so as to avoid these features where possible. The site sensitivity map (based on the specialist input) for **Kloofsig 1** is included as Figure 3-8.

3.1.3 Topography

The area is predominantly flat with gradients less than 1%, sloping to the north (see slope analysis map in Appendix F). The average elevation of the development area ranges from 1200 to 1240 meters above sea level (masl), with some soft rolling hills, rising 200-300 m above the surrounding plains, surrounding the development area.

The site and surrounding area consists of flat open plains, with gentle slopes in parts. Some small rocky koppies are located around the site, however these areas have been avoided in the proposed draft layout due to cost implications associated with levelling of the site, and ecological sensitivities associated with rocky outcrops.

3.1.4 Hydrology

All drainage in the area is directed into the Gariep River, the largest watercourse in the area, reaching it before its confluence with the Vaal River. The generally flat to undulating terrain often produces long and meandering watercourses. A dry natural pan is present in the western corner of the site, more than 50 m from Kloofsig 1 and a number of non-perennial streams are present in the area surrounding the site as shown on Figure 3-8. During the specialist's site visit the watercourses around the site were mostly found to be dry, apart from small pools after recent light rains that filled at least two of the many small earth dams built across the larger drainage lines. Small pans existed on the western boundary and at the northernmost watering point, but were dry during the visit in April 2015, as well as October 2016. Underground water is sweet and apparently plentiful.

The watercourses or aquatic systems identified on and around the site are as follows (see Figure 3-1):

1. A **dry Natural pan (**Figure 3-2**)** is present just outside the south-western corner of the site, (both sides of the farm boundary fenceline). This pan is excluded from the proposed development area.

2. A **transformed pan** (Figure 3-3), due to construction of a windpump, a water point for livestock and a sheep kraal.

3. A **dry drainage line** is present north of and parallel to the eastern part of the proposed powerline to the south of the site. This powerline will have to cross the drainage line to reach the proposed substation switch/substation south-east of the site.

In addition to these wetlands/aquatic systems the two windpumps south of the site, close to the road and close to the proposed power line alignment are indicated in Figure 3-1. The specialist has noted that although indicated as sensitive in the figure, this was done only because they are considered as watering points for livestock, outside the property of the development, and this should not be regarded as a limitation to the proposed power line.

The wetlands and/or aquatic systems were very dry at the time of the surveys, had no surface water and did not show any obvious zonation. All these systems are temporal / intermittent.

The northern parts of the site, especially parts situated north of Phase 1 (some areas of the planned Kloofsig Phase 2) become flooded during heavy rains. However, these areas are not regarded as wetlands or any other aquatic system, as this area is very flat and covered with normal karoo vegetation, with no typical wetland characteristics. The floodwater slowly drains northwards down the very slight slope, and eventually into a drainage line through the Kalkpoort, situated north-east of the farmhouse and outside the boundary Portion 18 of the Farm Kalkpoort.

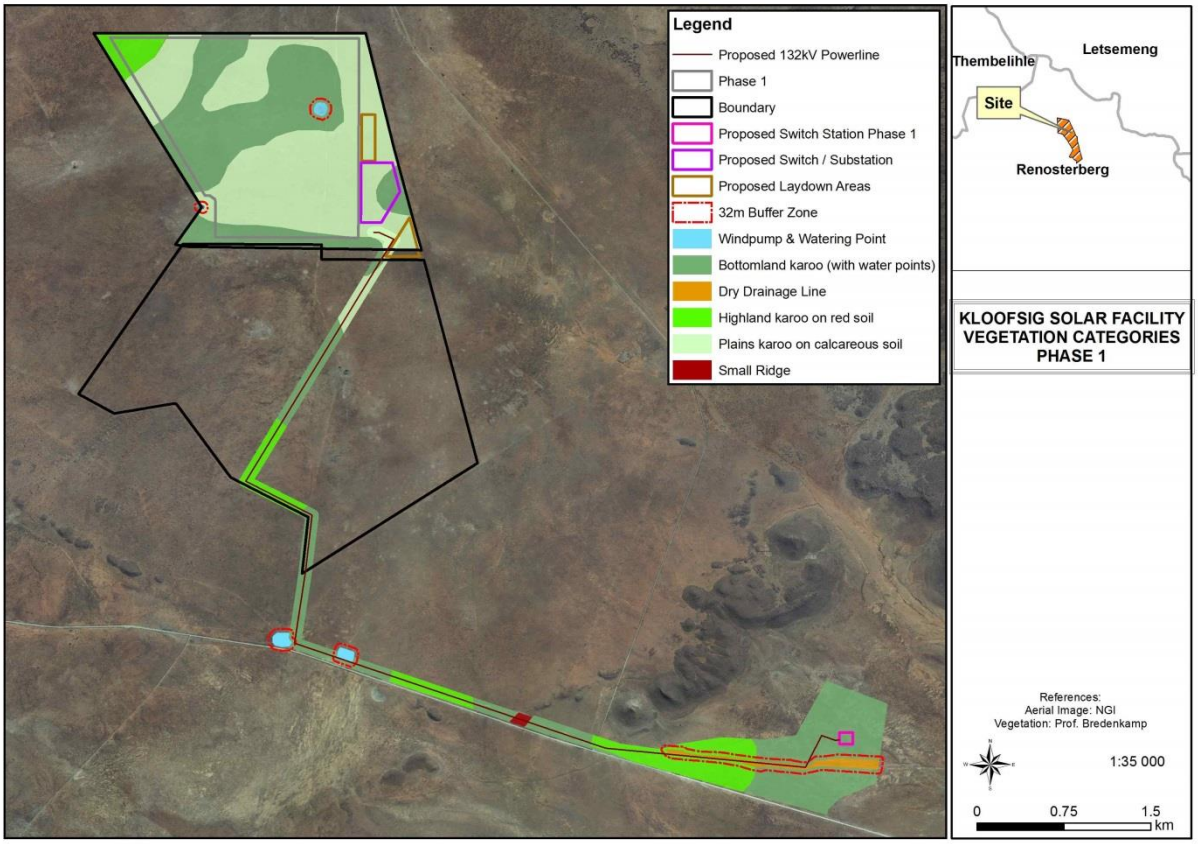


Figure 3-1: Vegetation map indicating locations of watercourses identified on and around the site (note, powerline alignment has subsequently been amended)

Figure 3-2: Watercourse 1 – Dry natural pan

Figure 3-3: Watercourse 2 - Transformed pan

The flooding or inundation of the system is unknown, but the Dry Natural Pan may become intermittently wet after good rains. The Dry Drainage Line will have water for a short period only after good rains.

Table 3-1: The Present Ecological Status (PES) and Environmental Importance and Sensitivity (EIS) of the wetlands and aquatic systems in the study area.

Watercourse description	PES	EIS
Dry Natural Pan	C Moderately modified	C Moderate
Transformed Pan	F Modifications critical	D Low
Dry Drainage Line	C Moderately modified	C Moderate

The Ecological Importance and Sensitivity of the Dry Natural Pan and the Drainage Line is regarded as being in Moderate while that of the Transformed Pan is regarded as Low. The latter pan is not ecologically important and sensitive on any scale. The biodiversity of these watercourses is ubiquitous and not sensitive to flow and habitat modifications.

The proposed development is about 50 m from the edge of the Dry Natural Pan. The Transformed Pan area will be developed. The proposed power line south of the site runs parallel and often close to the Drainage Line, and the power line will have to cross the Drainage Line.

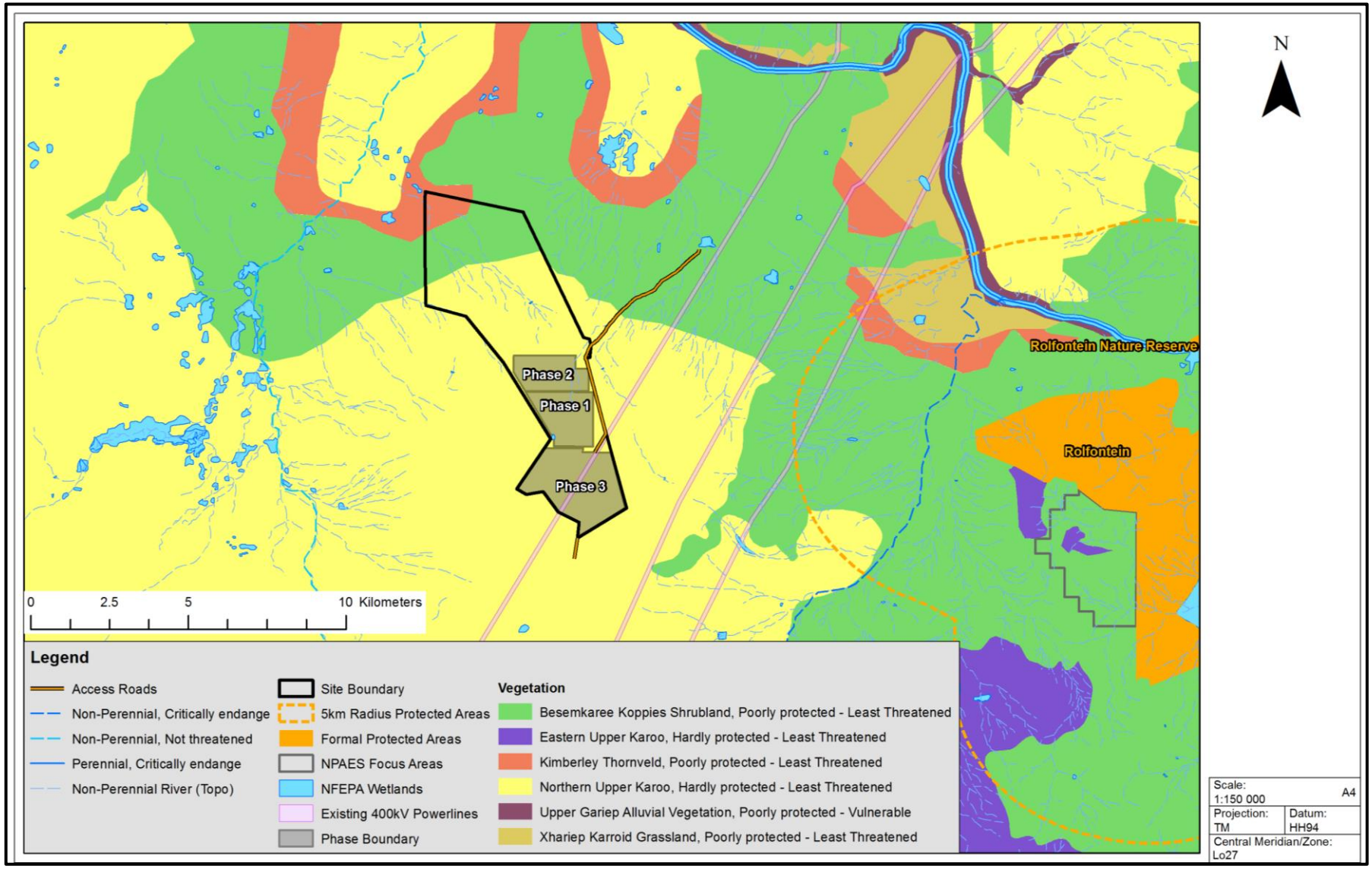


Figure 3-4: Geographical areas map for Kloofsig 1, 2 and 3, based on BGIS, July 2016

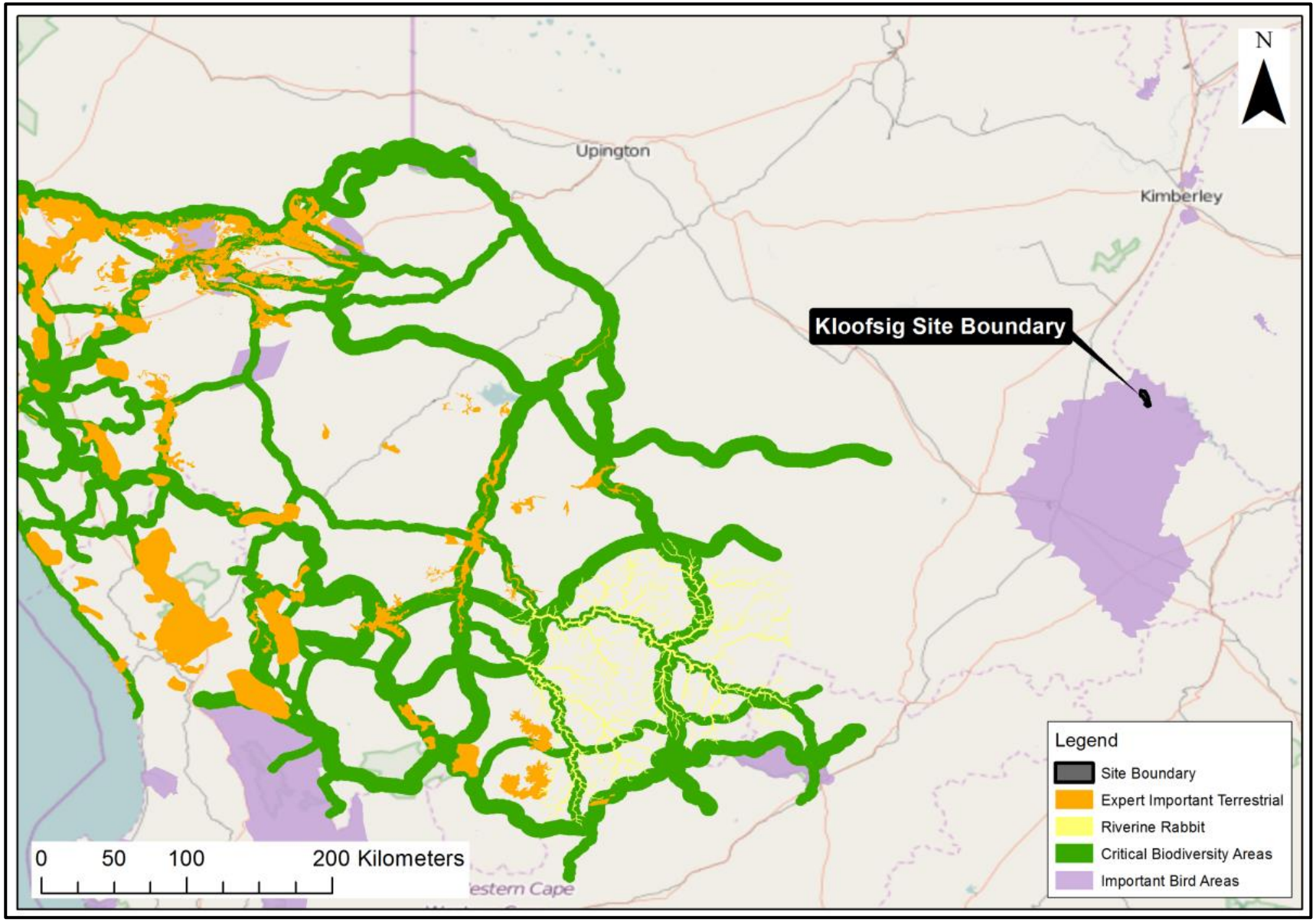


Figure 3-5: CBA and Important Bird Areas map for the Northern Cape Province (BGIS, July 2016)

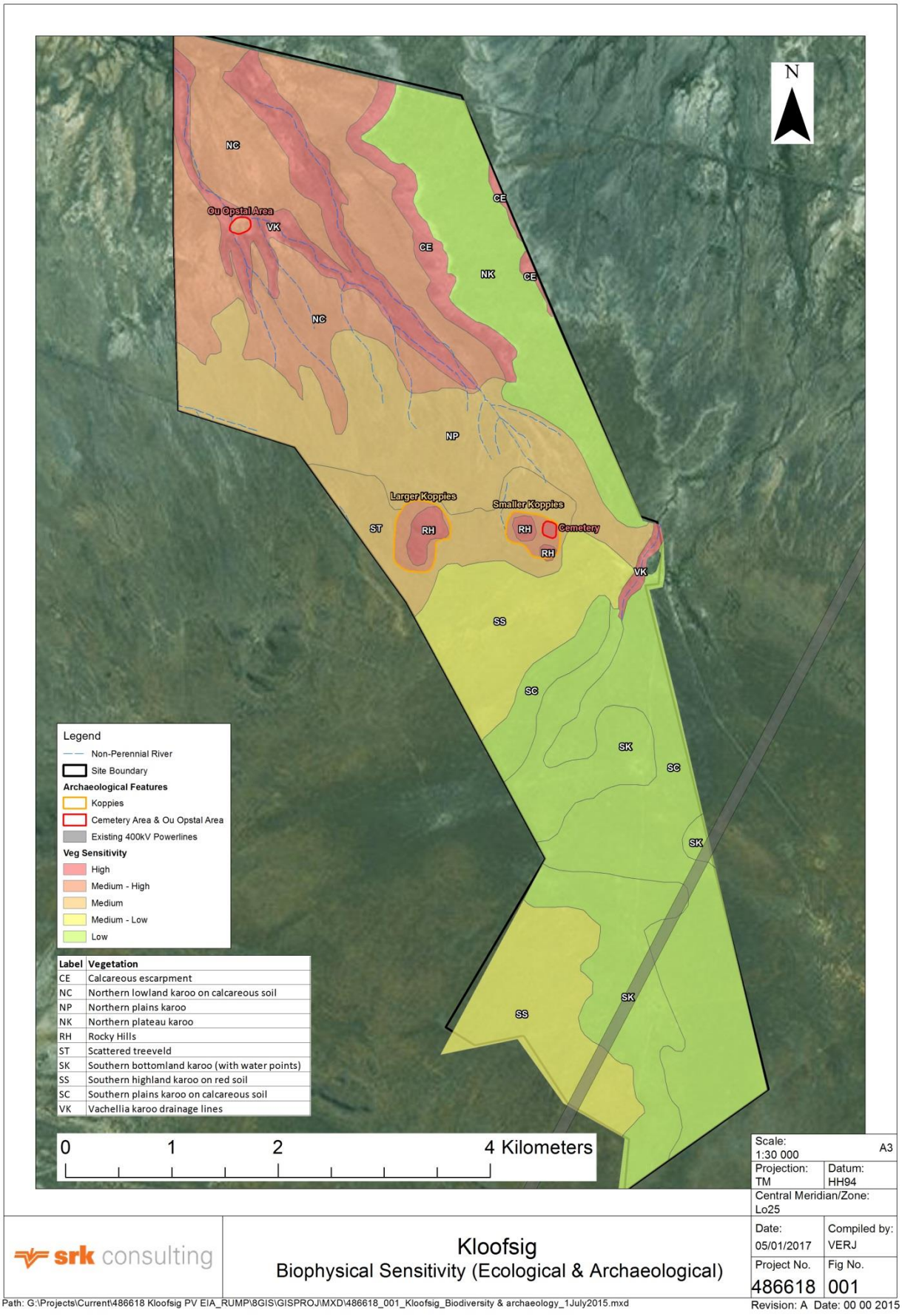


Figure 3-63-7: Sensitivity map of the Farm Kalkpoort, based on heritage and ecological features

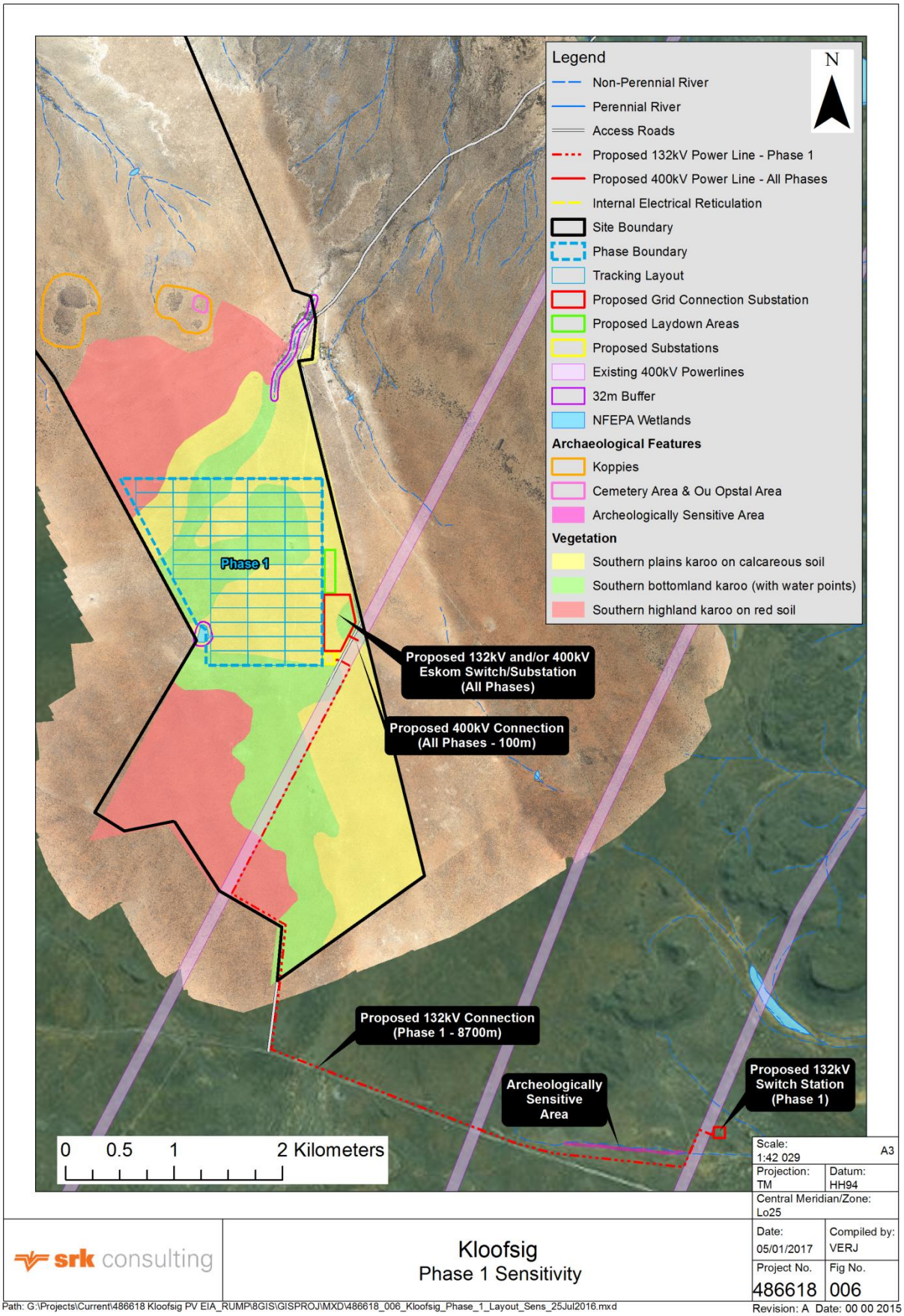


Figure 3-8: Sensitive areas on and around the site for Kloofsig 1 as determined by various baseline specialist studies

3.1.5 Geology

According to the Biodiversity assessment, historically the site must have been almost flat with shallow wind-blown soils over a hard calcrete base, but this base has been eroded by flows of rainwater making their way north to the Gariep River. The surface geology of the site appears mostly as shallow soils, but deeper below steep slopes around protruding hills and below calcrete shelves. Low rounded rocky hills in the west of the site and a ridge in the east protrude as dolerite intrusions across the centre of the site, part of the same mudstones, shales and dolerite boulders of the Rhenosterberg to the east and the other scattered hills and buttes across the western flats. Eroded alluvial washes, which come off the calcrete flats to the south, produce a build-up of grey sands in the steeper drainage lines heading north to the Gariep River. The calcrete base is penetrated at scattered spots by burrows of fossorial mammals and the whole area supports high densities of termite mounds, except on the isolated calcrete plateau in the north and adjacent drainage washes where densities are lower.

3.1.6 Climate

The weather of the Northern Cape is typically that of desert and semi-desert areas. It is a generally hot and dry region with fluctuating temperatures and generally low rainfall. Evaporation levels exceed the annual rainfall which varies between 50 mm and 400 mm (the average annual rainfall over the Province is 202 mm). The central, northern and eastern parts of the Province receive rain primarily during the summer months (December to February). Summer temperatures often top the 40°C mark in most of the Province, with temperatures as high as 48°C having been recorded along the Orange River. During winter (especially in June and August), average day temperatures are mild (approximately 22°C).

A key environmental phenomenon which represents an important potential comparative economic advantage is the high occurrence of sunny days which could be source of energy (NCPSDF, 2011).

3.1.7 Current Land Use

Most of the farms in the area conduct extensive livestock and game management on natural rangelands, and the proposed development site is used primarily for sheep farming. Closer to the river are farms with more intensive agriculture, based on crops irrigated by centre-point pivots with water from the river and a canal from the dam. Apparently, the area was suffering from the worst drought in 50 years during the time of the EAP's site visit, only slightly alleviated by modest recent rains, so the ground cover between the woody shrubs appears sparse and the stocking rates of livestock and game low.

3.1.8 Heritage

Heritage features of sensitivity as identified by the relevant specialists are described below and shown on Figure 3-8**.**

Most of the farm features dispersed Stone Age archaeological material in the form of a ubiquitous background scatter of stone artefacts within the surface gravels, rather than discrete concentrations of artefacts. This background scatter consists mainly of weathered and patinated mixed Middle Stone Age (MSA) / Later Stone Age (LSA) artefacts, mostly made of hornfels, although other raw materials were also noted. No organic material such as ostrich eggshell or bone was observed.

The major part of the affected area (which is likely to be the site of the proposed development) is considered to be of relatively low archaeological significance due to the fact that most of the Stone Age artefacts occur within the ubiquitous background surface scatter of mixed MSA/LSA material, usually in a secondary context in areas affected by sheet erosion.

It is possible however, that construction activities (especially excavation and earth-moving activities) could expose and potentially damage or destroy concentrations of historical and pre-colonial archaeological heritage material, and or human remains.

The area of the proposed 132 kV power line to the south and southeast of the proposed solar energy facility is characterised by dispersed Stone Age archaeological material in the form of a background scatter of stone artefacts within the surface and sub-surface gravels of the study area. These gravels are partially calcretised and consist mainly of hornfels clasts. They are mostly exposed in disturbed areas close to the proposed power line - for example, the strip surrounding the two roughly east-west aligned telephone lines to the south of the proposed line, along shallow watercourses and in areas where sheet wash has removed some of the topsoil. The background scatter visible in this disturbed context consists of very weathered and patinated artefacts which appear to be of mixed Middle Stone Age (MSA) and Early Stone Age (ESA) origin, with less Later Stone Age (LSA) material. In the eastern half of the study area, in situ gravels with ESA material were exposed along the watercourse to the north of the proposed line.

The palaeontological specialist noted that the area is not known to contain paleontological resources of value. No sensitive or no-go areas have been identified within the project area during the specialist field assessment. Pending the discovery of substantial new fossil remains during development, no further specialist palaeontological studies or mitigation are considered necessary for this project.

3.1.9 Vegetation and Flora

According to the Biodiversity assessment (conducted by Prof George Bredenkamp of EcoAgent in April 2015), most of the site is Nama Karoo, consisting of the Northern Upper Karoo vegetation unit (NKu 3 of Mucina & Rutherford 2006). As far as vegetation structure and floristic composition are concerned, the Northern Upper Karoo vegetation unit within the site is very homogeneous. Overall, the study site is dominated by small karroid shrubs, most below 50 cm high, with signs that sparse grass cover fills the bare areas between after sufficient rain. The plant species composition of the plant communities recognised is mostly quite similar, especially as far as dominant plant species are concerned.

The vegetation on the site can be divided into three sub-units, namely Southern plains karoo on calcareous soil, Southern bottomland karoo, and Southern highland karoo on red soil, all of which are classified as medium to low sensitivity. Key characteristics of each vegetation sub-unit are summarised in Table 3-2 and described in the subsections below.

Table 3-2: Summary table of characteristics of vegetation sub-units on the site

Southern Highland Karoo on red soil			
Status	Short karoo bossieveld		
Soil	Red and sandy loam	Rockiness %	0-5 mostly calcrete
Conservation priority:	Low	Sensitivity:	Medium-Low

Agricultural potential:	Low	Need for rehabilitation	Low
Dominant spp.	*Rhigozum trichotomum, Pentzia incana, Schmidtia pappophoroides, Eragrostis lehmanniana*		
Southern Plains Karoo on calcareous soil			
Status	Short karoo bossieveld		
Soil	Sandy loam, some limestone on soil surface	Rockiness %	1-15 limestone
Conservation priority:	Low	Sensitivity:	Low
Agricultural potential:	Low	Need for rehabilitation	Low
Dominant spp.	*Pentzia incana, Chrysocoma ciliata*		
Southern Bottomland Karoo			
Status	Somewhat trampled karoo bossieveld		
Soil	Sandy loam with lime	Rockiness %	1-15% calcrete
Conservation priority:	Low	Sensitivity:	Low
Agricultural potential:	Low	Need for rehabilitation	Low
Dominant spp.	*Lycium* spp, *Chrysocoma ciliata Pentzia* spp		

Southern Highland Karoo on red soil

This vegetation type is limited to the north-western corner and section of powerline to the south of the site for Kloofsig 1, as shown on Figure 3-8. The soil is deep red sand, with less calcrete visible on the soil surface (Figure 3).The vegetation is open bossieveld karoo with many bare patches. At the time of the survey the grass layer was poorly developed, very shortly grazed, with new growth commencing after the recent rains. Most of the general karroid dwarf shrubs and grass species occur in this area, though the somewhat taller-growing *Rhigosum trichotomum* is often prominent.

This vegetation type is widespread and not rare. The species richness is high, though none of these species are considered to be rare, threatened or protected. Sensitivity is considered to be medium-low.

Figure 3-9: Southern Highland Karoo on red soil

S
outhern Plains Karoo on Calcareous Soil

This vegetation occurs widely on the plains throughout the study site. The soil is shallow, light brown sandy loam over calcrete and much more calcrete is visible on the soil surface. The vegetation is very typical short bossieveld entirely dominated by karroid dwarf shrubs (Figure

3-10). At the time of the survey the vegetation was grazed by sheep. Very little grass was visible, though new grass growth appeared just after the recent rains.

This vegetation type is very widespread and not rare. The species richness is high, though none of these species are considered to be rare, threatened or protected. Sensitivity is considered to be low.

Figure 3-10: Southern Plains Karoo on calcareous soil

Southern Bottomland Karoo

This vegetation occurs in the somewhat lower-lying south-central parts of the study site and seems to form part of the drainage system of this area. The southern water holes are mostly located within this vegetation. The soil is reddish-brown with calcrete often abundant on the soil surface. At the time of the survey this area seemed to be moister than the adjacent, higher-lying plant communities. The vegetation is very similar to that of the Southern Plains Karoo described above, but seems to be more overgrazed by domestic livestock (Figure 3-11). Dwarf karroid shrubs are dominant and grass species are very short, appearing just after the recent rains.

Figure 3-11: Somewhat trampled Southern Bottomland Karoo

Although this plant community occurs widespread, it is restricted to the slightly bottomland situations within the slightly undulating landscape. These areas are also often more grazed

than the upland areas. The species richness is high, though none of these species is considered to be rare, threatened or protected. Sensitivity is considered to be low.

3.1.10 Animal Species

Mammals

Habitat Assessment

The study site is situated at an interface between three biomes, i.e. Nama Karoo, grassland and savanna, and is limited to terrestrial habitat. The site is dry most of the year and does not support wetland vegetation that is a prerequisite for discerning small mammals such as vlei rat and shrews. A number of manmade dams contained water during the time of the site visit, watering points and dry pans, but these too do not support wetland vegetation along their banks. At best the water bodies will benefit bats feeding on insect swarms rising at summer sunsets.

A prevailing perception is that mammal populations are at a nadir, probably as result of drought. Irrespective of the drought the conservation status of the entire farm is rated as good due to good range management.

There are no caves suitable for cave bats, but there may be rock crevice, overhangs, culverts or even large aardvark burrows that harbour rhinolophids, hipposiderids or nycterids.

The 500 meters of adjoining properties are rather similar to that the veld conditions described for the study site. The low stranded fences on farms themselves are not a deterrent to connectivity, but jackal-fenced boundaries offer a barrier to some medium-sized species incapable of burrowing underneath the obstacle.

Species Richness:

Of the 53 mammal species expected to occur on the study site (predominantly arid-adapted species), 29 were confirmed during the site visit as indicated in Table 3-3 for all three Kloofsig project sites. Species like the round-eared elephant shrew, a number of gerbils, ground squirrels, dassie rats, two whistling rat species, bat-eared and Cape foxes, black-footed cats, suricates, springbuck and others are characteristic.

Most of the species of the resident diversity are common and widely distributed (e.g. scrub hares, mole rats, springhares, grass mice, multimammate mice, Highveld gerbils, the bats listed, genets, yellow and slender mongooses, duiker, steenbok and others). However, some species are not common: a number of gemsbok has been reintroduced and there are a number of red Data mammals as listed in Table 3-3 below. Many of the medium-sized mammals persist on the farm such as aardvarks, baboons, monkeys, warthog, springbuck, kudu, duikers, steenbuck, mountain reedbuck and grey rhebuck.

Bat species diversity and population densities were found to be low. Relatively high species richness is due to the extensive size of the remaining natural areas on the Farm and of adjoining natural areas, enhanced by a high connectivity allowing near-to-natural migration. Veld fires are avoided meaning that the quality of environmental conservation from a mammal perspective can be ranked as good. Connectivity with neighbouring areas is high and migration is virtually unhindered.

All Red Data species listed in Table 3-3 are discerning species and became endangered as result of the deterioration of their preferred habitats.

The following mammals are protected by the Biodiversity Act No 10 of 2004:

- South African hedgehog
- Black-footed cat
- Brown hyena
- Honey badger

All indigenous species are protected and are differentially listed in Schedule 1 of the Northern Cape Conservation Act 9 of 2009 (specially protected species), Schedule 2 (Protected species) and Schedule 3 (common indigenous species). Schedule 4 list vervet monkeys, baboons, caracals and black-backed jackals as Damage Causing Mammals. Schedule 6 lists Invasive Species, none of which are recorded on the study site.

Table 3-3: Observed and potential mammal species diversity, with Red Data Book status.

Common English name	Scientific name	Occurrence on Site	Red Data Book Status
Round-eared elephant shrew	*Macroscelides proboscideus*	*****	
Western rock elephant shrew	*Elephantulus rupestris*	√	
Aardvark	*Orycteropus afer*	√	
Rock dassie	*Procavia capensis*	√	
Cape hare	*Lepus capensis*	√	
Scrub hare (ribbok haas)	*Lepus saxatilis*	√	
Smith's red rock rabbit	*Pronolagus rupestris*	√	
African mole rat	*Cryptomys hottentotus*	√	
Cape porcupine	*Hystrix africaeaustralis*	√	
Springhare	*Pedetes capensis*	√	
Dassie rat	*Petromus typicus*	?	
South African ground squirrel	*Xerus inaurus*	√	
Spectacled dormouse	*Graphiurus ocularis*	**?**	DD
Four-striped grass mouse	*Rhabdomys pumilio*	*****	
Southern multimammate mouse	*Mastomys coucha*	*****	
Namaqua rock mouse	*Aethomys namaquensis*	√	
Brant's whistling rat	*Parotomys brantsii*	*****	
Littledale's whistling rat	*Parotomys littledalei*	*****	
Cape short-tailed gerbil	*Desmodillus auricularis*	*****	
Hairy-footed gerbil	*Gerbillurus paeba*	√	
Highveld gerbil	*Gerbilliscus brantsii*	√	
Pouched mouse	*Saccostomus campestris*	*****	
Gerbil mouse	*Malacothrix typica*	*****	
Grey pygmy climbing mouse	*Dendromus melanotis*	**?**	

Common English name	Scientific name	Occurrence on Site	Red Data Book Status
Chacma baboon	*Papio hamadryas*	√	
Vervet monkey	*Cercopithecus pygerythrus*	√	
Lesser red musk shrew	*Crocidura hirta*	*	DD
Southern African hedgehog	*Atelerix frontalis*	√	NT
Egyptian free-tailed bat	*Tadarida aegyptiaca*	?	
Egyptian slit-faced bat	*Nycteris thebaica*	?	
Dent's horseshoe bat	*Rhinolophus denti*	?	
Aardwolf	*Proteles cristatus*	√	
Brown hyena	*Parahyaena brunnea*	?	NT
Caracal	*Caracal caracal*	√	
African wild cat	*Felis silvestris*	√	
Black-footed cat	*Felis nigripes*	√	
Small-spotted genet	*Genetta genetta*	√	
Suricate	*Suricata suricatta*	√	
Yellow mongoose	*Cynictis penicillata*	√	
Slender mongoose	*Galerella sanguinea*	√	
Bat-eared fox	*Otocyon megalotis*	√	
Cape fox	*Vulpes chama*	√	
Black-backed jackal	*Canis mesomelas*	√	
Honey badger	*Mellivora capensis*	?	
Striped polecat	*Ictonyx striatus*	?	
Common warthog	*Phacochoerus africanus*	√	
Kudu	*Tragelaphus strepsiceros*	√	
Gemsbok	*Oryx gazella*	√	
Common duiker	*Sylvicapra grimmia*	√	
Mountain reedbuck	*Redunca fulvorufula*	√	
Grey rhebuck	*Pelea capreolus*	√	
Springbok	*Antidorcas marsupialis*	√	
Steenbok	*Raphicerus campestris*	√	

√ Definitely there or have a high probability to occur;

***** Medium probability to occur based on ecological and distributional parameters;

? Low probability to occur based on ecological and distributional parameters.

Red Data species rankings as defined in Friedmann and Daly's S.A. Red Data Book / IUCN (World Conservation Union) (2004) are indicated in the last column: CR= Critically Endangered, En = Endangered, V = Vulnerable, LR/cd = Lower risk conservation dependent, LR/nt = Lower Risk near threatened, DD = Data Deficient. All other species are deemed of Least Concern.

Avifauna

Observed and potentially occurring bird species for the whole of the Kloofsig property, as reported by the specialist following a site visit in April 2015 (after most Palaearctic and intra-

African migrant bird species had departed) are listed in Table 3-4, indicating red data book status.

As mentioned in Section 3.1.1, Kloofsig 1, 2 and 3 fall within the Platberg–Karoo Conservancy Important Bird Area (IBA). The Important Bird and Biodiversity Area Programme aims to identify, document, monitor and protect a network of sites for the conservation of birds, other biodiversity and wider ecosystems and their services. A site is recognised as an IBA only if it meets certain criteria, based on the occurrence of key bird species that are vulnerable to global extinction or whose populations are otherwise irreplaceable.

Table 3-4: Observed and potential bird species diversity on site, with Red Data Book status.

Common English name	Scientific name	Occurrence on Site	Red Data Book Status
*Orange River francolin	*Scleroptila levaillantoides*	√	
*Swainson's Spurfowl	*Pternistis swainsonii*	√	
*Common Quail	*Coturnix coturnix*	√	
Helmeted Guineafowl	*Numida meleagris*	√	
Lesser Honeyguide	*Indicator minor*		
Cardinal Woodpecker	*Dendropicos fuscescens*		
Acacia Pied Barbet	*Tricholaema leucomelas*		
African Hoopoe	*Upupa africana*		
Common Scimitarbill	*Rhinopomastus cyanomelas*		
Swallow-tailed Bee-eater	*Merops hirundineus*		
European Bee-eater	*Merops apiaster*		
White-backed Mousebird	*Colius colius*		
Red-faced Mousebird	*Urocolius indicus*	√	
Diderick Cuckoo	*Chrysococcyx caprius*		
Alpine Swift	*Tachymarptis melba*		
Common Swift	*Apus apus*		
Bradfield's Swift	*Apus bradfieldi*		
Little Swift	*Apus affinis*		
White-rumped Swift	*Apus caffer*		
Barn Owl	*Tyto alba*		
Spotted Eagle-Owl	*Bubo africanus*	√	
Rufous-cheeked Nightjar	*Caprimulgus rufigena*		
Rock Dove	*Columba livia*	√	
Speckled Pigeon	*Columba guinea*	√	
Laughing Dove	*Streptopelia senegalensis*	√	
Cape Turtle-Dove	*Streptopelia capicola*	√	
Red-eyed Dove	*Streptopelia semitorquata*	√	
Namaqua Dove	*Oena capensis*	√	
Ludwig's Bustard	*Neotis ludwigii*	√	EN,EN
*Kori Bustard	*Ardeotis kori*	√	NT,NT
Northern Black Korhaan	*Afrotis afraoides*	√	

Common English name	Scientific name	Occurrence on Site	Red Data Book Status
Karoo Korhaan	*Eupodotis vigorsii*		NT,LC
Blue Korhaan	*Eupodotis caerulescens*		LC,NT
*Blue Crane	*Anthropoides paradiseus*	√	NT,VU
Namaqua Sandgrouse	*Pterocles namaqua*	√	
Marsh Sandpiper	*Tringa stagnatilis*		
Common Greenshank	*Tringa nebularia*		
Wood Sandpiper	*Tringa glareola*		
Common Sandpiper	*Actitis hypoleucos*		
Ruff	*Philomachus pugnax*		
Spotted Thick-knee	*Burhinus capensis*		
Black-winged Stilt	*Himantopus himantopus*		
Pied Avocet	*Recurvirostra avosetta*		
Kittlitz's Plover	*Charadrius pecuarius*		
Three-banded Plover	*Charadrius tricollaris*		
Blacksmith Lapwing	*Vanellus armatus*		
Crowned Lapwing	*Vanellus coronatus*		
Double-banded Courser	*Rhinoptilus africanus*		NT,LC
Burchell's Courser	*Cursorius rufus*		VU,LC
Black-shouldered Kite	*Elanus caeruleus*		
Yellow-billed Kite	*Milvus aegyptius*		
White-backed Vulture	*Gyps africanus*		EN,EN
Cape Vulture	*Gyps coprotheres*		EN,VU
Lappet-faced Vulture	*Aegypius tracheliotos*		EN,VU
Black-chested Snake-Eagle	*Circaetus pectoralis*		
Black Harrier	*Circus maurus*		EN,VU
Southern Pale Chanting Goshawk	*Melierax canorus*	√	
Gabar Goshawk	*Melierax gabar*		
Steppe Buzzard	*Buteo buteo*		
Jackal Buzzard	*Buteo rufofuscus*	√	
Tawny Eagle	*Aquila rapax*		EN,LC
Verreaux's Eagle	*Aquila verreauxii*		VU,LC
Martial Eagle	*Polemaetus bellicosus*		EN,VU
*Secretarybird	*Sagittarius serpentarius*	√	VU,VU
Lesser Kestrel	*Falco naumanni*		
Rock Kestrel	*Falco rupicolus*		
Greater Kestrel	*Falco rupicoloides*	√	
Lanner Falcon	*Falco biarmicus*		VU,LC
Black-headed Heron	*Ardea melanocephala*	√	
Cattle Egret	*Bubulcus ibis*		
*Hadeda Ibis	*Bostrychia hagedash*	√	

Common English name	Scientific name	Occurrence on Site	Red Data Book Status
*African Sacred Ibis	*Threskiornis aethiopicus*	√	
African Spoonbill	*Platalea alba*		
Black Stork	*Ciconia nigra*		VU,LC
Abdim's Stork	*Ciconia abdimii*		NT,LC
*White Stork	*Ciconia ciconia*	√	
Fork-tailed Drongo	*Dicrurus adsimilis*		
Crimson-breasted Shrike	*Laniarius atrococcineus*	√	
Bokmakierie	*Telophorus zeylonus*		
Pririt Batis	*Batis pririt*		
Cape Crow	*Corvus capensis*		
Pied crow	*Corvus albus*	√	
Red-backed Shrike	*Lanius collurio*		
Lesser Grey Shrike	*Lanius minor*		
Common Fiscal	*Lanius collaris*	√	
Cape Penduline-Tit	*Anthoscopus minutus*		
Ashy Tit	*Parus cinerascens*	√	
Barn Swallow	*Hirundo rustica*		
Greater Striped Swallow	*Cecropis cucullata*		
South African cliff-Swallow	*Petrochelidon spilodera*		
Rock Martin	*Hirundo fuligula*		
African Red-eyed Bulbul	*Pycnonotus nigricans*	√	
Fairy Flycatcher	*Stenostira scita*		
Long-billed crombec	*Sylvietta rufescens*		
Yellow-bellied Eremomela	*Eremomela icteropygialis*	√	
Karoo Eremomela	*Eremomela gregalis*		
Layard's Tit-Babbler	*Sylvia layardi*	√	
Chestnut-vented Tit-Babbler	*Sylvia subcaerulea*	√	
Orange River White-eye	*Zosterops pallidus*		
Grey-backed Cisticola	*Cisticola subruficapilla*		
Desert Cisticola	*Cisticola aridulus*		
Black-chested Prinia	*Prinia flavicans*		
Karoo Prinia	*Prinia maculosa*		
Rufous-eared Warbler	*Malcorus pectoralis*	√	
Cinnamon-breasted Warbler	*Euryptila subcinnamomea*		
Eastern clapper Lark	*Mirafra fasciolata*	√	
Sabota Lark	*Calendulauda sabota*	√	
Spike-heeled Lark	*Chersomanes albofasciata*	√	
Karoo Long-billed Lark	*Certhilauda subcoronata*		
Grey-backed Sparrowlark	*Eremopterix verticalis*		
Red-capped Lark	*Calandrella cinerea*	√	

Common English name	Scientific name	Occurrence on Site	Red Data Book Status
Stark's Lark	*Spizocorys starki*		
Pink-billed Lark	*Spizocorys conirostris*		
Large-billed Lark	*Galerida magnirostris*	√	
Short-toed Rock-Thrush	*Monticola brevipes*		
Karoo Thrush	*Turdus smithi*	√	
Chat Flycatcher	*Bradornis infuscatus*		
Fiscal Flycatcher	*Sigelus silens*		
Spotted flycatcher	*Muscicapa striata*		
Cape Robin-Chat	*Cossypha caffra*		
Kalahari Scrub-Robin	*Erythropygia paena*	√	
Karoo Scrub-Robin	*Erythropygia coryphoeus*	√	
African StoneChat	*Saxicola torquatus*		
Mountain Wheatear	*Oenanthe monticola*	√	
Capped Wheatear	*Oenanthe pileata*	√	
Sickle-winged Chat	*Cercomela sinuata*	√	
Familiar Chat	*Cercomela familiaris*	√	
Ant-eating Chat	*Myrmecocichla formicivora*	√	
Pale-winged Starling	*Onychognathus nabouroup*	√	
Cape Glossy Starling	*Lamprotornis nitens*	√	
Pied Starling	*Lamprotornis bicolor*		
Wattled Starling	*Creatophora cinerea*		
Malachite Sunbird	*Nectarinia famosa*		
Dusky Sunbird	*Cinnyris fuscus*	√	
Scaly-feathered Finch	*Sporopipes squamifrons*		
White-browed Sparrow-Weaver	*Plocepasser mahali*	√	
Southern Masked-Weaver	*Ploceus velatus*	√	
Red-billed Quelea	*Quelea Quelea*		
Southern Red Bishop	*Euplectes orix*	√	
African Quailfinch	*Ortygospiza fuscocrissa*		
Red-headed Finch	*Amadina erythrocephala*		
Common Waxbill	*Estrilda astrild*		
Red-billed Firefinch	*Lagonosticta senegala*		
Pin-tailed Whydah	*Vidua macroura*		
House Sparrow	*Passer domesticus*		
Cape Sparrow	*Passer melanurus*	√	
Southern Grey-headed Sparrow	*Passer diffuses*		
Cape Wagtail	*Motacilla capensis*	√	
African Pipit	*Anthus cinnamomeus*	√	
Buffy Pipit	*Anthus vaalensis*	√	
Cape Canary	*Serinus canicollis*		

Common English name	Scientific name	Occurrence on Site	Red Data Book Status
Black-headed Canary	*Serinus alario*		
Black-throated Canary	*Crithagra atrogularis*		
Yellow Canary	*Crithagra flaviventris*	√	
White-throated Canary	*Crithagra albogularis*		
Lark-like Bunting	*Emberiza impetuani*	√	
Cinnamon-breasted Bunting	*Emberiza tahapisi*		
Cape Bunting	*Emberiza capensis*		

Red Status is from The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland, Barnes (2001). T = Threatened; NT = Near-Threatened; Vul = Vulnerable; E = Endangered; CE = Critically Endangered; and RE = Regionally Extinct. * indicates species that were reported to have been seen by the landowner.

Based on the most recent assessment of the threatened status of South Africa's avifauna (Taylor 2015), a total of 16 Red Data avifaunal species are expected possibly to use the site and its surroundings, given the quantity and quality of the habitats available. One of these species (Ludwig's Bustard) has been reported for the pentad within which the site falls, and others within the surrounding pentads of the two QDGCs, 10 up to 1998 (SABAP1) but only eight so far during the period of the ongoing Southern African bird atlas project that started in 2009 (SABAP2).

Most of these threatened species fall into a few obvious categories by habitat preference and their likelihood of occurrence on site by habitat extent and quality, especially once one appreciates what use the habitats onsite are to their basic diurnal and annual requirements.

The majority of threatened species expected to make use primarily of the scrubland on calcrete. Generalist predators (Lanner Falcon, Tawny and Martial Eagles) are expected to seek prey over all habitats, while scavengers (White-backed, Cape and Lappet-faced Vultures) and terrestrial hunters (Abdim's Stork, Secretarybird) are also likely to locate food in the thornveld. The specialist Verreauxs' Eagle is expected only to visit for hunting hyrax on the rocky outcrops and the Black Stork aquatic prey in the water bodies. The Blue Crane is expected only to roost in the water bodies, when available.

The following species expected on Farm 18, Kalkpoort, are listed under Government Notice 2007 of the NEMBA 2004 Act:

- Endangered: Blue Crane, White-backed Vulture, Cape Vulture, Lappet-faced Vulture.
- Vulnerable: Tawny Eagle, Kori Bustard, Black Stork, Blue Korhaan, Lesser Kestrel, Ludwig's Bustard, Martial Eagle.

All indigenous species are protected except those in Schedules 1 of the Northern Cape Conservation Act, 2009 (specially protected species), 3 (common indigenous species) & 6 (invasive species), which include none of the threatened species expected on site.

Herpetofauna

The site has several prominent topographical features, such as a few dolerite hills and drainage lines with a few man-made dams, and a few small pans. Near or in some of the

drainage lines there are several trees which provide arboreal habitat. In general the study site is a homogenous environment that contains one large herpetofauna habitat, namely terrestrial karoo.

Of the 44 herpetofauna species recorded and/or expected on the remainder of portion 18 of the Farm Kalkpoort, one (the Giant Bullfrog, *Pyxicephalus adspersus*, which could potentially occur on the site) has threatened status. Note however that the high species richness inferred is for the general area and not only for the study site.

From a herpetological perspective, all drainage lines and water bodies like the temporary pans and the artificial water points must be regarded as sensitive, especially in an arid area such as the study site. The dolerite hills and trees along drainage lines on the study site should also be protected, as these provide habitat for many animal species.

This implies a buffer zone from the edge of the watercourses and pans (as usually prescribed for areas outside the urban edge).

3.2 Socio-Economic Profile

The summary provided below is extracted from the socio-economic specialist study report by Urban Econ, a full copy of which is provided as Appendix G7.

The proposed project falls within the Pixley ka Seme District Municipality, which covers a total surface area of is 103 410km²; or 27.7% of the total provincial landmass. In the Pixley ka Seme DM, the project falls within the Renosterberg Local Municipality, which .covers an area of 5 527km², and has a total population of 10 977 people. The LM is characterised by agricultural activities and the basic services driving the agricultural sector are provided by the two small towns of Petrusville and Phillipstown (Renosterberg LM SDF, 2012). The project area is situated within the Karoo region, which experiences winter rainfall as well as hot to very dry summers. The main settlements of the region are Petrusville, Phillipstown, and Vanderkloof and they mainly function as agricultural service centres of the municipality.

Petrusville is the closest town to the proposed Kloofsig Solar PV energy facility. The town lies in a fertile valley surrounded by a cluster of high hills. It is located 45km from Phillipstown and 10km south of the Orange River. Petrusville has a population of 5 212 people, and a growth rate of 32% The economy of the town is heavily reliant on Merino sheep farming as well as small farms that lie on the banks of the Orange River where wheat, corn and lucerne is planted.

Vanderkloof functions solely as a resort and holiday destination. Although the population figures of Vanderkloof town fluctuate seasonally, population figures recorded during the 2011 census indicate that the town has a total of 1 226 people.

Phillipstown lies on the southern periphery of the Renosterberg municipal area within an extensive farming area, Sheep farming (wool and meat production) is the main economic activity. The town has a population of 3 356 people, (Stats SA, 2011).

3.2.1 Demographic Profile

The Renosterberg LM houses 10 977 people, which accounts for 5.9% of the Pixley ka Seme DM total population. Since 2001, the Renosterberg LM population has increased by 6.6%. Within the LM, 89.3% of the people reside in urban areas, mainly in Petrusville town, while the

rest (10.7%) live in farms (Renosterberg IDP, 2015). Afrikaans (70.8%) is the most commonly spoken language, followed by isiXhosa (23.6%) with the dominant races being Coloured (57.7%) and Black people (32.9%). The population consists of 48.7% males and 51.3% females, and is characterised by a high dependency ratio (64%), with 32.7% falling within the 0-14 age group and 6.2% falling in the age group +65 years. The largest group of people falls in the 15-34 age group.

3.2.2 Economy

The Renosterberg LM is a small economy, making up 5.2% of the Pixley ka Seme DM's Gross Domestic Product per Region (GDP-R), which is valued at R8 535 million in current prices (Quantec, 2016). The contribution of the LM to the Province as a whole is low as it only accounts for 0.6% of the Northern Cape Provinces' economy. Growth rates average at 1.3% per annum.

The tertiary economic sector dominates as it contributes the largest portion (58.4%) to the LM's GDP-R. Prominent sub-sectors within the tertiary sector include general government (22%), trade (14.6%), as well as finance and insurance (8.6%). Within the primary and secondary economic sectors, the dominant contributing sub-sectors are agriculture (16.5%) and electricity, gas and water (18%), respectively.

3.2.3 Labour Force and Employment Structure

Employment and unemployment rates are important indicators of socio-economic well-being. Statistics relating to employment are shown in Table 3-5. Overall, the unemployment rate in the Renosterberg LM was 27.7% in 2011, which is as high as the provincial (27.4%) and national (29.7%) unemployment rates. Petrusville town on the other hand has a strikingly high unemployment rate of 42.4%.

Table 3-5: National, Provincial & Regional Labour Force Profile (Stats SA, 2011)

Area	Labour force			Discouraged job seekers	Unemployment rate
	Employed	Unemployed	Total		
South Africa	13254829	5586624	18841453	1848720	29,7%
Northern Cape	284202	107379	391581	40170	27,4%
Pixley ka Seme DM	43849	17566	61415	6655	28,6%
Renosterberg LM	2608	1001	3609	343	27,7%
Petrusville	888	655	1543	185	42,4%

Within the Pixley ka Seme DM, 66.2% of the population are employed in the formal sector, whilst 19% work in the informal sector, and 13% work for private households. In the Renosterberg LM, the majority (58%) of the people are also employed in the formal sector, whilst a third works in the informal sector with a relatively low (8%) portion working for private households. Similar to the districts' trends, two thirds of people residing in Petrusville town work in the formal sector, whilst only 26% work in the informal sector. Private households in Petrusville town provide the least employment at 6.6%

Employed individuals in the study area possess various skills and therefore, make different contributions to the workplace. In the Pixley ka Seme DM, within the formal sector, 11% of the

total working population are considered to be skilled whilst the rest are either semi-skilled (28%) or low-skilled individuals. The Renosterberg LM has less people who are skilled in the formal sector. The majority (35%) of them are low-skilled whilst 30% have informal skills (Stats SA, 2011).

Within the Renosterberg LM, the tertiary sector is the largest contributor to formal and informal employment with a share of 56%. As the spread over the various economic sectors is outlined in Table 3-5 below, the dominance of employment provision by the tertiary sector at the municipal level correlates with the prominence of the tertiary sector in the GDP-R contribution (Quantec, 2016).

3.2.4 Income and education

Income generally determines one's buying ability, standard of living, and is also linked to the type of employment, which is guided by the level of education.

The average household monthly income for the Renosterberg LM is R6 863 in 2016 prices, and that for Petrusville town is R5 320; this figure is lower the monthly income at the district level (R7 381) as well as the Provincial level (R8 521) per month. As indicated in Table 3-6 below, in 2011; 10% of the Renosterberg LM did not receive any form of income. Within the LM, 64% of the people fell below the poverty line as they earn less than R3 200 per month.

Table 3-6: Household monthly income groups (2011) (Stats SA, 2011)

Monthly household income	Northern Cape	Pixley ka Seme DM	Renosterberg LM	Petrusville
No income	7%	8%	10%	12%
R1 - R3 200	52%	58%	64%	60%
R3 201 - R6 400	14%	13%	9%	10%
R6 401 - R12 800	13%	10%	7%	9%
R12 801 - R25 600	8%	6%	4%	4%
R25 601 - R51 200	2%	1%	1%	0%
>R51 200	5%	4%	5%	5%

With respect to the level of education in the Renosterberg LM, 15.3% indicated that they did not have any form of education. Similar patterns are seen in Petrusville town as 15.2% also had no formal education during 2011 (Stats SA, 2011). 6.1% indicated primary school to be their highest level of education, whist 22.3% indicated matric was their highest level. Only 5.9% of the population indicated that they had continued to further their studies whilst Petrusville town has an even lower percentage of graduates (3.4%) (Stats SA, 2011). The high number of people without any education as well as the low numbers of post matric qualifications in the Renosterberg LM is a major concern as it contributes to the high illiteracy in the municipality. The lack of skilled professionals as a result of a small tertiary educated pool, places constraints in the development of the municipality both in the short and long-term (Renosterberg IDP, 2015).

4 Public Participation

The Public Participation Process (PPP) forms a key component of the EIA process and has already resulted in the identification of a number of issues and concerns. The objectives of the PPP are outlined below, followed by a summary of the approach taken, and the issues raised.

4.1 Objectives and Approach

The overall aim of the PPP is to ensure that all Interested and Affected Parties (IAPs) have adequate opportunities to provide input into the process. More specifically, the objectives of the PPP are as follows:

- Identify IAPs and notify them of the proposed project and of the EIA process;
- Provide an opportunity for IAPs to raise issues and concerns;
- Provide an opportunity for IAPs to review and comment on all reports before they are finalised; and
- Provide a record of responses to comments and concerns available to IAPs.

4.2 Public Participation Activities

The Public Participation Process that was undertaken to solicit public opinion regarding the proposed activity has included the following activities so far (for proof of the activities below, please refer to the FSR):

- Placement of two on-site posters on 14 April 2015
- Distribution of the Background Information Document (BID) for a 30 day comment period from 24 January 2016 to identified Interested and Affected Parties (IAPs), stakeholders and neighbouring residents.
- Distribution of the BID to the Ward 4 Councillor per registered mail on 18 February 2016.
- Collation of public and IAP comments on the BID and onsite poster, including responses to these issues;
- Preparation of a Draft Scoping Report;
- Inclusion in the Draft Scoping Report (DSR) of issues that were raised);
- Distribution of the Draft Scoping Report to the relevant Authorities;
- Making a hard copy of the Draft Scoping Report available at a public venue (Vanderkloof Public Library) for review by IAPs;
- Distribution of the Executive Summary of the DSR to all IAPs registered for this project;
- Provision of a 30 day comment period on the Draft Scoping Report (16 August – 16 September 2016);
- Placing of a newspaper notice in ‘Die Volksblad’ on 18 August 2016 announcing the availability of the DSR for public review and comment;

- Collation of public and IAP comments on the DSR, and incorporation of these into the Final Scoping Report;
- Distribution of the Final Scoping Report to the relevant Authorities;
- Making the FSR available for download on the SRK 'Public Documents' webpage, for review by IAPs;
- Distribution of the executive summary of the Final Scoping Report (including comments and responses report) to registered IAPs;
- Providing the contact details of the DEA case officer to all registered IAPs for the submission of final comments on the Scoping Phase;
- Submission of Final Scoping Report and Plan of Study for EIA to DEA for a decision regarding authorisation to proceed to the Impact Assessment phase of the EIA;
- Receipt of the letter of approval of the FSR and Plan of Study for the EIA from DEA dated 3 November 2016;
- Preparation of the Draft Environmental Impact Report (EIR)(this report);
- Inclusion in the Draft EIR of issues that were raised (Section 4.2.2);
- Distribution of the Draft EIR on 9 January 2017 to the relevant Authorities;
- Making a hard copy of the Draft EIR available at a public venue (Vanderkloof Public Library) for review by IAPs;
- Making the Draft EIR available for download on the SRK 'Public Documents' webpage, for review by IAPs;
- Distribution of the executive summary of the Draft EIR to registered IAPs; and
- Provision of a 30 day comment period on the Draft EIR (10 January – 9 February 2017).

4.2.1 Availability of Draft Environmental Impact Report

The Executive Summary of the Draft Environmental Impact Report (EIR) has been distributed to registered IAPs. A printed copy of this report is available for public review at:

- Vanderkloof Public Library

The report can also be accessed as an electronic copy on SRK Consulting's webpage via the 'Public Documents' link: http://www.srk.co.za/en/page/za-public-documents.

The public are encouraged to review this Draft Environmental Impact Report and send written comment by **12h00 on 9 February 2017** to:

Wanda Marais at SRK Consulting

PO Box 21842, Port Elizabeth, 6000

Email: wmarais@srk.co.za

Fax: (041) 509 4850

The Draft Environmental Impact Report (this report) has been submitted to DEA and the other relevant authorities, for comment before compilation of the Final Environmental Impact Report.

Once IAPs have commented on the information presented in the DEIR, the Final Environmental Impact Report (FEIR) will be produced and submitted to DEA to use in order to make a decision about the proposed development. The public is therefore urged to submit comments, as the comments will affect the FEIR and the decision taken by DEA.

4.2.2 Issues Raised

During the scoping phase, some IAPs and stakeholders raised issues and concerns regarding the proposed development. Copies of written correspondence received from IAPs were included in the FSR. A list of registered and notified IAPs is given in Appendix D. Issues raised by IAPs to date are summarised in Table 4-1 (comments on the BID); Table 4-2 (comments on the DSR) and Table 4-3 (comments on the FSR) below and original copies of comments on the FSR are provided in Appendix E1. For copies of correspondence received on previous reports, please refer to the FSR.

Table 4-1 Issues and concerns prior to the release of the DSR

Commentator	Issue Raised	Response (by SRK unless otherwise noted)
L Bosoga (DAFF)	DAFF is commenting authority in terms of Conservation of Agricultural Resources Act 43 of 1983 (CARA) and competent authority in terms of Subdivision of Agricultural Land Act 70 of 1970 (SALA).	At this stage, SRK is corresponding with DAFF as commenting authority for the EIA. Any application in terms of SALA will be dealt with by the applicant directly.
J Vorster (DAFF)	Care should be taken to disturb as little as possible areas in terms of removal of vegetation for the purpose of constructing roads and/or infrastructure.	Measures to minimise vegetation clearing will be included in the EMPr, and the significance of the clearing that would take place has been assessed in the EIR (section 5.5 and 5.7).
J Vorster (DAFF)	The occurrence of soil erosion in terms of water and / or wind must be prevented and mitigated immediately on identifying the potential or occurrence of soil erosion.	Measures to minimise vegetation clearing have been included in the EMPr, and the significance to the clearing that would take place has been assessed in the EIR (section 5.5 and 5.7).
J Vorster (DAFF)	Sloping, landscaping, ripping and establishment of natural vegetation are essential during rehabilitation of resources impacts and needs to be done continuously during the development process.	Recommendations regarding rehabilitation of the site are included in the EMPr (Chapter 7) and the Revegetation and Rehabilitation Management Plan (Appendix H1).
J Vorster (DAFF)	The occurrences and establishment of all declared weeds must be controlled in terms of Reg 15 and 16 of Act 43 of 1983.	Control of alien invasive vegetation will form part of the standard measures included in the EMPr, as well as the Alien invasive Vegetation Management Plan (Appendix H1).
N Abrahams (SANRAL)	Seems as if the proposed development will not have an impact on SANRAL due to distance away for the National Road N12.	Noted. Any further input from SANRAL is welcomed.
G Julius (SANRAL)	SANRAL must be timeously informed regarding proposed route for the transportation and movement of any heavy loads on the national roads that involves this development. This is to ensure that appropriate planning is involved to ensure minimum impact to the road use and potential impact on any construction related activities on the national routes.	Requirements for notifying SANRAL of transportation of any heavy loads are included as a specification in the transportation management plan (included as part of the Traffic Impact Assessment report in Appendix G8)

Commentator	Issue Raised	Response (by SRK unless otherwise noted)
BC Spies (Neighbouring Landowner)	According to the map, the proposed 132 kV connection will be traversing my farm. I am, however, in favour of the project.	Correct and noted.
RC Bester (Neighbouring Landowner)	I need a more detailed map to see how development will affect me.	A larger A3 map than that distributed with the BID is available in Appendix F.
RC Bester (Neighbouring Landowner)	Development will destroy natural beauty of area.	A visual impact assessment was completed as part of the EIA (see summary of impacts in Section 5.9 and full specialist report in Appendix G6)
RC Bester (Neighbouring Landowner)	Who will be responsible for my losses in the event of poaching / theft / damages? My game camp is in the area.	Measures to prevent and manage poaching, theft and damage have been included in the EMPr (Chapter 7).
RC Bester (Neighbouring Landowner)	Will I be able to continue with my established farming practises?	Potential impacts on surrounding land users has been assessed as part of the Socio-economic study (Appendix G7), To date, no impacts have been identified that are likely to negatively affect neighbouring farming practices.

Table 4-2: Issues and Responses following the release of the DSR

Commentator	Issue Raised	Response (by SRK unless otherwise noted)
N Mkhwanazi - DEA	All relevant listed activities applied for must be specific and able to be linked to the development activity or infrastructure as described in project description. If activities applied for in application form differ from those mentioned in FSR, an amended application form must be submitted.	All relevant listed activities and associated development activities are provided in Table 1-1.
N Mkhwanazi - DEA	FSR must investigate and identify all associated traffic impacts.	A description of potential traffic impacts included in Section 5.13 (see full specialist report in Appendix G8)
N Mkhwanazi - DEA	All issues raised by registered IAPs and relevant authorities must be dealt with in FSR.	Responses to all comments are provided in this table.
N Mkhwanazi - DEA	Comments must be requested from the Department's Biodiversity Section.	A copy of the DSR and FSR has been sent to the relevant representatives (see proof of delivery in Appendix E2) and comment received below.
N Mkhwanazi - DEA	Proof of correspondence with various stakeholders must be included in FSR. If no comments received, proof of attempts to obtain comments must be included.	See Appendix E1 for correspondence received and Appendix E3 for proof of attempts to obtain comment.
N Mkhwanazi - DEA	Provide a description of any identified alternatives for proposed activity that are feasible and reasonable, including advantages and disadvantages on the environmental and community. Alternatively submit written proof of any investigation and motivation if no reasonable or feasible alternatives exist.	Additional discussion on alternatives has been included in Section 2.6 and 5.16.
N Mkhwanazi - DEA	Department requires comment from Square Kilometer Array (SKA) to be included in FSR.	Comment has been solicited from the SKA, however none has been received to date (see proof of requests for comment in Appendix E3).

Commentator	Issue Raised	Response (by SRK unless otherwise noted)
		Further attempts to obtain comment from SKA will be made during the Draft EIR stage.
N Mkhwanazi - DEA	Specific requirements noted in respect of specialist studies conducted in-house or by a specialist who is not suitably qualified in the relevant field.	The specific requirements have been noted and all specialist reports EIR explicitly address these requirements. CVs of all specialists are included with their reports in Appendix G.
N Mkhwanazi - DEA	Specific requirements noted in respect of EAP declaration.	A declaration by the EAP is included in Appendix J4
N Mkhwanazi - DEA	The details of the EAP who prepared the report and their expertise must be submitted.	CVs for the EAPs are included in Appendix J5.
S Tshitwamulomoni – DEA: Biodiversity	Requests electronic copy of DSR and future reports.	Electronic copies of all reports have been provided for comment, as will future reports.
N Higgit - SAHRA	No heritage resources may be disturbed without a permit for the relevant heritage resources authority. Before such disturbance, a Heritage Impact Assessment must be done (Phase 1 and Phase 2).	Phase 1 archaeological and palaeontological assessments have been conducted, specialist reports for which are provided in Appendix G2 and 3. Where possible the layout has avoided areas of identified heritage resources (Figure 2-8)
N Higgit - SAHRA	Where bedrock is affected, or where there are coastal sediments, or marine or river terraced and in potentially fossiliferous superficial deposits, a Palaeontological Desk Top study must be done, or at least a letter of exemption obtained.	A palaeontological study has been conducted, and the specialist's report and letter of exemption is included in Appendix G3.
N Higgit - SAHRA	Any other heritage resources that may be affected such as built structures over 60 years old, sites of cultural significance associated with oral histories, burial grounds and graves, graves of victims of conflict, and cultural landscapes or viewscapes must also be assessed.	Heritage studies (palaeontology and archaeology), as well as a visual impact assessment have been completed (see Section 5.3, 5.4 and 5.9, and specialist reports in Appendix G2, 3 and 6).
N Higgit - SAHRA	Project must be correctly mapped on the GIS layer of the SAHRIS Case application. A kml file must be uploaded.	The relevant kml file has been uploaded to SAHRIS
N Higgit - SAHRA	Please upload Final Scoping Report and all appendices to SAHRIS case file. The Draft EIR must be submitted to SAHRIS during the next comment period.	All relevant reports will be made available to SAHRA for comment via SAHRIS (proof of distribution will be provided in the FEIR)
L Bosoga - DAFF: Land Use & Soil Management	DAFF is commenting authority in terms of Conservation of Agricultural Resources Act 43 of 1983 (CARA) and competent authority in terms of Subdivision of Agricultural Land Act 70 of 1970 (SALA).	This information has been conveyed to the applicant, who will handle these applications outside of the EIA process.
BN de Lange - DAFF: Land Use & Soil Management	Acknowledge receipt of notification and request for comment.	Noted
J Scholtz - Department of Environment and Nature Conservation	Acknowledge notification and request for comment.	Noted

Commentator	Issue Raised	Response (by SRK unless otherwise noted)
S Mabaso - DMR	Acknowledge notification and request for comment.	Noted
J Vorster - DAFF: Agriculture	Has no further comments in addition to those previously submitted on the BID.	Noted
MA Gabaitumele - Telkom	Approves proposed work as indicated on drawings. Provides contact details of Network Field Services Department to be notified before commencement of any work.	These contact details have been forwarded to the applicant.
R de Kock - SANRAL	Unaffected by proposed project and does not have any comment.	Noted
JH Bredenkamp – Local Resident	Why was the alternative of locating the facility nearer to Vanderkloof substation not considered? There are farms nearer to the Roodekuil sub-station if you are planning on using that substation.	[Africoast] (project engineers): Eskom have indicated that the Van der Kloof Substation and associated powerline are dedicated to the Hydro Power Plants. It would also be prohibitively costly to connect to this substation. The Roodekuil substation was considered as a grid connection point, but the higher value agricultural land close to the river, surface complexities and the location relative to existing 400 kV overhead lines have informed the final site selection process, and not proximity to the above-mentioned substations.

Table 4-3: Issue & Responses following the release of the FSR (original comments in Appendix E1)

Commentator	Issue Raised	Response (by SRK unless otherwise noted)
N Higgit (SAHRIS)	SAHRA APM will only be able to provide comment once the Archaeological and Palaeontological Assessment Reports have been submitted.	These reports will be uploaded to SAHRIS as part of the DEIR for comment (see Appendix G2 and G3)
W Lutsch (DEA:Biodiversity)	The protection of sites of international importance for conservation of the world's birds and other biodiversities are significant to ensure biodiversity targets are reached.	The ecological and avifaunal specialists have taken this into account in their assessments (see Section 5.6 and 5.7 and full reports in Appendix G4 and G5).
W Lutsch (DEA:Biodiversity)	Precautionary approach must be taken as potential impact of renewable energy facilities on biodiversity is not fully understood.	The ecological and avifaunal specialists have taken this into account in their assessments (see Section 5.6 and 5.7 and full reports in Appendix G4 and G5).
W Lutsch (DEA:Biodiversity)	The PV layouts and associated infrastructure positions must be located outside ecologically sensitive areas. This must be clearly depicted on sensitivity maps within the report. Appropriate buffers to protect sensitive biodiversity features must be clearly shown.	An initial screening exercise was undertaken by the ecological specialists to inform the layout and thereby avoid impacts on sensitive areas of the site where possible (see Figure 3-63-7). Buffer areas were also proposed as indicated on Figure 2-8
W Lutsch (DEA:Biodiversity)	All overhead power lines must be designed in a manner that minimises electrocution and collision risk.	Noted. Recommendations in this regard are provided by the avifauna and ecological specialists (see Section 5.6 and 5.7).
W Lutsch (DEA:Biodiversity)	An avifaunal impact study must be done to assess and quantify impacts associated with proposed development and associated infrastructure.	An avifauna study has been completed – see impact descriptions in Section 5.6 and full report in Appendix G5

Commentator	Issue Raised	Response (by SRK unless otherwise noted)
W Lutsch (DEA:Biodiversity)	A clear demonstration of how all recommendations and mitigation proposed by all specialists have been taken into consideration must be made. Where impacts are unavoidable, this should be clearly stated and motivated.	The initial screening exercise was undertaken to inform the layout and thereby avoid impacts on sensitive areas of the site where possible (see Figure 3-63-7). Impact significance ratings are provided for all potential impacts before and after mitigation, along with mitigation measures.
W Lutsch (DEA:Biodiversity)	Project descriptions must be sufficiently detailed to allow for assessment of relative impact on receiving environment and support conclusion about why alternative may have been selected or rejected.	Noted. The impact assessment has taken the various alternatives described into account and provided recommendations in this regard (see Section 5.16)
W Lutsch (DEA:Biodiversity)	Comments from conservation agencies and provincial department must be sought and their recommendations incorporated.	See list of IAPs in Appendix D, which includes relevant conservation agencies and commenting authorities. The comments and responses table details how the various comments received have been incorporated into the EIR.
W Lutsch (DEA:Biodiversity)	A site visit with ecological specialist, provincial commenting authority and DEA case officers must be done.	Noted. DEA may contact SRK to arrange the proposed site visit with the specialist.
H Roberts (SACAA)	Proposed energy facility restricted to a maximum height of 10 m above ground level. Proposed overhead power or transmission lines restricted to a maximum of 40 m above ground level.	Refer to Section 2.3 for detail on heights of the various components. All necessary CAA requirements will be met, and CAA approval has been obtained (see Appendix J1)
H Roberts (SACAA)	Developer must provide SACAA with ‘as built’ parameters of facility, including height of pylon structures conveying power generated by facility.	Noted. CAA approval has been obtained for the development (see Appendix J1) and the powerline design will comply with the relevant requirements.
J Geeringh (Eskom)	Provided Eskom requirements for works at or near Eskom Infrastructure.	Noted. These have been forwarded to the applicant.

5 Assessment of Environmental Impacts

5.1 Identification of Potential Impacts

The key environmental issues identified during the scoping phase were assessed by means of specialist studies. The objective of the specialist studies was to further investigate each of the issues identified and assess their potential environmental impact, in order to determine their significance and propose mitigation measures to address the impacts, if required. The identification of potential impacts of the proposed activity was based on the following factors:

- The legal requirements;
- The nature of the proposed activity;
- The nature of the receiving environment; and
- Issues raised during the public participation process.

Considering the factors listed above, a number of potential environmental impacts which could result from the proposed Kloofsig PV Facility were identified. These are discussed in this section.

Copies of the specialist study reports are provided in Appendix G of this report, as well as signed declarations of interest (either as a separate document or in the report). Assumptions and limitations relating to each of the specialist studies are listed in Section 1.6.

Table 5-1: List of Specialist Studies

Name	Company	Study	Appendix
Prof George Bredenkamp	EcoAgent	Biodiversity (including aquatic study)	Appendix G4
Dr Alan Charles Kemp	Naturalists & Nomads	Avifauna	Appendix G5
Dr John Almond	Natura Viva	Palaeontology	Appendix G3
Ms Madelon Tusenius	Natura Viva	Archaeology	Appendix G2
Dr Garry Paterson	ARC-Institute for Soil, Climate and Water	Agriculture Potential	Appendix G1
Mr Keagan Allan	SRK Consulting	Visual Impact Assessment	Appendix G6
Ms Elena Broughton	Urban-Econ	Socio-economic	Appendix G7
Mr Stefan Schutte	AfriCoast Engineers	Traffic Impact Assessment	Appendix G8

5.2 Impact Rating Methodology

5.2.1 Impact Rating Procedure

The assessment of impacts will be based on the professional judgement of specialists at SRK Consulting, fieldwork, and desk-top analysis. The significance of potential impacts that may result from the proposed development will be determined in order to assist DEA in making a decision.

The significance of an impact is defined as a combination of the consequence of the impact occurring and the probability that the impact will occur. The criteria that are used to determine impact consequences are presented in Table 5-2 below.

Table 5-2: Criteria used to determine the Consequence of the Impact

Rating	Definition of Rating	Score
A. Extent– the area over which the impact will be experienced		
None		0
Local	Confined to project or study area or part thereof (e.g. site)	1
Regional	The region, which may be defined in various ways, e.g. cadastral, catchment, topographic	2
(Inter) national	Nationally or beyond	3
B. Intensity– the magnitude of the impact in relation to the sensitivity of the receiving environment		
None		0
Low	Site-specific and wider natural and/or social functions and processes are negligibly altered	1
Medium	Site-specific and wider natural and/or social functions and processes continue albeit in a modified way	2
High	Site-specific and wider natural and/or social functions or processes are severely altered	3
C. Duration– the time frame for which the impact will be experienced		
None		0
Short-term	Up to 2 years	1
Medium-term	2 to 15 years	2
Long-term	More than 15 years	3

The combined score of these three criteria corresponds to a Consequence Rating, as follows:

Table 5-3: Method used to determine the Consequence Score

Combined Score (A+B+C)	0 – 2	3 – 4	5	6	7	8 – 9
Consequence Rating	Not significant	Very low	Low	Medium	High	Very high

Once the consequence has been derived, the probability of the impact occurring will be considered using the probability classifications presented in Table 5-4.

Table 5-4: Probability Classification

Probability– the likelihood of the impact occurring	
Improbable	< 40% chance of occurring
Possible	40% - 70% chance of occurring
Probable	> 70% - 90% chance of occurring
Definite	> 90% chance of occurring

The overall significance of impacts will be determined by considering consequence and probability using the rating system prescribed in the table below.

Table 5-5: Impact Significance Ratings

Significance Rating	Possible Impact Combinations		
	Consequence		Probability
Insignificant	Very Low	&	Improbable
	Very Low	&	Possible
Very Low	Very Low	&	Probable
	Very Low	&	Definite
	Low	&	Improbable
	Low	&	Possible
Low	Low	&	Probable
	Low	&	Definite
	Medium	&	Improbable
	Medium	&	Possible
Medium	Medium	&	Probable
	Medium	&	Definite
	High	&	Improbable
	High	&	Possible
High	High	&	Probable
	High	&	Definite
	Very High	&	Improbable
	Very High	&	Possible
Very High	Very High	&	Probable
	Very High	&	Definite

Finally, the impacts will also be considered in terms of their status (positive or negative impact) and the confidence in the ascribed impact significance rating. The system for considering impact status and confidence (in assessment) is laid out in the table below.

Table 5-6: Impact status and confidence classification

Status of impact	
Indication whether the impact is adverse (negative) or beneficial (positive).	+ ve (positive – a 'benefit')
	– ve (negative – a 'cost')
Confidence of assessment	
The degree of confidence in predictions based on available information, SRK's judgment and/or specialist knowledge.	Low
	Medium
	High

The impact significance rating should be considered by authorities in their decision-making process based on the implications of ratings ascribed below:

- Insignificant: the potential impact is negligible and will not have an influence on the decision regarding the proposed activity/development.
- Very Low: the potential impact is very small and should not have any meaningful influence on the decision regarding the proposed activity/development.

- Low: the potential impact may not have any meaningful influence on the decision regarding the proposed activity/development.
- Medium: the potential impact should influence the decision regarding the proposed activity/development.
- High: the potential impact will affect the decision regarding the proposed activity/development.
- Very High: The proposed activity should only be approved under special circumstances.

Practicable mitigation measures will be recommended and impacts will be rated in the prescribed way both with and without the assumed effective implementation of mitigation measures. Mitigation measures will be classified as either:

- Essential: must be implemented and are non-negotiable; or
- Optional: must be shown to have been considered, and sound reasons provided by the proponent, if not implemented.

5.3 Potential Archaeological Impacts

5.3.1 Introduction

Due to the scale of the development, an assessment of potential heritage impacts is a legal requirement. SRK Consulting appointed Madelon Tusenius of Natura Viva cc to undertake an Archaeological Impact Assessment (AIA) as part of the EIA for the proposed facility. This included a screening study to inform the proposed development layout, which was subsequently amended to avoid all archaeological resources of significance that were identified. A copy of the AIA report is included in Appendix G2. Archaeological resources referenced below in the report are included on Figure 3-8. This section therefore describes the associated impacts that the solar facility could have on archaeological resources, the assessment thereof, as well as the recommended mitigation measures.

The following general mitigation measures are applicable to all identified archaeological impacts, and where applicable, additional specific mitigation measures are listed in the tables below:

- If concentrations of historical and pre-colonial archaeological heritage material and/or human remains (including graves and burials) are uncovered during construction, all work must cease immediately and be reported to the South African Heritage Resource Agency (SAHRA). Phase 2 mitigation in the form of test-pitting/sampling or systematic excavations and collections of the pre-colonial heritage material will then be conducted to establish the contextual status of the sites and possibly remove the archaeological deposit before development activities continue; and

- A person must be trained as a site monitor to report any archaeological sites found during the development. Construction managers/foremen and/or the Environmental Control Officer (ECO) should be informed before construction starts on the possible types of heritage sites and cultural material they may encounter and the procedures to follow when they find sites.

5.3.2 Impact A1: Potential impact on archaeological resources during construction

The broader proposed development area generally has archaeological heritage remains of low sensitivity. Within this area, one area of medium local archaeological sensitivity occurs in which a concentration of Early Stone Age (ESA), Middle Stone Age (MSA) and Fauresmith material was recorded amongst coarse alluvial gravels along the watercourse in a section of the eastern power line study area (south of the site).

This area is regarded as being of medium local archaeological sensitivity, the material possibly being of scientific value, and may therefore require mitigation before destruction. The impact of the damage, destruction and permanent loss of archaeological heritage resources due to the proposed construction of the power line and servitude in the area along the watercourse to the south for the site is thus considered to be of medium significance. No further significant impacts on archaeological heritage resources are anticipated during the operational and decommissioning phases.

The rest of the proposed Kloofsig 1 and switch station areas, as well as most of the proposed power line and servitude, are considered to be of low archaeological sensitivity, and the impact of the proposed development on these archaeological heritages resources is expected to be of low significance.

The overall impact of the proposed development is however regarded as being of low significance in terms of local archaeological heritage. An impact rating is provided below for the impacted area as described above, noting mitigation measures (note, the alignment of the powerline to the southeast of the site has been moved to fall outside the archaeologically sensitive area as indicated in Figure 3-6.

Table 5-7: Significance rating of impact A1 and recommended mitigation measures

	Spatial Extent	Intensity	Duration	Consequence	Probability	Significance	+-	Confidence
Before Management	Local	Low	Long term	Low	Definite	**Low**	-	Medium
Management Measures								
• Avoid the section of the watercourse to the north of the eastern power line which was identified as being of medium local archaeological sensitivity and cordon it off with security tape. • Restrict construction activities in the eastern power line area to the disturbed zone between the telephone lines and the gravel road. • If dense concentrations of stone artefacts are uncovered during construction, the ECO should notify SAHRA. • If any human remains, graves or stone burial cairns are found during construction, work in that area must cease and the ECO must immediately notify SAHRA. If the burials cannot be avoided, exhumation by a suitably qualified and accredited professional archaeologist would need to be done under a permit issued by SAHRA. Mitigation is at the cost of the developer.								
After Management	Local	Low	Long term	Low	Probable	**Low**	-	Medium

5.4 Potential Palaeontological Impacts

5.4.1 Introduction

SRK consulting appointed Dr John Almond of Natura Viva to conduct a Palaeontological Impact Assessment (PIA) for the site. After visiting the site as part of a screening study to

inform the proposed development layout, Dr Almond reported that no palaeontological resources of significance were identified within the proposed development area and that further assessment was therefore not required. He therefore provided a Letter of Exemption from further paleontological studies, a copy of which, as well as the screening report, is included in Appendix G3.

5.4.2 Impact P1: Disturbance, damage or destruction of significant fossils during construction

Desktop and field-based palaeontological studies indicate that the Tierberg Formation (Ecca Group) and Karoo dolerite bedrocks as well as the overlying superficial sediments in the Kloofsig 1 Solar PV Energy Facility study area on Farm 18, Kalkpoort near Petrusville, Northern Cape, are of low to very low palaeontological sensitivity (Almond 2015). Impacts of the proposed development – including the associated infrastructure such as the on-site substation and the 132 kV powerline grid connection – are assessed as very low. Given the large outcrop areas of the potentially fossiliferous formations concerned, the loss of unique or irreplaceable fossil heritage is not anticipated here. Confidence levels for this assessment are moderate. No sensitive, conservation-worthy fossil sites were identified within the development footprint during fieldwork. The specialist noted no objections on palaeontological grounds to authorisation of the development and, pending the potential discovery of substantial new fossil remains during development, no further specialist palaeontological studies or mitigation are recommended here.

Table 5-8: Significance rating of impact P1 and recommended mitigation measures

	Spatial Extent	Intensity	Duration	Consequence	Probability	Significance	+-	Confidence
Before Management	Local	Low	Long term	Low	Improbable	**Very Low**	-	Moderate
Management Measures								
• Safeguarding of chance fossil finds (preferably in situ) during the construction phase by the responsible ECO, followed by reporting of finds to SAHRA. • Recording and judicious sampling of significant chance fossil finds by a qualified palaeontologist, together with pertinent contextual data (stratigraphy, sedimentology, taphonomy). • Curation of fossil material within an approved repository (museum / university fossil collection) by a qualified palaeontologist.								
After Management	Local	Low	Long term	Low	Improbable	**Very Low**	-	Moderate

5.5 Potential Soil and Agricultural Impacts

5.5.1 Introduction

SRK Consulting appointed Dr Garry Paterson to conduct a Soils and Agricultural Potential Assessment in terms of the Subdivision of Agricultural Land Act (Act 70 of 1970), which states that any application for change of land use must be approved by the Minister of Agriculture, and the Conservation of Agricultural Resources Act (Act 43 of 1983) which states that no degradation of natural land is permitted.

Dr Paterson conducted a desktop assessment to obtain all existing soil information and to produce a soil map of the specified area as well as to assess broad agricultural potential of the proposed Solar PV site. A copy of the report, as well as a supporting letter from the specialist confirming that the study has adequately covered the information requirements for decision making, is included in Appendix G1.

5.5.2 Impact SA1: Loss of arable land use due to construction of infrastructure

The first major impact on the natural resources of the study area would be the loss of arable land due to the construction of the various types of infrastructure. However, this impact would in all probability be of limited significance and would be local in extent. At the end of the project life, it is anticipated that removal of the structures would enable the land to be returned to more or less a natural state following rehabilitation, with little impact, especially given the low prevailing agricultural potential.

Table 5-9: Significance rating of impact SA1 and recommended mitigation measures

	Spatial Extent	Intensity	Duration	Consequence	Probability	Significance	+-	Confidence
Before Management	Local	Medium	Long Term	Medium	Improbable	**Low**	-	High
Management Measures								
• The maximum agricultural potential is for grazing, so the main mitigation would be to ensure that as little surface disturbance as possible occurs, so that grazing land is minimally affected.								
After Management	Local	Medium	Long term	Medium	Improbable	**Low**	-	High

5.5.3 Impact SA2: Increased susceptibility to water erosion during construction, operation and decommissioning

Erosion is a common occurrence on construction sites where soil is loosened and vegetation cover is stripped. The nature of the development should only include the partial clearance of vegetation within the development footprint. Vegetation should be permitted to remain on the surface for the maximum possible area and should be maintained throughout the operation phase. Due to the sporadic occurrence of duplex soils, as mentioned above, the hazard of water erosion when the topsoil is disturbed may be present, as such areas are mapped as “highly susceptible” (ARC-ISCW, 2004).

Table 5-10: Significance rating of impact SA2 and recommended mitigation measures

	Spatial Extent	Intensity	Duration	Consequence	Probability	Significance	+-	Confidence
Before Management	Local	Low	Long term	Medium	Improbable	**Low**	-	High
Management Measures								
• Ensure that as little surface disturbance as possible occurs. Where vegetation is removed for construction, specific measures would need to be put in place during both the construction and operational phases, which would include: absolute minimum removal of vegetation; soil conservation measures; re-vegetation as soon as possible; regular monitoring of erosion situation.								
After Management	Local	Low	Long term	Medium	Improbable	**Low**	-	High

5.6 Potential Impacts on Avifauna

5.6.1 Introduction

Dr Alan Kemp was appointed by EcoAgent CC for SRK Consulting to conduct an assessment of the avifaunal habitats and bird diversity for the proposed development sites and their immediate surroundings. The purpose of the survey was to estimate the bird species expected for the area and the likelihood of their interactions with the proposed development

and to propose possible mitigations should the development proceed. The avifauna report is included in Appendix G5.

The habitat on and around the development site is expected to support 158 species of birds, of which 18 are listed as nationally threatened in South Africa. The Kloofsig PV site lies at the northwest edge of the extensive Platberg-Karoo Conservancy, classified as a national Important Bird Area (SA037). Of most concern is the globally Endangered and near-endemic Ludwig's Bustard, which was seen on site and seemed relatively common in surrounding areas. This species, together with five others (Vulnerable Secretarybird and Lanner Falcon, and Near Threatened Kori Bustard, Karoo Korhaan and Double-banded Courser) are expected as regular residents or frequent visitors, while the remaining 12 threatened species are only expected as erratic to infrequent visitors. Eleven of the 18 species are large cumbersome species (3 vultures, 2 korhaans, 2 bustards, 2 storks, Blue Crane and Secretarybird), known for their propensity to collide with high-tension powerlines.

The construction and extent of arrays required will have unavoidable impacts on the substrate and the Northern Upper Karoo vegetation unit that it supports, disturbing the shallow soil layer and selectively excluding previously direct sunlight and rainfall patterns. It is also expected to affect bird species differentially, driving some away but offering novel shade and shelter to others. The exact outcomes of these effects on the vegetation and avifauna are poorly understood, but suggestions are provided for further investigation and monitoring that might inform avenues for mitigation (see also Avifaunal monitoring plan in Appendix H2).

Powerlines are better understood than PV arrays with respect to bird and habitat interactions, and Eskom, through its affiliation with the Endangered Wildlife Trust (EWT), apply comprehensive guidelines for their design and mitigation.

5.6.2 Description of Potential Impacts

Concerns over avifaunal impacts of the proposed developments for the Kloofsig PV site fall in to two main categories: 1) reduction in availability of pristine habitat, and 2) alterations in bird populations due to interactions with PV-array and transmission-line infrastructure.

Impacts associated with PV Arrays

Given the known influence of water and shade regimes on the germination, seed/fruit production and survival of some Karoo plants (Esler et al. 2006), changes in vegetation structure and composition under and around arrays can be expected. The effects discussed below should therefore be seen as primarily for consideration during monitoring, rather than proven changes to which known mitigation can be applied.

On the particular Kloofsig PV site, due to its proximity to other neighbouring habitats (Besemkaree Koppies Shrubland, Kimberley Thornveld and the Gariep River), visitation by a wider range of bird species is expected than if the site was only surrounded by Nama-Karoo ecosystems.

Effects of PV arrays and associated structures – For birds, solar PV arrays create tree-like structures that will be especially novel in the flat, shrubby vegetation of the Karoo. The formation of artificial 'trunks', 'branches' and 'canopies' may attract some bird species normally found in more wooded habitats such as the Kimberley Thornveld at the northern end of the property. They may offer potential perch, roost and even nest sites for any birds

passing through the area., The tops of the PV arrays form a smooth sloping surface that is not expected to constitute a reflective or collision risk The three main potential effects of the PV arrays will be underneath them where 1) they will cast shade on what is naturally a virtually unshaded flora and fauna, 2) their 'feet' on concrete slabs resting on or buried in the ground will resemble loose rocks and result in loss of vegetated habitat, and 3) any exposed legs, struts, wiring and boxes will provide possible roost and/or nest sites for some bird species (e.g. Cape Sparrow).

An important effect may arise from effects of shading on the vegetation, altering plant community composition, survivorship and/or structure, and hence use by and effects on birds, but this remains unstudied.

The effect of the exposed legs, struts and wiring will depend on how well the design discourages birds, such as having only vertical and sloping surfaces, and concealing wiring/boxes, to prevent perching and/or nest attachment.

Effect on use and management of water –The only effect on birds would be if residual water gathers on the arrays and attracts birds to drink, assuming that the water does not contain any potentially toxic ingredients used to clean the panel surfaces. Open reservoirs in which large birds sometimes drown should be avoided.

Loss of conservation-significant taxa and/or changes in community structure – The relatively small footprint of the total solar array on the greater landscape is unlikely to cause direct and widespread loss of threatened taxa or change in community structure. The development is placed in good Nama Karoo habitat, but the actual surface footprint of the arrays themselves and their cabling/piping is limited, expected to be temporary in the longer term and capable of rehabilitation.

Increased habitat fragmentation & loss of connectivity – The scope of the solar panel array within the greater area is unlikely to have any significant effect on habitat fragmentation or connectivity, especially for birds that can move over, under and around the development. The affected habitat is widespread all around the development and does not include restricted or sensitive movement corridors.

Increased anthropogenic encroachment – The solar panel arrays do markedly extend the normal anthropogenic effects for this arid and sparsely populated farming region, but on a relatively small spatial (<1000 ha) and short temporal (<40 year) scale Security provisions, such as lighting and fencing, could also create significant impacts for birds.

Loss and degradation of natural habitat – The general effect of the construction and maintenance of the solar array will inevitably lead to some immediate loss and alteration of the natural habitats on site. These effects can be mitigated to some extent, especially bearing in mind what needs to remain after decommissioning, but the impact is likely to be evident for a long time, especially on such a dry and sensitive substrate with slow wind and water erosion.

Loss of conservation-significant taxa and/or changes in community structure – The relatively small footprint of the solar array on the landscape is unlikely to cause direct and widespread loss of any threatened bird taxa, but it is likely to cause some site-specific changes in community structure while in operation. Species that dislike living under solid cover might decrease while others that welcome the shade and protection might increase, or

species that nest in shrubs or on the ground might decrease while those that can make use of man-made lattice structures might prosper.

Impacts associated with Transmission Lines

Portion RE/18 already has four high-voltage powerlines passing over or near the site, which are known hazards for collisions by large flying birds, especially bustards, cranes vultures and storks, so the relatively minor addition of connecting lines for the Kloofsig 1 development is expected to be of low additive impact provided it is planned and executed efficiently, with adequate warning devices attached where appropriate. Of these additions, the ~8.5 km of 132kV lines and pylons proposed to extend south and then east from the 400-kW grid-connection substation are of most concern, because, to the east, they run more-or-less perpendicular to the existing lines, so forming a new orientation of the hazard for any birds habituated to flying along and not across the existing lines.

Given the variance expected in bird species and numbers, resulting from the highly unpredictable and erratic fluctuations in climate and habitat responses for the Karoo, uncertainties with regard to potential impacts and the effectiveness of mitigation measures exists. Monitoring of changes, to inform ongoing adaptive management of the habitat and associated structures is therefore important. Furthermore, designs and interventions by Eskom, such as for pylon structures or markers on earth lines, can only be afforded at identified sections, based on monitoring results and protocols and devices established by the Eskom-EWT Strategic Partnership (http://www.eskom.co.za/AboutElectricity/FactsFigures/Documents/Partnerships).

Effects of lines and associated structures – Lines and their supporting pylons intrude into previously open space. This may increase the risk of aerial collisions, and provide potential perch/roost/nest sites. Effects from the proposed powerline are of most concern for the relatively large number of threatened species that are large, and therefore less manoeuvrable in flight to avoid collisions (e.g. bustards, cranes, eagles, storks) and risk electrocution (e.g. eagles, vultures). Use of the structures by birds has the potential for positive and negative ecological consequences, as well as a risk to birds of electrocution if they land/perch/take-off in such a way that they touch live and earth lines, or their moist droppings compromise insulator efficiency. This risk exists regardless of the voltage of the lines, but many/most modern line and pole/pylon designs by Eskom have reduced this risk to a minimum. The site already has a range of powerline and other utility line structures and routes across and alongside it, but the addition of 132 kV pylons (lattice or monopole <24 m high) still requires optimal siting and design.

Loss and degradation of natural habitat – The general effect of the construction of transmission lines on the habitats they traverse is low due to the small areas involved, however, the required servitude (15.5 m on each side for these 132 kV lines) increases this. Negative effects of electromagnetic radiation immediately around the lines on flora and fauna have also been proposed, but are considered unlikely. Effects of lines on habitats are mainly due to their prominence as perches and/or obstructions above sensitive habitats, or where high densities and/or diversities of birds concentrate, such as along updrafts on ridgelines or across narrow linear ecosystems like rivers or ponds. The effect of these 132 kV servitudes have been minimised by directing the powerline routes alongside areas already cleared and/or otherwise transformed, such as road/utility-line servitudes, and avoiding crossing ridges and watercourses (although one watercourse crossing is required for Kloofsig 1).

Loss of conservation-significant taxa and/or changes in community structure – The small footprint of lines on the landscape is unlikely to cause direct and widespread loss of threatened taxa or change in community structure, except for species prone to collision - such as cranes, bustards, vultures and storks. This is especially significant for the proposed 132 kV powerline routes, and monitoring along the powerline should be conducted to report any incidences of interactions with birds (negative or positive) for attention.

Increased habitat fragmentation & loss of connectivity – the proposed powerlines and their pylons are unlikely to cause habitat fragmentation and or connectivity loss. Increased anthropogenic encroachment – The proposed powerlines will not obviously increase the local anthropogenic effects.

5.6.3 Impact AV1: Effects of development on avian habitat under Solar PV arrays during operation

The introduction of PV arrays and associated infrastructure into such flat and open Nama-Karoo habitat provides a novel third dimension due to the tree-like effect of the 'trunks', 'branches' and 'canopies' formed by the arrays. The effect this will have on the avifauna is undocumented, but is expected to be used by some resident and attract other arboreal species (for shade and perch/roost/nest), with concomitant concentration of nutrient and seed/fruit loads below.

Table 5-11: Significance rating of impact AV1 and recommended mitigation measures

	Spatial Extent	Intensity	Duration	Consequence	Probability	Significance	+ -	Confidence
Before Management	Local	Low	Long-term	Low	Probable	**Low**	-	Medium
Management Measures								
• Monitor and report any bird/animal interactions with all aspects of the array, to allow adaptive management and remedial action, and also to compile databases relevant to the further phases and developments of these little-studied effects of the technology on semi-arid habitats. • As far as possible, ensure that the edges and undersides of panels (poles/legs, frames, wiring) do not provide unsuitable perch/roost/nest sites for birds or other animals. • Monitor other bird uses of the structures, such as use of shade for resting, or where unnaturally high input of nutrients or seeds may alter vegetation structure, composition and/or attractiveness.								
After Management	Local	Low	Long-term	Low	Possible	**Low**	-	Medium

5.6.4 Impact AV2: Disturbance of birds during construction, operation and decommissioning

Vehicles and people moving about and building infrastructure in such open Nama-Karoo habitat are obvious and disturbing to birds, especially to larger and more sensitive species. Open habitat also tends to induce long flights to safety by disturbed birds, which increases the effort of recovery, especially if they are nesting. The intensity of disturbance would be highest during construction, due to the number of workers and activities on the site.

Table 5-12: Significance rating of impact AV2 and recommended mitigation measures during construction and decommissioning

	Spatial Extent	Intensity	Duration	Consequence	Probability	Significance	+ -	Confidence

Before Management	Local	High	Short term	Low	Definite	**Low**	-	High
Management Measures								
• Limit on-site activities to daytime where possible. • Minimize the use of equipment that results in noise generation as far as possible. • Restrict construction staff to an allocated area and avoid access to surrounding or sensitive habitats. • Provide adequate ablution facilities to avoid use of natural (sensitive) areas as toilets. • Minimise the number of vehicles using access and maintenance roads as far as possible. • Invertebrates flying at night are attracted to lights and these should be kept to a minimum so as not to impact on activities of nocturnal predatory or avian prey species. • All outside lighting should be directed to the minimal area necessary and away from sensitive areas. Fluorescent and mercury-vapour lighting should be avoided and sodium vapour (yellow) lights used wherever possible.								
After Management	Local	Medium	Short term	Very Low	Definite	**Very Low**	-	High

Table 5-13: Significance rating of impact AV2 and recommended mitigation measures during operation

	Spatial Extent	**Intensity**	**Duration**	**Consequence**	**Probability**	**Significance**	**+ -**	**Confidence**
Before Management	Local	Low	Long-term	Low	Definite	**Low**	-	High
Management Measures								
• Limit on-site activities to daytime where possible. • Minimize the use of equipment that results in noise generation as far as possible. • Restrict construction staff to an allocated area and avoid access to surrounding or sensitive habitats. • Provide adequate ablution facilities to avoid use of natural (sensitive) areas as toilets. • Minimise the number of vehicles using access and maintenance roads as far as possible. • Invertebrates flying at night are attracted to lights and these should be kept to a minimum so as not to impact on activities of nocturnal predatory or avian prey species. • All outside lighting should be directed to the minimal area necessary and away from sensitive areas. Fluorescent and mercury-vapour lighting should be avoided and sodium vapour (yellow) lights used wherever possible.								
After Management	Local	Low	Long-term	Low	Definite	**Low**	-	High

5.6.5 Impact AV3: Negative bird-powerline interactions during operation

A variety of bird species collide with and/or are electrocuted by powerline structures but, given the lengths involved, mitigation can only be applied where high risk or hot-spot areas are identified by regular monitoring. Therefore, the development should monitor its own lengths of powerline that connect to the national grid, and any parts of the national grid that pass through and might be affected by the arrays. Installing anti-collision devices is expensive, and only justified where problems are obvious, which is impossible to determine during a brief site visit, especially for so many nomadic and uncommon threatened species that characterise the Karoo avifauna.

Table 5-14: Significance rating of impact AV3 and recommended mitigation measures

	Spatial Extent	**Intensity**	**Duration**	**Consequence**	**Probability**	**Significance**	**+ -**	**Confidence**
Before	Regional	Medium	Long-	High	Possible	**Medium**	-	Medium

Management			term					
Management Measures								
• The new 132 kV powerline route and design should be assessed for high sensitivity areas for potential bird-powerline interactions by an avifaunal specialist taking into account the Birdlife SA guidelines, before construction commences. • Bird anti-collision devices for diurnal, nocturnal and/or auditory warning should be installed where power lines cross movement corridors, the exact locations for these interventions to be guided by regular search, location, identification and reporting of interactions or casualties								
After Management	Regional	Low	Long-term	Medium	Possible	**Low**	-	Medium

5.6.6 Impact AV4: Degradation of habitat due to construction of the solar PV development

Habitat that is currently used by birds will be lost due to clearing of the site, and development of the project infrastructure, for the duration of project operation. Despite the extensive areas of surrounding Nama-Karoo habitat, the patch(es) of habitat affected by the development need to be disturbed as little as possible during development and operation, so that birds can continue to use them as much as possible. Even such relatively small patches as the development may have high temporary and local importance given the localised rainfall events that can attract large numbers of nomadic species. Minimal disturbance will also enable more effective rehabilitation after decommissioning, especially given the slow recovery of the woody plants that constitute a significant proportion of Karoo ground cover.

Table 5-15: Significance rating of impact AV4 and recommended mitigation measures

	Spatial Extent	**Intensity**	**Duration**	**Consequence**	**Probability**	**Significance**	**+ -**	**Confidence**
Before Management	Local	Medium	Long-term	Medium	Definite	**Medium**	-	Medium
Management Measures								
• Minimize the areas cleared for construction activities by remaining within the terrestrial footprint of each particular development. This includes the areas excavated for array supports, cabling/piping and used by staff during construction. • Locate materials in an ecologically secure site, ideally within habitat that is or will be transformed by the development rather than on additional natural habitat nearby. If feasible, make the laydown areas within the last-to-be-developed array areas, so as to avoid unnecessary clearing of areas that will require early rehabilitation. • Remove any waste or rubble from the site as soon as possible, especially on decommissioning. • All building materials, mixes and chemicals should be held within impervious rims to prevent seepage/spillage. • Physical barriers must be constructed around fuel depots and generators to prevent spilled fuel from spreading or coming into contact with surface or ground water. Chemicals and equipment for the treatment of fuel spillages must be available on site at all times.								
After Management	Local	Low	Long-term	Low	Definite	**Low**	-	Medium

5.7 Potential Biodiversity and aquatic Impacts

5.7.1 Introduction

Eco-Agent Ecological Consultants CC was appointed to assess the vegetation and wetlands / aquatic habitat and undertake a mammal, reptile and amphibian study of the area of the proposed Kloofsig 1 development. The EcoAgent team (Prof G.J. Bredenkamp (botanist, ecologist) Dr I.L. Rautenbach (mammalogist), Dr A. Kemp (ornithologist, ecologist) and Mr

J.C.P. van Wyk (herpetologist) conducted a site visit on 17-19 April 2015, and Prof Bredenkamp and Dr Rautenbach conducted a further site visit 6-8 October 2016. The site was investigated via vehicle and by walking random transects, to record plant community type and fauna and flora diversity.

Although four different karoo mapping units and an additional wetland / aquatic system were recognised, the differences in plant species composition are small. The plant species composition of the plant communities recognised is mostly quite similar, especially as far as dominant plant species are concerned. No red listed or protected plant species occur on the site.

From a mammal habitat perspective three of the four major habitats are present, i.e. mainly terrestrial, with limited rupicolous, arboreal and wetland habitat present. The site is dry most of the year and does not support much wetland vegetation.

On a micro-scale, each of the panels of voltaic units can be expected to alter the floral composition by replacing plant species adapted to the sunny and arid exposed karoo conditions with extremes in ambient temperatures, to those amenable to shady conditions. On a local and especially regional scale no mammal species will come under threat, although the effect of the development is likely to be measureable at population levels.

No red data herpetofauna species occur within the study site. From a herpetological perspective, all drainage lines and water bodies like the temporary pans and the artificial water points are regarded as sensitive. The development is not considered a direct threat to any reptile or amphibian species, and the spatial impact is small in the context of the widespread karoo plain habitat. The development is expected to have a small impact on herpetofauna and their environment, once the disruption of construction is over.

Two pans and a drainage line were identified on the Phase 1 Kloofsig site or within 500 m of the site boundary, or along the proposed power line route. These wetlands and/or aquatic systems were very dry at the time of the surveys, and did not show any obvious zonation. All these systems are seasonal, and temporal / intermittent.

5.7.2 Impacts on Vegetation

The main ecological impact associated with PV energy facilities is vegetation / habitat loss resulting in the displacement of fauna species from the site. Impacts on vegetation during construction, operation and decommission are tabled and described below.

Impact EC1: Habitat destruction and loss of plant species during construction

Construction of the photovoltaic facility including the associated infrastructure will result in destruction or disturbance of vegetation and faunal habitat within the construction footprint area, resulting in a general loss of plant and faunal species from the specific development site. Although the footprint area of the powerline pylons is small, the additional area that will need to be cleared and / or disturbed for the powerline servitude and access road add substantially to the total disturbed area.

The intensity and significance of this impact of habitat destruction and disturbance is regarded to be high in the absence of mitigation and will last for the lifetime of the facility.

Table 5-16: Significance rating of impact EC1 and recommended mitigation measures

	Spatial Extent	Intensity	Duration	Consequence	Probability	Significance	+ -	Confidence
Before Management	Local	High	Long-term	High	Definite	**High**	-	High
Management Measures								
• Restrict construction activities to the development site. • Minimize areas cleared for construction and building activities, including the powerline servitude and all areas used by staff during construction. • Wherever possible, any activities that can damage vegetation (e.g. tracks, unloading, storage, construction etc.) should be limited to specific allocated local sites and only within the footprint of the development area. • Clearly demarcate activity-specific construction areas to control and limit movement of personnel, vehicles and materials to contain the extent of the impacts to the lowest level possible. • Avoid clearing the corridors between the panels. • Keep the number of access routes and temporary routes within the development site to a minimum to decrease the land area that will be transformed, thus reducing impacts and remediation. • Conserve the (limited) areas that will not be developed to retain as much as possible natural habitat for flora and fauna. • Sequential construction strategy i.e. phasing the construction of the site (rows of panels) and rehabilitating immediately after each phase. • Not leaving bare soil surfaces exposed to erosion for lengthy periods.								
After Management	Local	Medium	Long-term	Medium	Definite	**Medium**	-	Medium

Impact EC2: Loss of red data, protected or other plant species of concern during construction

No protected or red listed plant species were identified or expected to occur within the study site during the site investigation, therefore the significance of the impact on these plant species is regarded as Very Low, and no mitigation measures are required. When considering the relatively small footprint of the proposed development site, it is highly unlikely that this proposed development will cause any loss of threatened flora or faunal taxa on a regional scale.

Table 5-17: Significance rating of impact EC2

	Spatial Extent	Intensity	Duration	Consequence	Probability	Significance	+ -	Confidence
Before Management	Local	Low	Long-term	Low	Improbable	**Very Low**	-	Medium

The following recommendations are provided:

- Any individuals of succulent (e.g. Aloes) or geophytic (bulb) plant species that may be found during construction can be kept in a temporary nursery to be used later in re-vegetation programs, as the survival of these species when re-planted will be more likely than that of the dominant dwarf shrubs. Rescued plants can also be relocated at suitable sites (e.g. farm houses, site gate or site offices etc.).
- Harvesting or removal, other than for rescue purposes, of any plant material is strictly prohibited. Staff shall only assist with the (necessary) removal of possible plant species, if requested to do so, under supervision.

Impact EC3: Change in plant species composition: increase in alien species during construction, operation and decommissioning

Due to the construction activities and resulting loss of natural vegetation and plant species, a change in plant species composition is expected, mainly due to the increase of alien species. These alien species are pioneers albeit to establish and grow in disturbed or denuded areas. Although this is definitely expected to happen, the significance is low, as there are currently very few alien invasive species on the site. With mitigation, this impact is relatively easy to control.

Table 5-18: Significance rating of impact EC3 and recommended mitigation measures during construction, operation and decommissioning

	Spatial Extent	Intensity	Duration	Consequence	Probability	Significance	+ -	Confidence
Before Management	Local	Medium	Medium-term	Medium	Definite	**Low**	-	Medium
Management Measures								
• Prevent introduction of alien woody plant species. Be aware of the fact that seeds of invasive plants can be transported by vehicles as well as staff clothing. • Eradicate invasive species. • Declared alien species that may become established during construction and operation phases must be identified and managed in accordance with the Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983), the implementation of a monitoring programme in this regard is recommended, being the responsibility of the ECO. • Re-vegetate exposed soils as soon as possible to stabilise the top soils, or apply rock fragments or other suitable material (e.g. plant material that was removed by clearing) to reduce the exposure of top soils to events that may initiate excessive erosion. • Use only indigenous (to the area) plant material. • Rehabilitate as a continual process, to maximize viability of the natural seed bank and reduce loss of top soil during storage.								
After Management	Local	Medium	Medium-term	Very Low	Definite	**Low**	-	Medium

Impact EC4: Impact of fuel and chemical spills on vegetation during construction, operation and decommissioning

The impact of pollution by fuel and chemical spills on vegetation is regarded as being insignificant during both the construction as well as the operational phases.

Table 5-19: Significance rating of impact EC4 and recommended mitigation measures during construction, operation and decommissioning

	Spatial Extent	Intensity	Duration	Consequence	Probability	Significance	+ -	Confidence
Before Management	Local	Low	Short-term	Very Low	Possible	**Insignificant**	-	Medium
Management Measures								
• Clear accidental spillage of fuel or chemicals immediately. • Ensure measures are in place (e.g. driptrays, bunding) to prevent leaks and spills during storage and handling of hazardous liquids.								
After Management	Local	Low	Short-term	Very Low	Possible	**Insignificant**	-	Medium

Impact EC5: Impact of shading on vegetation and plant species during operation

Karoo plant species grow in full, bright sunlight and are not shade tolerant. It is therefore expected that the plant species composition will change, and many karoo plant species will die when they are in the shade most of the time. This will have a definite impact on the plant species composition on the site, especially in the shade cast by the panels.

Due to the loss of natural vegetation and plant species, and the mentioned shading effect, a change in plant species composition is expected, mainly due to the increase of weedy pioneer species to establish and grow in disturbed or denuded areas and also in shaded areas. There is currently no guideline though it would be ideal if strips of vegetation between panel rows could remain in full sun for most of the day. This will assist in providing seed banks for vegetation recovery after decommission.

Table 5-20: Significance rating of impact EC5 and recommended mitigation measures

	Spatial Extent	Intensity	Duration	Consequence	Probability	Significance	+ -	Confidence
Before Management	Local	High	Long-term	Medium	Definite	**Medium**	-	High
Management Measures								
• If possible, space panel rows sufficiently to enable patches of vegetation between the rows to remain relatively intact and only minimally affected by shading.								
After Management	Local	Medium	Long-term	Medium	Definite	**Low**	-	Medium

Impact EC6: Habitat destruction during decommissioning

During decommissioning, disturbance of the site and surrounding habitat similar to that which occurred during construction is expected. Contractors responsible for the decommissioning and breakdown of the panels and other infrastructure may cause damage to the substrate and any remaining natural vegetation.

Rehabilitation of the site at decommission should lead to the re-establishment of the original indigenous plant species composition of the plant community that was affected by the development.

Table 5-21: Significance rating of impact EC6 and recommended mitigation measures

	Spatial Extent	Intensity	Duration	Consequence	Probability	Significance	+ -	Confidence
Before Management	Local	High	Medium-term	Medium	Definite	**Medium**	-	High
Management Measures								
• Ensure that contractors are contractually bound to responsible repair of the environment. Clearing of constructed materials should be complete, with no rubble or waste be left on the site. • Rehabilitation of all disturbed areas after decommissioning, to return the site to as close to its pre-construction condition as possible.								
After Management	Local	Medium	Medium-term	Low	Definite	**Low**	-	Medium

5.7.3 Impacts on Vertebrate Fauna (mammals and herpetofauna)

Development of a PV array runs the risk of interfering with ecosystem function, such as removal of vegetation as source of food and shelter, breeding habitat and also reduction in water quality, soil pollution or underground water contamination. These in turn will impact negatively on vertebrate species, fauna species richness and population numbers.

Impact EC7: Loss of mammal and herpetofaunal habitat and ecosystem function during construction

The general effect of construction of the photovoltaic panels including the associated infrastructure, is that the faunal habitats and associated ecosystem functions will be destroyed, or at least highly disturbed, resulting in a general loss of faunal species from the specific development site. In situ populations of these species may no longer be able to find suitable habitat on the site or surrounding land. This could possibly lead to a decline in population numbers, but not to regional extinctions.

The intensity of faunal habitat destruction on the study site is regarded as high while the significance of this impact is regarded to be medium, but can be mitigated to very low.

Table 5-22: Significance rating of impact EC7 and recommended mitigation measures

	Spatial Extent	Intensity	Duration	Consequence	Probability	Significance	+ -	Confidence
Before Management	Local	High	Long-term	High	Possible	**Medium**	-	Medium
Management Measures								
• Restrict construction activities to the development site. • Minimize areas cleared for construction and building activities, including the powerline servitude and all areas used by staff during construction. • Wherever possible, any activities that can damage vegetation (e.g. tracks, unloading, storage, construction etc.) should be limited to specific allocated local sites and only within the footprint of the development area. • Clearly demarcate activity-specific construction areas to control and limit movement of personnel, vehicles and materials to contain the extent of the impacts to the lowest level possible. • Avoid clearing the corridors between the panels.								
After Management	Local	Medium	Medium-term	Low	Possible	**Very Low**	-	Medium

Impact EC8: Loss of mammal and herpetofaunal species during construction

The surest way of losing faunal (mammal and herpetofauna) species, is through the loss of habitat. Where-as larger faunal species may migrate to adjacent suitable habitats, smaller species are not able to do this and will be lost, either by lack of suitable habitat, or direct kills. The intensity and significance of loss of faunal species is regarded as high, but medium with mitigation.

Table 5-23: Significance rating of impact EC9 and recommended mitigation measures

	Spatial Extent	Intensity	Duration	Consequence	Probability	Significance	+ -	Confidence
Before	Local	High	Long-	High	Definite	**High**	-	High

Management			term					
Management Measures								
• Restrict construction activities to the development site. • Minimize areas cleared for construction and building activities, including the powerline servitude and all areas used by staff during construction. • Wherever possible, any activities that can damage vegetation (e.g. tracks, unloading, storage, construction etc.) should be limited to specific allocated local sites and only within the footprint of the development area. • Clearly demarcate activity-specific construction areas to control and limit movement of personnel, vehicles and materials to contain the extent of the impacts to the lowest level possible. • Avoid clearing the corridors between the panels. • Keep the number of access routes and temporary routes within the development site to a minimum to decrease the land area that will be transformed, thus reducing impacts and remediation. • Conserve the (limited) areas that will not be developed to retain as much as possible natural habitat for fauna.								
After Management	Local	Medium	Long-term	Medium	Definite	**Medium**	-	Medium

Impact EC9: Disturbance of fauna due to noise and lighting during construction, operation and decommissioning

Noise and night-time lighting generated during construction and operation activities may disturb fauna in the immediate surroundings. Light may attract or retard faunal species to the site (e.g. insects and bats).

Table 5-24: Significance rating of impact EC9 and recommended mitigation measures during construction and decommissioning phase

	Spatial Extent	**Intensity**	**Duration**	**Consequence**	**Probability**	**Significance**	**+ -**	**Confidence**
Before Management	Local	Low	Short-term	Very Low	Probable	**Very Low**	-	Medium
Management Measures								
• Bats (and birds) and invertebrates flying at night are attracted to lights, and these should be kept to a minimum. • Outside lighting should be designed to minimize impacts on fauna. • Fluorescent and mercury vapour lighting should be avoided and sodium vapour (yellow) lights should be used wherever possible.								
After Management	Local	Low	Short-term	Very Low	Possible	**Insignificant**	-	Medium

Table 5-25: Significance rating of impact EC9 and recommended mitigation measures during operational phase

	Spatial Extent	**Intensity**	**Duration**	**Consequence**	**Probability**	**Significance**	**+ -**	**Confidence**
Before Management	Local	Low	Long-term	Low	Probable	**Low**	-	Medium
Management Measures								
• Bats (and birds) and invertebrates flying at night are attracted to lights, and these should be kept to a minimum. • Outside lighting should be designed to minimize impacts on fauna. • Fluorescent and mercury vapour lighting should be avoided and sodium vapour (yellow) lights should be used wherever possible.								
After	Local	Low	Long-	Low	Possible	**Very Low**	-	Medium

Management			term					

Impact EC10: Collision and electrocution due to powerlines during operation

From a fauna perspective (apart from birds, which are rated separately in Section 5.6.5) the impact of construction of powerlines is restricted to bats. Although many individuals of several bat species may fly over the site during the night, this impact is regarded as low. Lighting will attract flying insects, which in turn will attract bats. However, incidents of bats colliding with powerlines are not recorded.

Table 5-26: Significance rating of impact EC10 and recommended mitigation measures

	Spatial Extent	Intensity	Duration	Consequence	Probability	Significance	+ -	Confidence
Before Management	Local	Low	Long-term	Low	Improbable	**Very Low**	-	High
Management Measures								
• Ensure that powerlines are made safe to bats by applying standard Eskom measures.								
After Management	Local	Low	Long-term	Low	Improbable	**Very Low**	-	High

Impact EC11: Increased human activities, illegal hunting and poaching during construction, operation and decommissioning

Increased human activities during the construction, operational as well as decommissioning phases may lead to killing of faunal species, especially reptiles, small mammals and herpetofaua. The site is vulnerable to hunting/trapping by workers. Harassing and hunting by workers could be a risk, though it is expected that the larger fauna will emigrate from the site. The impact of human activities on fauna on the site is therefore regarded as Very Low during all project phases.

Table 5-27: Significance rating of impact EC11 and recommended mitigation measures

	Spatial Extent	Intensity	Duration	Consequence	Probability	Significance	+ -	Confidence
Before Management	Local	Medium	Medium-term	Low	Possible	**Very Low**	-	Medium
Management Measures								
• Education of the construction staff about the value of wildlife and environmental sensitivity. • The contractor must ensure that no animals are disturbed, trapped, hunted or killed. • Conservation-orientated clauses should be built into contracts for construction personnel, complete with penalty clauses for non-compliance. • Restrict the movement of construction vehicles and construction personnel to designated construction areas only.								
After Management	Local	Low	Medium-term	Very Low	Possible	**Insignificant**	-	Medium

5.7.4 Impacts on Wetlands and Aquatic Systems:

Wetlands and aquatic systems are very limited on the study site. Three specific watercourses were identified and assessed by the specialist:

- Watercourse 1 – a dry natural pan

- Watercourse 2 – Transformed pan
- Watercourse 3 – dry drainage line

Possible impacts that proposed development of the Kloofsig PV array may have on the identified wetlands / aquatic systems include:

- Destruction of wetland / aquatic system habitat during construction.
- Sedimentation into wetlands / aquatic systems during construction, operation and decommissioning.
- Pollution of wetlands and potential to affect water quality during construction, operation and decommissioning. Due to the transient nature of the watercourses on the site, pollution is not expected to result in any impacts on water quality provided the specified buffers are adhered to.

Buffer zones are generally proposed as a standard mitigation measure to reduce impacts of land-uses / activities that are planned adjacent to water resources. The specialist has recommended a 32 m buffer zone around watercourse 1 (dry natural pan) and 3 (dry drainage line). the originally proposed alignment for the powerline to the south of the site did include a section running within the 32 m buffer area, however this has subsequently been moved to the south, so that the powerline remains outside the 32 m buffer area apart from a single crossing prior to connecting to the 132 kV existing overhead line. The pylons would therefore need to be positioned appropriately in the crossing area so as to minimise impacts on the drainage line.

Watercourse 2 (transformed pan) is within the development footprint area for Kloofsig 1.

Impact EC12: Destruction of wetland / aquatic habitats during construction

Watercourse 1: Dry natural pan

This watercourse is at least 50 m from the proposed development footprint and the construction of the proposed PV array will not have any impact on this wetland.

Watercourse 2: transformed pan

This pan is already transformed and even without mitigation (which is only possible by avoiding the borehole area) the significance of the impact on the (now not existing) pan is Low.

Watercourse 3: Dry drainage line

The original alignment of the powerline was often located within the 32 m buffer zone of the drainage line. In spite of the insignificant impact that the pylons of this powerline could have had during the construction and operation phases of the proposed development, the alignment was moved slightly southwards and this will eliminate any impacts.

It should, however, be noted that the powerline will have to cross the drainage line, but will easily span over the drainage line without any impacts.

Table 5-28: Significance rating of impact EC12 and recommended mitigation measures

	Spatial Extent	Intensity	Duration	Consequence	Probability	Significance	+-	Confidence
Before Management								
Watercourse 1 Dry Natural Pan	Local	None	Short term	very low	Improbable	**Insignificant**	-	High
Watercourse 2 Transformed Pan	Local	High	Short term	Low	Definite	**Low**	-	High
Management Measures								
Watercourse 2: • Fence off the pan (watercourse 2) and buffer zone area (32 m from the outer edge of the pan) from the development area to avoid entry of workers into the pan area. No mitigation measures are proposed for watercourses 1 and 3 as the development footprint will be outside their buffer areas.								
After Management								
Watercourse 1 Dry Natural Pan	Local	None	Short term	Very low	Improbable	**Insignificant**	-	High
Watercourse 2 Transformed Pan	Local	None	Short term	very low	Improbable	**Insignificant**	-	High

Impact EC13: Sedimentation into wetlands / aquatic systems during construction

Watercourse 1:

This natural pan is located at least 50 m from the proposed development footprint. It is clear that sedimentation from the proposed development will not have any impact on this wetland during the construction or operational phases.

Watercourse 2:

This pan is already destroyed and even without mitigation (which is only possible by avoiding the borehole area), the impact is Insignificant. This pan has no ecological significance.

Watercourse 3:

It is not foreseen that the powerline will cause any sedimentation of the drainage line.

Table 5-29: Significance rating of impact EC13 and recommended mitigation measures during construction

	Spatial Extent	Intensity	Duration	Consequence	Probability	Significance	+-	Confidence
Before Management								
Watercourse 2 Transformed Pan	Local	Low	Short term	Very Low	Improbable	**Insignificant**	-	High

	Spatial Extent	Intensity	Duration	Consequence	Probability	Significance	+-	Confidence
Management Measures								
Watercourse 2: • Avoid activities in the borehole area (including 32 m buffer around the pan). • Limit the construction footprint and rehabilitate disturbed areas as soon as possible								
After Management								
Watercourse 2 **Transformed Pan**	Local	None	Short term	Very low	Improbable	**Insignificant**	-	High

Impact EC14: Pollution into watercourses and potential to affect water quality during construction and operation

No impacts on any of the watercourses identified as a result of pollution are anticipated to occur during construction, operation or decommissioning of the proposed facility, and no mitigation measures are proposed.

5.8 Potential Socio-Economic Impacts

5.8.1 Introduction

SRK Consulting appointed Elena Broughton of Urban-Econ Development Economists to conduct a Socio-Economic Impact Assessment. A copy of the Socio-Economic Impact Assessment report is included Appendix G7.

The purpose of the socio-economic impact assessment is to assess the need and desirability of the project. It specifically aims to ensure that the project, if approved, provides for justifiable social and economic development outcomes.

The following sections discuss the socio-economic impacts that the proposed project is envisaged to create, considering the knowledge of the potentially affected socio-economic environment, and the project components. The analysis of socio-economic impacts is divided into the following groups:

- Impact on natural capital
- Impact on human capital
- Impact on social capital
- Impact on cultural and spiritual capital
- Impact on physical capital
- Impact on financial capital
- Impact on political and institutional capital

5.8.2 Impact on Natural Capital

Impact SE1: Loss of agricultural land during operation

The land that is proposed for the development of the Kloofsig Solar PV energy facility is used for sheep and cattle farming as well as game hunting. Should the proposed development commence as planned, the land affected by the project footprint may be partially or fully sterilised from agricultural production. However, the loss of the agricultural land, due to its current low grazing capacity and productivity in general, will not result in a noticeable reduction in agricultural production in the area.

Table 5-30: Significance rating of impact SE1 and recommended mitigation measures

	Spatial Extent	Intensity	Duration	Consequence	Probability	Significance	+-	Confidence
Before Management	Local	Medium	Long--term	Medium	Probable	**Medium**	-	High
Management measures								
• The project developer should design the infrastructure layout in a manner that limits the footprint of the facility and all associated infrastructure; this should also be done in consultation with the land owner • If feasible, assist the owners of the farm with relocation of the sheep to nearby farms to ensure minimal loss in livestock production								
After Management	Local	Low	Long-term	low	Probable	**low**	-	High

Impact SE2: Disruption of commercial agricultural activities during construction

Concern has been raised by a neighbouring farmer over the wellbeing of its livestock as a result of traffic (on the access road to the site, which crosses his farm), stock theft and disturbance due to construction activities. With respect to other adjacent farms, there is no evidence to suggest that the proposed project will create any disruptions to their commercial operations, as they will not be affected by the footprint of the project, nor the physical movement of vehicles; thus, all existing commercial operations on these farms are expected to continue.

Table 5-31: Significance rating of impact SE2 and recommended mitigation measures

	Spatial Extent	Intensity	Duration	Consequence	Probability	Significance	+-	Confidence
Before Management	Local	Medium	Short--term	Very low	Probable	**Very Low**	-	High
Management measures								
• Put adequate measures to prevent the sheep from accessing the access road (i.e. fencing), as well as to ensure that the sheep could be moved over the road to other pastures, when required • Consult with the affected farm owners and impose strict rules in terms of the movement of construction and delivery vehicles from and to the site along the access road (i.e. maximum speed limit, headlights, hours of movement, etc.)								
After Management	Local	Low	Short--term	Very low	Probable	**Very Low**	-	High

5.8.3 Impacts on Human Capital

Impact SE3: Increased employment during construction and operation

The project proponent estimates that the **construction** phase period of the proposed Kloofsig 1 Solar PV energy facility will generate a total of 300 full time equivalent (FTE) person-years over the 12-18-month construction period. Of these, 42% employment opportunities will be occupied by unskilled individuals, about 19% of which will be made available to the local community, and specifically the towns of Petrusville, Vanderkloof and Phillipstown. These opportunities will, however, be short-term as they will only last for the duration of the construction phase of the Kloofsig 1 Solar PV energy facility.

When the development reaches the **operational** phase, it is expected that 17 sustainable jobs will be created and sustained over the PV facility's operational period. Of these, 40% will be for unskilled people, 19% of which will be made available to the local community.

These anticipated employment levels should be viewed in the context of the high unemployment levels in the area, especially Petrusville (42% or 655 individuals), resulting in a medium intensity rating for construction and low for operation.

Apart from the expected potential employment opportunities to be provided by the development of the project, the proponent also plans to assist in creating new and supporting the expansion of existing create Small, Medium and Micro Enterprises (SMME's) for the local community through local procurement. During the construction phase, local businesses within the security, catering and transport sectors could benefit indirectly; while during operations indirect opportunities for SMME's will be created within cleaning and security services. This means that there is a possibility to increase the magnitude of the impact of the development.

Table 5-32: Significance rating of impact SE3 and recommended mitigation measures during construction

	Spatial Extent	Intensity	Duration	Consequence	Probability	Significance	+-	Confidence
Before Management	Regional	Medium	Short-term	Low	Definite	**Low**	+	High
Enhancement measures								
• Local labour should be employed as far as feasible to maximise the benefits to the local community. For that purpose, establish if a skills database exists within the local area, and: o If the database exists, it should be made available to contractors - information sharing will ensure that the proposed development is understood, enabling those individuals with fitting skills, if any, to make their services and/or knowledge available to the project proponent o If no database exists, set-up a skills desk at the local municipal office and in the nearby communities to identify skills available in the community, which will assist in recruiting local labour during both construction and operation. • Where feasible, training and skills development programmes targeted at the locals should be initiated prior to commencement of the construction phase • The recruitment process should promote gender equality. • Where possible and feasible, ensure that goods are procured from local businesses so as to increase chances of indirect job creation • Consultation with local authorities is essential so as to manage job creation expectations and ensure that all eligible workers in the primary study area are informed of the opportunities								
After Management	Regional	Medium	Short-term	Low	Definite	**Low**	+	High

Table 5-33: Significance rating of impact SE3 and recommended mitigation measures during operation

	Spatial Extent	Intensity	Duration	Consequence	Probability	Significance	+-	Confidence
Before Management	Regional	Low	Long-Term	Medium	Probable	**High**	+	High
Enhancement measures								
• Where possible, maximize the number of local labour employed for the jobs at the solar PV facility • Identify potential candidates from the local community to occupy permanent positions long before commencement of operations and, if necessary, send them for additional training								
After Management	Regional	Low	Long-Term	Medium	Probable	**High**	+	High

Impact SE4: Enhancement of skills and knowledge during construction and operation

According to the proponents' estimations, 19% of employment opportunities will be for the benefit of the local community during both the construction and operational phases, which will require both skilled and unskilled labour. Based on the community's current literacy rate level, it seems unlikely that the skilled labour will be sourced from the local economy.

It is therefore, clear that during the **construction** phase, the local labour that will have been employed by the proponent will mainly benefit from a selection of certain **skills development** and on the job training. This will be of particular benefit in the event that similar Solar PV energy facilities are developed in the area as individuals will now have a higher chance of being appointed for the same construction-related opportunities.

Once the Kloofsig 1 Solar PV energy facility is **operational**, it is not yet evident what type of training the proponent will offer to the local community. The percentage of the annual revenue that will be allocated toward Social Development as well as Enterprise Development initiative is yet to be determined. Nonetheless, it is known that a certain amount of revenue will be allocated for skills development specifically targeting the local community and the towns of Petrusville, Vanderkloof and Phillipstown. Importantly, these skills development initiatives would be devised in consultation with the local authorities and communities; thus, targeting the major areas of need and opportunities.

Table 5-34: Significance rating of impact SE4 and recommended mitigation measures during construction

	Spatial Extent	Intensity	Duration	Consequence	Probability	Significance	-	Confidence
Before Management	Regional	Medium	Short-term	Low	Probable	**Low**	+	Medium
Enhancement measures								
• Where possible, local procurement of labour should be applied so as to ensure that benefits accrue to local community • Contractors involved in the project should be encouraged to offer on-the-job training and share knowledge with the workers								
After Management	Regional	Medium	Short-term	Low	Probable	**Low**	+	Medium

Table 5-35: Significance rating of impact SE4 and recommended mitigation measures during operation

	Spatial Extent	Intensity	Duration	Consequence	Probability	Significance	+-	Confidence

Before Management	Regional	Medium	Long-Term	High	Probable	**High**	+	High
Enhancement measures								
• Vocational skills transfer/training programmes should be developed and made available for the local labour • Investigate the needs of the local community with respect to skills and address these though the skills development programme as part of the Enterprise Development and Social Development initiatives								
After Management	Regional	Medium	Long-Term	High	Probable	**High**	+	High

Impact SE5: Impact on health (and nutrition) of the community during construction

During the construction phase, dust will be generated primarily due to movement of the construction and delivery vehicles to and from the project site. This is a short-term impact and importantly, considering the limited number of people who reside on the directly affected and adjacent farm portions and potential for mitigation of this impact using dust suppression methods, the significance of this impact from a human health perspective could be rated as low.

In the event that the development attracts an influx of migrant workers as well as jobseekers to the area, the potential increase in sexually transmitted diseases, prostitution levels as well as xenophobic outbursts may be expected. With this expectation, the presence of more people living and interacting within the local community increases the risk of a greater and faster spread of communicable diseases in the area.

In contrast to the above, it can also be argued that that improved living standards as a result of created employment opportunities as well as potentially stimulated purchasing power, might lead to an improvement on peoples' nutrition levels. This, however, is only limited to individuals who will be employed during the development of the Solar PV energy facility and their beneficiaries.

Table 5-36: Significance rating of impact SE5 and recommended mitigation measures

	Spatial Extent	**Intensity**	**Duration**	**Consequence**	**Probability**	**Significance**	**+-**	**Confidence**
Before Management	Regional	Medium	Medium-Term	Medium	Probable	**Medium**	-	High
Management measures								
• Conduct awareness campaigns among construction workers and local community members (specifically targeting the youth and females) on health issues, including HIV/AIDS • Make condoms available to employees and all contracted workers for free • Developing a Code of Conduct for all employees related to the project, which includes no tolerance of activities such as alcohol and drug abuse • A Monitoring Forum (MF) should be created between the parties of interest who are directly and indirectly impacted by the project (i.e. farm owners, local councillors, project developers, local social workers, etc.)								
After Management	Regional	Low	Medium-Term	Low	Probable	**Low**	-	High

5.8.4 Impacts on Social Capital

Impact SE6: Impact on social relations during construction

As previously mentioned, it is highly unlikely that the area will be able to provide the necessary skills required for the construction as well as operational phase of the Kloofsig 1

Solar PV. Thus, although some of the labour requirements will be sourced from the local community, jobs that mostly require skilled or semi-skilled individuals are likely to be granted to migrant workers. This has the potential to increase the population of the area as it will result in an influx of workers from outside communities or from the rest of the country.

It is envisaged that up to 243 migrant workers may be present in the area during some stages of the construction phase. Considering the small population sizes of the nearby towns, the potential migration of the above-mentioned workers will be highly noticeable in these local communities. The project is also likely to attract job seekers from other areas, making the impact even more apparent.

In the likely event that most of the labourers choose to remain within the town after the construction is complete, in hope for available employment opportunities post-construction activities, the demographics of the area will be altered.

More often than not, a change in demographics that is influenced by the influx of male job seekers is associated with an increase in **social pathologies**:

- An influx of people from other parts of the country or potentially from outside of the country, may result in conflict between the locals and the migrants who are competing for the same job opportunity.
- Criminal activity can also increase as a result of people from outside the area who have failed to find employment for themselves forcing them to resort to unlawful activities.

Many of the above effects are difficult to avoid completely, but could be mitigated through engagement with the local communities and local authorities, proper sharing of information regarding the projects and opportunities available, as well as following strict labour sourcing channels and rules.

Table 5-37: Significance rating of impact SE6 and recommended mitigation measures during construction

	Spatial Extent	Intensity	Duration	Consequence	Probability	Significance	+-	Confidence
Before Management	Regional	High	Medium-term	High	Probable	**High**	-	Medium
Management measures								
• Locals should be informed upfront about employment opportunities so that there are no unrealistic expectations on the part of the community • Ensure clear communication of the project information and effective public participation processes to minimise the possibility of an influx of migrant workers								
After Management	Regional	Medium	Medium-term	Medium	Probable	**Medium**	-	Medium

Impact SE7: Impact on Personal Safety and Security during construction

With regard to safety, the only mentioned concern is the possibility of stock theft, crime, and attacks on personal property due to an increase in the number of people present and moving around the area during the construction phase. If this happens, farming operations could be disturbed and farmers could incur losses. To ensure that this is not a common occurrence, the project proponent should carefully manage the expectation surrounding employment provision during both phases of the development, as well as instil strict access control measures. Prior engagement with the land owners in the area will also be required to ensure that the parties (the land owners and the developer) reach a mutually beneficial agreement

with respect to the responsibilities and compensation policies if the above-mentioned risks transpire.

With the high unemployment rate in the area, chances of an influx of migrant workers to the area are highly probable. In the likely event that some of the workers will remain in the region either in hope for receiving permanent employment or in search for other employment, the impact on safety is most likely to go beyond the construction phase.

Table 5-38: Significance rating of impact SE7 and recommended mitigation measures

	Spatial Extent	Intensity	Duration	Consequence	Probability	Significance	+-	Confidence
Before Management	Regional	Medium	Medium-term	Medium	Possible	**Low**	-	Medium
Management measures								
• Ensure clear communication of the project information and effective public participation processes to minimise the possibility of an influx of migrant workers • Set up a strict access control system to the site and ensure that it prevents any chance of loitering by potential job seekers or other unauthorised people on the farm and adjacent farms • Manage the movement of workers/vehicles to and from the site and ensure that they are only on site during the reasonable working hours • Prior construction, rules and regulations regarding presence of construction workers on site need to be devised in consultation with the land owners of directly affected and adjacent properties • During construction, the rules and regulations must be clearly communicated to all workers and contractors, as well as penalties or consequences for not abiding by the rules; personal property must be respected • Any losses, personal of livestock related, incurred by the land owners of the direct affected or adjacent farms should be compensated if proven to be related to the project								
After Management	Regional	Low	Short-term	Very Low	Improbable	**Insignificant**	-	Medium

5.8.5 Impacts on cultural and spiritual capital

Impact SE8: Change in Sense of Place during construction and operation

Effects on the cultural as well as social capital of an area is examined through the review of an altered sense of space and place. More often than not, the identity of an individual is linked to the space upon which one resides. The likely cause of this is often the shared and lived experiences attached to a particular familiar surroundings and environment. Therefore, a change in the environment has the potential to affect the wellbeing of an individual.

In the context of the proposed Kloofsig 1 Solar PV facility, the potential change in the sense of place and associated impact on cultural capital of the impacted individuals can be analysed on two levels:

- Landowners could potentially have a negative experience in the event that the area they use to identify their social and cultural capital is altered to an industrialised space ensued due to the changes in the landscape. Furthermore, the increase in traffic volumes on the local roads, noise associated with the movement and operation of construction vehicles, as well as the change in the landscape will all negatively affect the sense of place experienced by the people living in the vicinity of the project site.
- There could also be a positive experience if the landowners view the presence of the energy facility within their area as a chance for stimulation of the local economy and alleviation of poverty levels in the community.

One landowner expressed his concern in relation to an altered sense of place as he feels the natural surroundings will be altered; thus, affecting the visual make-up of the area. Importantly, though, none of the other parties interviewed for this study expressed their concerns and rather viewed the facility from a positive perspective, which could create new jobs and stimulate economic activities in the area. Therefore, from a general point of view, the development of one PV facility is not likely to change the perception of the larger community to a degree that it will have an impact on the cultural and spiritual capital of the community members. Having said this, appropriate mitigation measures will need to be put in place to minimise the visual effect of the facility on the surrounding land owners and visitors to the area.

Table 5-39: Significance rating of impact SE8 and recommended mitigation measures during construction and operation

	Spatial Extent	Intensity	Duration	Consequence	Probability	Significance	-	Confidence
Before Management	Local	Low	Long-term	Low	Probable	**Low**	-	High
Management measures								
• Adhere to mitigation measures suggested by visual specialists to ensure that the magnitude of the impact is minimised								
After Management	Local	Low	Long-term	Low	Probable	**Low**	-	High

5.8.6 Impacts on Physical Capital

Impact SE9: Increased local production during construction and operation

The project proponent estimates that the construction of the Kloofsig 1 Solar PV facility will require capital expenditure (CAPEX) of R1.5 billion in 2016 prices. The investment is required for the purchase of the goods, services, and labour needed as inputs to construct the Solar PV facility. It is also estimated that 50% of this CAPEX will be spent on procurement of goods within South Africa, whilst the rest will most probably be sourced from outside the local economy and possibly the province in general.

The steps that need to be taken in an attempt to increase the benefit of increased production to the local community during the construction phase includes the commitment to maximise the use of the local labour and service providers. However, considering that the local economic base is very small and is not sufficiently diversified, it should be acknowledged that such opportunities will be limited. At this point, the magnitude of the economic benefit that is expected to ensue in the local community is not certain; however, it is likely to be of a medium effect as it will only last for the duration of the construction phase (12-18 months).

The upkeep and maintenance of the Kloofsig Solar PV facility will incur operational costs during the 20-year lifespan of the development. Although it would be highly beneficial to the local community, opportunities for this may be limited as it might require goods and skills which may not be available locally. However, the facility will be generating revenue, which will increase the size of the local economy and specifically it's utilities sector; thus considerably altering the structure of the local economy.

Table 5-40: Significance rating of impact SE9 and recommended mitigation measures during construction

	Spatial Extent	Intensity	Duration	Consequence	Probability	Significance	+-	Confidence
Before Management	National	High	Short-Term	High	Definite	**High**	+	High
Management measures:								
• Where possible procure goods and services from the local SMMEs								
After Management	National	High	Short-Term	High	Definite	**High**	+	High

Table 5-41: Significance rating of impact SE9 and recommended mitigation measures during operation

	Spatial Extent	Intensity	Duration	Consequence	Probability	Significance	+-	Confidence
Before Management	Regional	High	Long-term	Very High	Definite	**Very High**	+	High
Management measures:								
• Where possible procure goods and services from the local SMMEs								
After Management	Regional	High	Long-term	Very High	Definite	**Very High**	+	High

Impact SE10: Wear and tear of Road Infrastructure during construction

Increase in traffic, especially considering the size and weight of the vehicles to be travelling to the site, is likely to impact negatively on the road condition. Without appropriate maintenance, the condition could further deteriorate. In order to prevent this from occurring, the project proponent will need to engage with the local municipality responsible for the road maintenance and come to an agreement with respect to the necessary support that may need to be provided to ensure that the road condition is not worsened as a result of the project development.

Table 5-42: Significance rating of impact SE10 and recommended mitigation measures

	Spatial Extent	Intensity	Duration	Consequence	Probability	Significance	+-	Confidence
Before Management	Local	Medium	Medium-term	Low	Probable	**Low**	-	Medium
Management measures								
• Dust suppression measures must be implemented on site • Appropriate signage must be put up for traffic control and road safety • Engage with local municipality to discuss the potential impact on local road quality and the possible mitigation measures.								
After Management	Local	Low	Medium-term	Very Low	Probable	**Very Low**	-	Medium

Impact SE11: Increased pressure on social facilities during construction

With the expected influx of migrant workers and job seekers, considerable pressure will be placed on the regions' already stretched health care services. This means that in the event that the proponent fails to properly manage job expectation outcomes, government will need to act in accordance with the development needs in the provision of sufficient social infrastructure services such as personal healthcare. The impact however, should be short to medium-term as the influence of the influx is meant to last for the duration of the construction phase. In the likely event that workers will remain in the town in hope for employment during the operational phase, the duration of the impact may be prolonged but its significance is

likely to decrease as many of the jobs seekers and migrant workers are likely to move away in search for other job opportunities. Provision of the dedicated health service by means of a mobile clinic at the site itself will also assist in mitigating the potential issue.

Table 5-43: Significance rating of impact SE11 and recommended mitigation measures

	Spatial Extent	Intensity	Duration	Consequence	Probability	Significance	+-	Confidence
Before Management	Regional	Medium	Short-term	Low	Probable	**Low**	-	High
Management measures								
• Ensure effective communication of the project information throughout all stages to effectively manage expectations of local communities, local authorities and local land owners • Ongoing communication with the Local Municipality to ensure that they are aware of the potential demands that might arise from the development of the PV facility • Provision of a mobile clinic services to the workers								
After Management	Regional	Low	Short-term	Very Low	Probable	**Very low**	-	High

Potential Impact SE12: Impact on Basic Service Delivery during construction

Household backlog challenges that currently cripple the municipality are linked to problems around the lack of access to land, slow delivery of housing developments, lack of funding for housing development.

The proposed Kloofsig 1 PV development will result in up to 300 construction workers residing in the nearby towns, with the majority (up to 243) coming from outside these towns. This means that the demand for temporary accommodation as well as basic services during the construction phase will increase sharply in the nearby towns. The latter specifically refers to the demand for water and electricity provision, as well as health and recreational facilities. Without appropriate planning the increase in demand can negatively impact on the current service provision in the municipality, increasing the existing backlogs, as well as reducing the quality and availability of some of the services.

Attraction of potential job seekers, who are unlikely to find formal accommodation in the area and be able to pay for it may result in the formation of informal settlements in and around the neighbouring towns. Alternatively, residents within the towns may take advantage of the opportunity and utilise their backyards for renting purposes creating an informal hospitality industry. The presence of job seekers that were unable to find employment and adequate income source may also increase the pressure of police services in the area, as it could result in the alleviated rate of crime.

In order to mitigate this negative effect that could ensue during construction, engagement with the local councillors and local municipal authority (i.e. municipal manager, Local Economic Development officer, IDP officer, town planner, etc.), adequate information sharing regarding job opportunities during both construction and operation with the public and the local municipality, strict and transparent hiring practices, and assistance with the provision of selected municipal services (i.e. mobile clinic on site) may be implemented.

During operations, about 17 people will be employed on site to maintain and operate the facility with a few of these coming from the nearby towns. Due to the magnitude of the number of people that may need to permanently move to the area, it is unlikely to have any significant effect on the local community's service delivery and specifically the demand for

health, educational and recreational facilities. However, the presence of migrant workers or jobs seekers, who may decide to stay in the area after construction is completed in hope to find employment during operations may prolong the issues experienced during construction.

Table 5-44: Significance rating of impact SE12 and recommended mitigation measures during construction

	Spatial Extent	Intensity	Duration	Consequence	Probability	Significance	+-	Confidence
Before Management	Regional	Medium	Short-term	Low	Probable	**Low**	-	Medium
Management measures								
• Ensure effective communication of the project information throughout all stages of the development to ensure management of the expectations • Ongoing communication with the Local Municipality to ensure that they are aware of the potential demands that might arise from the development of the PV facility • Establish a health facility for the duration of the construction period to provide services to the construction crew and alleviate pressure on the local facilities								
After Management	Regional	Low	Short-term	Very Low	Probable	**Low**	-	Medium

5.8.7 Impacts on financial capital

Impact SE13: Increased Household Income and Financial Resources during construction and operation

It is estimated that almost two thirds of the households in the Renosterberg LM as well as Petrusville town earn less than R3 200 per month.

Considering that the intended level of local labour procurement at this point is 19% of available positions, it is evident that the benefit to be accrued to the local community is limited. Nonetheless, households that have individuals who are employed on site either during the construction or operational phase will experience an increase in disposable income. In addition, those households who benefit from indirect effects, i.e. procurement of catering, cleaning, and transportations services will also benefit financially. More often than not, an increase in income is accompanied by improved living standards.

Table 5-45: Significance rating of impact SE13 and recommended mitigation measures during construction

	Spatial Extent	Intensity	Duration	Consequence	Probability	Significance	+-	Confidence
Before Management	Regional	Medium	Short-term	Low	Probable	**Low**	+	Medium
Management measures								
• Recruit local labour as far as possible to ensure that the benefits accrue to local households within the community • Employ labour-intensive methods as far as possible in the construction phase • Where possible, sub-contract to local companies								
After Management	Regional	Medium	Short-term	Low	Probable	**Low**	+	Medium

Table 5-46: Significance rating of impact SE13 and recommended mitigation measures during operation

	Spatial Extent	Intensity	Duration	Consequence	Probability	Significance	+-	Confidence
Before Management	Regional	Low	Long-term	Medium	Probable	**Medium**	+	Medium

Management measures								
• Recruit local labour as far as possible to ensure that the benefits accrue to local households within the community • Where possible, sub-contract to local companies								
After Management	Regional	Low	Long-term	Medium	Probable	**Medium**	+	Medium

Impact SE14: Impact on Property Values during operation

Farms situated around the directly affected farm portion are mainly utilised for commercial sheep farming and game breeding purposes. During the interviews, none of the farm owners indicated that the presence of the Solar PV energy facility would affect their commercial agricultural activities. Furthermore, the presence of the project will not result in any land sterilisation of the directly adjacent farms and may only affect the land within the footprint of the project itself. This means that their main source of income (commercial farming) will not be sensitive to the development of the proposed project, and the latter will not have a direct negative effect on the surrounding farming operations. There were however, concerns related to dust pollution, stock theft, and personal safety, which are all considered to be a possibility and which will need to be taken seriously by the project proponent.

Renewable energy developments such as this one could have one or two primary impacts on property values:

- Land value could be reduced based on real or perceived adverse effects of the proposed development such as noise levels; traffic; and aesthetics, or
- The demand for surrounding properties and temporary accommodation could increase, leading to a rise in the areas property value.

Considering the fact that the directly and indirectly affected farms will continue with their current commercial agriculture activities, it is reasonable to assume that the values of indirectly and directly affected farms will remain unaffected by the project. The demand for affordable accommodation, though could increase the property prices in the nearby towns, which has been observed in areas such as Postmasburg, De Aar, and Prieska. However, this will likely only happen in the event that other similar developments in the area are approved, raising the demand for residential and commercial property.

Table 5-47: Significance rating of impact SE14 and recommended mitigation measures

	Spatial Extent	**Intensity**	**Duration**	**Consequence**	**Probability**	**Significance**	**+-**	**Confidence**
Before Management	Local	Medium	Short-Term	Very low	Possible	**Insignificant**	-	Medium
Management measures								
• Ensure that other specialists' recommendations regarding mitigations of noise, dust pollution and visual effects are implemented • Employ as many local labour as possible to curb the increase in demand for temporary accommodation and limit the growth in property prices								
After Management	Local	Low	Short-Term	Very low	Possible	**Insignificant**	-	Medium

5.8.8 Impacts on Political and Institutional Capital

Impact SE15: Improved government revenue and ability to service the community during construction and operation

Currently, the Renosterberg LM is experiencing several backlogs related to the housing as well as basic services such as sanitation, social, and recreational infrastructure as well as water backlogs.

The proposed Kloofsig 1 Solar PV energy facility will generate revenue for the government. This will either be in the form of tax-related revenue collected by national government (i.e. VAT, payroll, and income taxes) and tax- and rates-related revenue collected by local government (i.e. property rates, services rates, etc.).

Revenue collected by local government will be of benefit to local communities and the LM as a whole as the revenue is often invested in the upliftment of local municipalities which can result in an improvement in service delivery. Taking into consideration the fact that revenue collected will occur for the whole duration (construction and operational) of the project, the impact of the collected revenue is most likely to have a long-term effect.

No enhancement measures are proposed for this impact.

Table 5-48: Significance rating of impact SE15 during construction

	Spatial Extent	Intensity	Duration	Consequence	Probability	Significance	+-	Confidence
Before Management	National	Medium	Short-term	Medium	Definite	**Medium**	+	High

Table 5-49: Significance rating of impact SE15 during operation

	Spatial Extent	Intensity	Duration	Consequence	Probability	Significance	+-	Confidence
Before Management	National	Medium	Long-term	Very-high	Definite	**Very high**	+	High

5.9 Potential Visual impacts

5.9.1 Introduction

A Visual Impact Assessment (VIA) is required to assess the potential visual impact the proposed PV energy facility may have on viewers in the area. SRK Consulting appointed Mr Keagan Allan and Ms Andrea Murray-Rogers from SRK Consulting to conduct the Visual Impact Assessment (VIA) as per the terms of reference included in the Final Scoping Report. A copy of the VIA is included in Appendix G6, as well as the peer review report by Bernard Oberholzer, to meet DEA's requirement for external review of all in-house specialist studies.

This assessment considered both the magnitude of the visual impact, rated and guided by the Western Cape VIA Guidelines (WC Guidelines) (Oberholzer, 2005) (due to the absence of guidelines regarding VIA's in the Northern Cape Province), and the significance of the visual impact (rated according to prescribed methodology).

Based on the WC Guidelines, the proposed development requires a Level 3 VIA assessment, for which the following methodology was applied to meet the terms of reference in the most objective way:

- Identification of data requirements and collation of data. This included acquiring spatial data on topography (contours), existing visual character and quality, details and plans of the propose development, as well as other background information to:
    - Become familiar with the project site and its surroundings;
    - Verify the desktop spatial analysis undertaken;
    - Identify possible visual receptors; and
    - Identify and assess viewing points and visibility.
- A geo-spatial raster analysis1 of all the processed data was conducted to provide an estimate of the magnitude of the visual impacts of the following attributes:
    - Visual Exposure (viewshed) and viewing distance;
    - Visibility;
    - Visual Absorption Capacity (VAC);
    - Landscape / townscape integrity;
    - Sensitivity of viewing receptors; and
    - Mitigation measures to reduce the overall visual impact to acceptable levels.

The specialist noted that there are standard measures available for the type of visual impact being assessed and hence the rating does not suggest the existence of a fatal flaw. Furthermore, there are no no-go areas or buffer zones required.

The single significant visual impact of the project is considered to be the **Direct** impacts associated with the Operational phase. No indirect visual impacts were identified for any phase of the project. The proposed rehabilitation of the project site aims to reduce the effect of significant residual visual impacts.

The VIA used an adaptation of the impact assessment methodology as described in Section 5.2. (see VIA report in Appendix G6 for details of the methodology used).

The criteria used for the VIA include:

- Visual character, quality, absorption capacity and landscape compatibility of the study area;
- Visual exposure, visibility and distance of the proposed development;
- Viewer sensitivity

To ensure consistency of impact rating methodology between the various impacts assessed, the EAP has re-assessed the impact ratings provided by the specialist in the VIA, in terms of SRK's standard methodology, as reported below. The ratings may therefore differ slightly from what is provided in the VIA report, due to differences in the rating criteria and scales between the two methodologies.

Based on the positioning of the proposed infrastructure, the visibility rating of the development can be described as being marginally visible – viewers situated in close proximity to the proposed development, specifically in the south of the development site, are expected to be more exposed to the development than viewers located in other directions. This is attributed to the topography of the surrounding area, which is expected to shield viewers from the facility. Most receptor locations at which the proposed development is predicted to be highly

visible fall within 3-5 km of the site (see viewshed in VIA report), which for the purposes of visual impact assessment is considered to constitute a local impact.

5.9.2 Impact V1: Visual Impacts associated with Solar Panels

The solar panels associated with Kloofsig 1 are proposed within the centre of the project site, which is approximately 6 km south of the R369, covering an area of approximately 244 hectares. The panels will be mounted onto arrays, standing approximately 2 magl.

Due to the area predominately consisting of agricultural activities and natural vegetation, the proposed solar panels are considered to be of Low compatibility with the surrounding landuse.

5.9.3 Impact V2: Visual Impacts associated with Power Lines

An 8.5 km overhead 132 kV powerline running to the south-east of the site, from the solar panels to proposed substation site is proposed. Tower positions of this powerline are anticipated to be approximately 24 magl. Due to the powerline tower positions being undefined at the time of the study, it was assumed that the powerline span would be an average of 200 m. Large existing powerlines traverse the area within close proximity to the proposed development, therefore making the proposed powerlines and substation Moderately compatible with the surrounding landuse.

5.9.4 Impact V3: Visual Impacts associated with the Substation

A 132 kV substation site is proposed to the south-east of the site, with a short connection to the existing 400 kV overhead powerline. The substation is expected to cover an area of 1 ha, and the highest point of the substation is expected to be 24 magl. An additional switching station, approximately 5.5 km south-east of the site is proposed, due to the uncertainties regarding the future capacity of the 132 kV connection from the proposed project to the existing powerline.

Table 5-50: Significance rating of impact V1, V2 and V3 and recommended mitigation measures during construction, operation and decommissioning

	Spatial Extent	Intensity	Duration	Consequence	Probability	Significance	+-	Confidence
Impact V1 – visual impact of the solar panels								
Before Management	Local	Medium	Long term	Medium	Probable	**Medium**	-	Medium
Impact V2 – visual impact of the powerlines								
Before Management	Local	Low	Long term	Low	Probable	**Low**	-	Medium
Impact V3 – visual impact of the substations								
Before Management	Local	Low	Long term	Low	Probable	**Low**	-	Medium
Management Measures								
The impact management objective is to decrease the visibility of the proposed development from potentially sensitive receptors, through the following: • The construction footprint must be minimised. • Where vegetation is to be cleared on site, erosion control measures should be in place, to reduce the potential for visually scarring of the landscape by erosion.								

	Spatial Extent	Intensity	Duration	Consequence	Probability	Significance	+-	Confidence
• Concurrent revegetation of the disturbed areas should be considered where possible. • During construction and operations, dust control measures should be implemented. • If construction or operation is to occur during the night, all lighting should be placed to ensure that excessive light does not escape from the site. • During construction and operation, litter control measures should be kept in place to ensure that the site is maintained in a neat and tidy condition. • External signage should be kept to a minimum, and where possible should be attached to existing buildings.								
Impact V1 – visual impact of the solar panels								
After Management	Local	Medium	Long term	Medium	Possible	**Low**	-	Medium
Impact V2 – visual impact of the powerlines								
After Management	Local	Low	Long term	Low	Possible	**Very Low**	-	Medium
Impact V3 – visual impact of the substations								
After Management	Local	Low	Long term	Low	Possible	**Very Low**	-	Medium

5.10 Potential Waste Management Impacts

5.10.1 Introduction

This section describes the waste management impacts associated with the proposed development, the significance thereof and the recommended mitigation measures, as assessed and rated by the Environmental Assessment Practitioner (EAP).

5.10.2 Impact W1: Waste management impacts associated with construction

Construction activities will involve the generation of significant quantities of construction waste such as spoil material and packaging. Domestic waste will be generated by construction personnel who will be housed on-site. Permitted wasted disposal facilities are a considerable distance from the project site and uncontrolled waste management and/or disposal of waste on the site may lead to wind-blown litter and visual impacts. A large portion of the domestic waste stream is recyclable and disposal of this waste would result in a needless loss of natural resources.

Volumes of inert construction waste and excess spoil material are undetermined but are expected to be significant and their disposal on site may lead to increased ecological (through loss of habitat) and hydrological (through increased pollution of watercourses) as well as visual impacts. In this EIA it is assumed that spoil material that cannot be accommodated within the assessed footprint will be removed from site and disposed of at a registered landfill site.

Table 5-51: Significance rating of impact W1 and recommended mitigation measures

	Spatial Extent	Intensity	Duration	Consequence	Probability	Significance	+-	Confidence
Before Management	Local	Medium	Medium term	Low	Definite	**Low**	-	High
Management Measures								
• A waste management plan should be in place and should address classification of waste streams, segregation at source, control of waste on site before disposal, removal of wastes from site, and record keeping; • The Contractor must identify and separate materials that can be reused or recycled to minimise waste, e.g. metals, packaging and plastics, and provide separate marked bins/ skips for these items. These wastes must then be sent for recycling and records kept of recycling; • No disposal of wastes, other than at registered landfill sites; • No waste may be burned; • Sufficient portable on-site weather & vermin proof bins with lids need to be provided and appropriately placed and emptied regularly (contents to be disposed of at a licensed landfill site, and proof of disposal retained for auditing purposes); • Ensure that construction materials (e.g. bags of cement) are suitably stored and protected to avoid wastage; and • Excess excavated material that cannot be used for backfill should not be allowed to accumulate on site and should be disposed of at a formal landfill site or suitable spoil site identified in conjunction with the ECO.								
After Management	Local	Low	Medium-term	Very low	Possible	**Insignificant**	-	High

5.10.3 Impact W2: Waste management impacts associated with operation

Operational activities will involve the generation of small quantities of construction waste resulting from maintenance and repairs. Permitted waste disposal facilities are a considerable distance from the project site and uncontrolled waste management and/or disposal on the site may lead to wind-blown litter and/or illegal dumping, both of which can lead to further visual impacts.

Table 5-52: Significance rating of impact W2 and recommended mitigation measures

	Spatial Extent	Intensity	Duration	Consequence	Probability	Significance	+-	Confidence
Before Management	Local	Low	Long term	Low	Probable	**Low**	-	High
Management Measures								
• The developer must identify and separate materials that can be reused or recycled to minimise waste e.g. metals, packaging and plastics, and provide separate marked bins/ skips for these items. These wastes must then be sent for recycling and records kept of recycling; • No dumping within the surrounding area shall be permitted, and no waste may be buried or burned on site; and • Sufficient portable on-site weather & vermin proof bins with lids need to be provided and appropriately placed and emptied regularly (contents to be disposed of at a licensed landfill site, and proof of disposal retained for auditing purposes).								
After Management	Local	Low	Long term	Low	Possible	**Very low**	-	High

5.10.4 Impact W3: Waste management impacts associated with decommissioning of the PV Facility

Should the PV Facility be decommissioned at some stage, materials such as steel and rubble will need to be removed from site so that they do not litter the environment. The impacts related to decommissioning will be similar to those during construction, however the volumes will be significantly higher.

Table 5-53: Significance rating of impact W3 and recommended mitigation measures

	Spatial Extent	Intensity	Duration	Consequence	Probability	Significance	+-	Confidence
Before Management	Local	High	Long term	High	Definite	**High**	-	High
Management Measures								
• All infrastructure, equipment, plant, fencing, temporary services and foreign materials with no ongoing purpose on the site should be removed from the site and recycled or properly disposed of; and • Waste material should be removed entirely from the development area and disposed of at a registered disposal facility.								
After Management	Local	Low	Long term	Low	Possible	**Very low**	-	High

5.11 Potential Stormwater and Erosion Impacts

The ecological and wetland specialist has addressed stormwater and erosion impacts relating to watercourses (see Section 5.7.4), and the agricultural specialist has addressed erosion impacts on soils from an agricultural potential perspective (see Section 5.5.3). Additional management measures to prevent and address stormwater and erosion impacts are provided in the Stormwater and Erosion Management Plan (Appendix H3).

5.12 Potential Air Quality Impacts

5.12.1 Introduction

This section describes the impacts that the proposed development will have on the air quality in the surrounding area, and provides recommendations for mitigation measures. Air quality impacts have been qualitatively assessed and rated by the Environmental Assessment Practitioner (EAP).

Nuisance impacts from dust may result from construction vehicles travelling on gravel access roads past existing dwellings and agricultural lands to the site, and could negatively affect local communities, who may experience dust as a nuisance. Excess dust could also reduce visibility along the surrounding gravel access roads creating safety concerns, and may contribute to visual impacts.

5.12.2 Impact AQ1: Impact of dust during construction and decommissioning

Dust generated by construction activities has the potential to impact on off-site access roads by creating a dust nuisance to pedestrians and residents and impairing visibility on the roads thereby affecting traffic safety and visual impacts. Excess dust can also draw undue attention to the site by increasing the visibility of construction activities. This impact is rated as low (-ve) but can be reduced to insignificant with proper mitigation.

Table 5-54: Significance rating of impact AQ1 and recommended mitigation measures

	Spatial Extent	Intensity	Duration	Consequence	Probability	Significance	+-	Confidence
Before Management	Regional	Medium	Short term	Low	Definite	**Low**	-	High
Management Measures								
• Areas shall be cleared of vegetation or topsoil only when required, and shall be left without vegetation cover for the minimum amount of time; • When necessary, appropriate dust control measures (such as wetting or covering of soil) shall be implemented; • Vehicle speeds should be limited to 40 km/h on unpaved surfaces to reduce dust generation; • When transporting fine materials, dust tarps should be installed on vehicles; and • When necessary, gravel roads shall be surfaced.								
After Management	Regional	Low	Short term	Very low	Possible	**Insignificant**	-	High

5.13 Potential Noise Impacts

5.13.1 Introduction

This section describes the associated impacts that the proposed solar facility could have on noise levels in the surrounding area during the construction phase of the development, as assessed and rated by the Environmental Assessment Practitioner (EAP).

5.13.2 Impact N1: Noise creation during construction and decommissioning

Noise will result mostly from the increase in vehicular traffic on the roads to the site as well as from the movement of vehicles and use of machinery (plant) for construction related activities such as drilling of holes for installation of the panels and trenching for underground power lines on the site itself.

The noise impact resulting from construction activities is rated as very low with or without mitigation as the site is not near any residential areas and work will be limited to normal working hours. Due to the lack of receptors in close proximity to the site, noise impacts during operation of the site are estimated to be negligible.

Table 5-55: Significance rating of impact N1 and recommended mitigation measures

	Spatial Extent	Intensity	Duration	Consequence	Probability	Significance	+-	Confidence
Before Management	Local	Medium	Short term	Very Low	Definite	**Very Low**	-	Medium
Management Measures								
• Construction activities that are likely to result in noise levels in excess of 7 dB above ambient noise, at a distance of 100 m from the sources should be restricted to normal working hours (i.e. 6:00 to 18:00, Monday to Saturday) according to the Noise Control Regulations in terms of the Environmental Conservation Act (Act 73 of 1989) to reduce the noise impact to an acceptable level. Deliveries to the site should also be limited to these times.								
After Management	Local	Low	Short term	Very low	Probable	**Very Low**	-	Medium

5.14 Potential Traffic Impacts

5.14.1 Introduction

Impacts on traffic flow and safety for other road users on public roads leading to the site may result from transportation of materials and equipment to and from the site, primarily during construction. A traffic impact assessment (TIA) was conducted by AfriCoast Engineers as part of this EIA, the report for which is included as Appendix G8. A description of the possible route options for transportation of goods and materials to the site during construction is provided in Section 2.5. A traffic and transportation management plan is included in the TIA report to manage traffic impacts.

5.14.2 Impact T1: Impact on traffic flows and safety during construction, operation and decommissioning

Due to the remote location of the proposed PV Solar Farm and the small towns surrounding the Kloofsig site, current traffic volumes at all of the affected major traffic nodes are estimated to be low to very low. Seasonally higher traffic volumes will be experienced during the harvesting season, along some routes in the vicinity, however peak volumes are still expected to be far below capacity for the roads. The main increase in traffic volumes will be associated with construction, when equipment and materials will be trucked to the site. During operations the main sources of project-related traffic will be water trucks and standard vehicles, as opposed to heavy vehicles.

Increases in traffic volumes, especially of construction related heavy vehicles, may result in increased wear and tear on public roads, and negatively affect road safety and traffic flows. Due to the current road capacity and condition however, significant impacts on traffic flow, including at nodes, safety and road condition in the area are not anticipated during construction or operation.

Table 5-56: Significance rating of impact T1 and recommended mitigation measures during construction and decommissioning

	Spatial Extent	Intensity	Duration	Consequence	Probability	Significance	+-	Confidence
Before Management	National	Low	Short term	Low	Probable	**Low**	-	High
Management Measures								
• Regular maintenance of affected routes • Traffic safety signage as required on and around the site • Strict adherence to speed limits and other road rules.								
After Management	National	Low	Short term	Low	Possible	**Very Low**	-	High

Table 5-57: Significance rating of impact T1 and recommended mitigation measures during operation

	Spatial Extent	Intensity	Duration	Consequence	Probability	Significance	+-	Confidence
Before Management	Local	Low	Long term	Low	Possible	**Very Low**	-	High
Management Measures								
• Regular maintenance of affected routes								

• Traffic safety signage as required on and around the site • Strict adherence to speed limits and other road rules.								
After Management	Local	Low	Long term	Low	Improbable	**Very Low**	-	High

5.15 Cumulative Impacts

The proposed Kloofsig 2 and Kloofsig 3 Solar PV Facilities will border the Kloofsig 1 facility and cumulative impacts that these facilities might have on each other have been assessed in the reports associated with those applications (the assumption being that the developments, if authorised, would be developed consecutively). Most other renewable energy projects currently in operation or authorised in the region are more than 30 km from the proposed site. The Rhenosterfontein Solar PV Facility is situated approximately 5 km to the east of the proposed Kloofsig PV Facility. The Swartwater Solar PV Facility is situated 14 km southwest of Petrusville, and approximately 20 km south of the proposed Kloofsig PV Facility, and the Grootpoort PV Solar Energy Facility is situated near Luckhoff in the Free State, approximately 30 km northeast from the proposed Kloofsig Solar PV Facility (see Figure 5-1 for locations of closest PV facilities relative to the Kloofsig site).

Relevant comments made by the various specialists on potential cumulative impacts are summarised below.

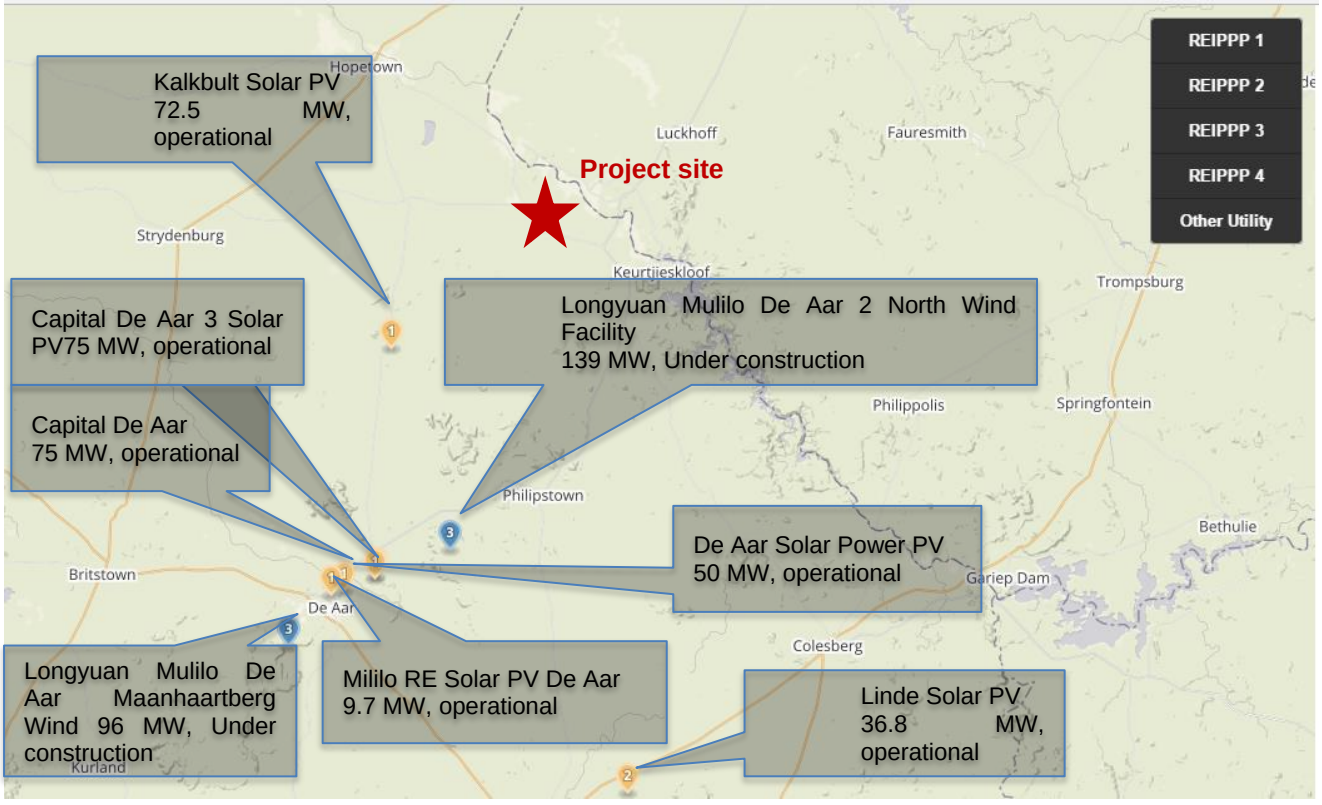


Figure 5-1: Map showing approved and operational renewable energy projects in the area (Source: Urban-Econ 2016)

5.15.1 Archaeology

The cumulative impact of the proposed Kloofsig development, as well as two other solar projects in the vicinity (Swartwater and Grootpoort solar PV facilities) was assessed, also taking into account other developments in the area for which archaeological impact assessments have been done (i.e. the Hydra-Perseus and Beta-Perseus 765 kV transmission power lines (Van Jaarsveld 2006) and the upgrade of the Transnet railway line between Hotazel and Coega (Nel 2008)).

These studies, as well as those mentioned in the Archaeological specialist report, revealed that early and mid Stone-Age material (ESA / MSA) comparable to the background scatter in part of the affected area is dispersed over the surface throughout the wider region. The cumulative impact of the proposed development in the broader area is considered to be **medium** if the concentration of ESA/MSA/Fauresmith material is not mitigated. The archaeologist is not aware of the recorded occurrence of such material in the area immediately west of the Vanderkloof Dam. This suggests that these archaeological remains may be of scientific value, albeit limited, as the material has been mixed and no organic remains have been preserved.

Table 5-58: Significance rating for cumulative impacts on archaeological resources and recommended mitigation measures

	Spatial Extent	Intensity	Duration	Consequence	Probability	Significance	+-	Confidence
Before Management	Regional	Low	Long term	Medium	Definite	**Medium**	-	Medium
Management Measures								
• If dense concentrations of stone artefacts are uncovered during construction, the ECO should notify SAHRA.								
After Management	Regional	Low	Long term	Medium	Possible	**Low**	-	Medium

5.15.2 Palaeontology

There are very few relevant, field-based palaeontological studies, whether academic studies or impact assessments, for the broader study region. In the case of palaeontological heritage, it makes sense to consider cumulative impacts on comparable fossil assemblages present in the same formations that are represented in the broader study region. The analysis below presents cumulative impacts on fossil heritage preserved within rock units that are represented in the Kloofsig Solar study area as well as nearby projects.

In all the relevant field-based palaeontological studies available for the area, the palaeontological sensitivity and the palaeontological heritage impact significance has been rated as low. While fossils do occur within some of the formations present, they tend to be sparse and represent common forms that occur widely within the outcrop areas of the rock units concerned. It is therefore concluded that the cumulative impact significance of the Kloofsig 1, 2 and 3 Solar PV Energy Facilities in the context of alternative energy and other developments in the region is very low.

Table 5-59: Significance rating of cumulative impact on palaeontological resources and recommended mitigation measures

	Spatial Extent	Intensity	Duration	Consequence	Probability	Significance	+-	Confidence
Before Management	Local	Low	Long term	Low	Improbable	**Very Low**	-	Moderate
Management Measures								
• Safeguarding of chance fossil finds (preferably in situ) during the construction phase by the responsible ECO, followed by reporting of finds to SAHRA. • Recording and judicious sampling of significant chance fossil finds by a qualified palaeontologist, together with pertinent contextual data (stratigraphy, sedimentology, taphonomy). • Curation of fossil material within an approved repository (museum / university fossil collection) by a qualified palaeontologist.								
After Management	Local	Low	Long term	Low	Improbable	**Very Low**	-	Moderate

5.15.3 Soil and Agriculture

In this case, there is a possibility of sediment removal by water erosion from one site to another, especially if shared infrastructure, such as access roads, is established. No impact rating was provided by the specialist, however the following mitigation measures are recommended:

- Appropriate soil erosion management measures must therefore be implemented during construction to minimize loss of topsoil resources. These would include soil conservation techniques such as geotextiles, contouring or construction of berms, culverts etc. and immediate re-vegetation and regular monitoring of all disturbed areas.
- Regular and focused communication must be implemented between representatives of all such projects in the vicinity to co-ordinate mitigation measures and monitoring where necessary.

5.15.4 Avifauna

The specialist reported that no cumulative impacts on avifauna are associated with the proposed Kloofsig 1 PV Facility.

5.15.5 Ecological and Wetland

The main cumulative impact associated with Kloofsig 1 is an increase in local and regional fragmentation and isolation of habitats.

The general region is characterised by low levels of transformation and the introduction of the new developments is not perceived as having a significant cumulative effect. Existing developments at or close to the study site include the main road, Eskom lines and substation and a close-by farm. No impact significance rating or mitigation measures were therefore provided by the specialist.

5.15.6 Visual

The specialist determined that no cumulative impacts would be associated with the proposed Kloofsig 1 PV Facility.

5.15.7 Socio-economic

Most of the projects shown on Figure 5-1 are clustered around De Aar, whereas the proposed site will be developed outside Petrusville town, which is not in close proximity to any of these. Kalkbult is the closest Solar PV energy facility to Petrusville town that has previously had an impact in creating temporary jobs for the Petrusville community during the construction phase. The above suggests that no cumulative impacts associated with the proposed Kloofsig development and other renewable energy projects in the area can be expected at this stage.

Since most of the renewable facilities are also developed further away from the site and are situated mainly in the Emthanjeni Local Municipality (i.e. around De Aar), the cumulative effect on agricultural production in the local municipality will be negligible.

5.16 Alternatives

5.16.1 Panels (fixed vs tracking)

The following input relating to the two panel technology alternatives was provided by the specialists:

- From a visual perspective, the specialist does not believe that there will be any major differences in the impacts from a visual perspective, other than:
    - Fixed panel structures will require a smaller area to develop (i.e. reducing the visual footprint of the development when compared to the tracking panels); and
    - The tracking panel structure would be expected to reduce the reflection caused by the panels, and therefore although a large area would be required to develop the structures, there could potentially be a reduction in the visual impacts associated with panel reflection.
- From an ecological perspective the specialist is of the opinion that there is very little difference between fixed and tracking panels and that either would be acceptable. It is noted however that fixed panels would occupy a smaller area (therefore less vegetation clearing and associated impacts on species and habitats) compared to tracking panels.
- From an avian perspective, fixed arrays are the preferred option because these do not have slow moving parts in which small animals and birds can become trapped or entangled.

It therefore appears that there is no clear consensus or definite preference between the two options and that the impacts related to either option would be similar, and therefore both options are proposed for authorisation.

5.16.2 Powerline (monopoles vs lattice masts)

The following input relating to the two pylon design alternatives was provided by the specialists:

From an ecological as well as avifaunal perspective, monopoles are preferred over lattice pylons for the following reasons:

- They occupy a smaller footprint;
- They offer fewer resting, roosting and nesting sites for birds, thereby decreasing the risk of negative interactions with the powerlines.

It therefore appears that monopoles are strongly preferred over lattice pylons, and this is therefore proposed as the preferred alternative for authorisation.

5.16.3 Decommissioning or re-powering

The potential impacts of repowering and decommissioning would be similar to those of the construction and operation phase, potentially less severe given that all infrastructure would already be in place. If repowering is not considered to be a viable option, then decommissioning will continue as described in Section 2.4.3, in which case the impacts will also be similar to those experienced during construction.

Repowering of the facility would mean that rehabilitation of the site and disposal of project infrastructure and equipment that can remain in use would be delayed until such a time as the facility is eventually decommissioned. As such, no significant differences between the impacts of both options are anticipated and both options are proposed for authorisation.

6 Findings, Evaluations and Recommendations

This chapter evaluates the impact of the proposed solar facility based on the findings of the Environmental Impact Assessment. The principal findings are presented in this chapter, followed by a discussion of the key factors DEA will have to consider in order to make a decision in the interests of sustainable development.

As is to be expected, the Kloofsig 1 Solar PV Facility and associated infrastructure has the potential to cause both negative and positive impacts. The EIA has examined the available project layout information and drawn on both available (secondary) and specifically collected (primary) baseline data to identify and evaluate the environmental (biophysical and socio-economic) impacts of the proposed project.

The EIA Report aims to inform decision-makers of the key considerations by providing an objective and comprehensive analysis of the potential impacts and benefits of the project, and has created a platform for the formulation of mitigation (for negative impacts) and enhancement (for positive impacts) measures to manage these impacts. These measures are consolidated in the Draft Environmental Management Programme (EMPr), which forms the next chapter (Section 0) of this Environmental Impact Report.

This chapter presents the general conclusions drawn from the EIA process which should be considered by decision makers in evaluating the project. The chapter should be viewed as a supplement to the detailed assessment of individual impacts presented in the previous chapter.

6.1 Environmental Impact Statement

The evaluation is undertaken in the context of:

- The information provided during the EIA;
- The assumptions made for this EIR;
- The recommended mitigation measures, which it is assumed will be effectively implemented;
- The assessments provided by the specialists; and
- The practicality of the recommendations for mitigation and enhancement.

The evaluation and the basis for the subsequent discussion are represented concisely in Table 6 1 below, which summarises the potentially significant impacts and their significance ratings before and after application of mitigation and/or enhancement measures.

Table 6-1: Summary of potential impacts of the proposed Kloofsig 1 Solar PV Facility and associated infrastructure

Impact group	Impact Description	+ / -	Significance without mitigation	Significance with mitigation
CONSTRUCTION				
Archaeological	A1: Destruction of archaeological resources	-	Low	Low

Paleontological		P1: Disturbance, damage or destruction of significant fossils	-	Very Low	Very Low
Soil and Agriculture		SA1: Loss of arable land use	-	Low	Low
		SA2: Increased susceptibility to water erosion	-	Low	Low
Avifauna		AV2: Disturbance of birds	-	Low	Very Low
		AV4: Degradation of habitat	-	Medium	Low
Biodiversity and aquatic	Impacts on Vegetation and Flora	EC1: Habitat destruction and loss of plant species	-	High	Medium
		EC2: Loss of red data, protected or other plant species of concern	-	Very Low	Insignificant
		EC3: Change in plant species composition: increase in alien species	-	Low	Low
		EC4: Impact of fuel and chemical spills on vegetation	-	Insignificant	Insignificant
	Impacts on Vertebrate Fauna	EC7: Loss of mammal and herpetofaunal habitat and ecosystem function	-	Medium	Very Low
		EC8: Loss of mammal and herpetofaunal species	-	High	Medium
		EC9: Noise and lighting	-	Very Low	Insignificant
		EC11: Increased human activities, illegal hunting and poaching	-	Very Low	Insignificant
	Impacts on Wetlands and Aquatic Systems	EC12: Destruction of wetland / aquatic habitats			
		Wetland 1	-	Insignificant	Insignificant
		Wetland 2	-	Low	Insignificant
		EC13: Sedimentation into wetlands / aquatic systems			
		Wetland 2	-	Insignificant	Insignificant
Socio-economic	Impact on Natural Capital	SE2: disruption of agricultural activities	-	Very Low	Very Low
	Impact on Human Capital	SE3: Increased employment	+	Low	Low
		SE4: Enhancement of skills and knowledge	+	Low	Low
		SE5: Impact on health (and nutrition) of the community	-	Medium	Low
	Impact on Social Capital	SE6: Impact on social relations	-	High	Medium
		SE7: Impact on Personal Safety and Security	-	Low	Insignificant
	Impact on cultural / spiritual capital	SE8: Change in Sense of Place	-	Low	Low
	Impact on Physical Capital	SE9: Increased local production	+	High	High
		SE10: Impact on Road Infrastructure	-	Low	Very Low
		SE11: Impact on Social Facilities	-	Low	Very Low
		SE12: Impact on Basic Service Delivery	-	Low	Low
	Impacts on financial capital	SE13: Increased Household Income and Financial Resources	+	Low	Low

	Impacts on Political and Institutional Capital	SE15: Increased government revenue and ability to service community	+	Medium	Medium
Visual	V1: Visual Impact of solar panels		-	Medium	Low
	V2: Visual Impact of powerlines		-	Low	Very Low
	V3: Visual Impact of Substations		-	Low	Very Low
Noise	N1: Noise disturbance		-	Very Low	Very Low
Air Quality	AQ1: Impact of dust		-	Low	Insignificant
Waste	W1: Impact of construction waste		-	Low	Insignificant
Traffic	T1: Impact on traffic flows and safety		-	Low	Very Low
OPERATION					
Soils and Agriculture		SA2: Increased susceptibility to water erosion	-	Low	Low
Avifauna		AV1: Effects of development on avian habitat under Solar PV arrays	-	Low	Low
		AV2: Disturbance of birds	-	Low	Low
		AV3: Negative bird-powerline interactions	-	Medium	Low
Biodiversity and aquatic	Impacts on Vegetation and Flora	EC3: Change in plant species composition: increase in alien species	-	Low	Low
		EC4: Impact of fuel and chemical spills on vegetation	-	Insignificant	Insignificant
		EC5: Impact of shading on plant species	-	Medium	Low
	Impacts on Vertebrate Fauna	EC9: Noise and lighting	-	Low	Very Low
		EC10: Power lines, collision and electrocution	-	Very Low	Very Low
		EC11: Increased human activities, illegal hunting and poaching	-	Very Low	Insignificant
	Impacts on Wetlands and Aquatic Systems	EC12: Sedimentation into wetlands / aquatic systems			
		Wetland 1	-	Insignificant	Insignificant
		Wetland 2	-	Insignificant	Insignificant
		Wetland 3	-	Insignificant	Insignificant
		EC13: Pollution into wetlands and potential to affect water quality			
		Wetland 1	-	Insignificant	Insignificant
		Wetland 2	-	Insignificant	Insignificant
		Wetland 3	-	Insignificant	Insignificant
Socio-economic	Impact on Natural Capital	SE1: Loss of agricultural land	-	Medium	Low
	Impact on Human Capital	SE3: Increased employment	+	High	High
		SE4: Enhancement of skills and knowledge	+	High	High
	Impact on cultural and spiritual capital	SE8: Change in Sense of Place	-	Low	Low

	Impact on Physical Capital	SE9: Increased local production	+	Very High	Very High
	Impacts on financial capital	SE13: Increased Household Income and Financial Resources	+	Medium	Medium
		SE14: Impact on property values	-	Insignificant	Insignificant
	Impacts on Political and Institutional Capital	SE15: Increased government revenue and ability to service community	+	Very High	Very High
Visual	V1: Visual Impact of solar panels		-	Medium	Low
	V2: Visual Impact of powerlines		-	Low	Very Low
	V3: Visual Impact of Substations		-	Low	Very Low
Waste	W2: Impacts due to waste		-	Low	Very Low
Traffic	T1: Impact on traffic flows and safety		-	Very Low	Very Low
DECOMMISSIONING					
Soil and Agriculture	SA2: Increased susceptibility to water erosion		-	Low	Low
Avifauna	AV2: Disturbance of birds		-	Low	Very Low
Visual	V1: Visual Impact of solar panels		-	Medium	Low
	V2: Visual intrusion of turbines		-	Low	Very Low
	V3: Visual intrusion of powerlines		-	Low	Very Low
Waste	W3: Impact due to Waste		-	High	Very Low
Biodiversity and aquatic	Impacts on Vegetation and Flora	EC6: Habitat destruction	-	Medium	Low
		EC3: Change in plant species composition: increase in alien species	-	Low	Low
		EC4: Impact of fuel and chemical spills on vegetation	-	Insignificant	Insignificant
	Impacts on Vertebrate Fauna	EC9: Noise and lighting	-	Very Low	Insignificant
		EC11: Increased human activities, illegal hunting and poaching	-	Very Low	Insignificant
	Impacts on Wetlands and Aquatic Systems	EC12: Destruction of wetland / aquatic habitats	-	Insignificant	Insignificant
		EC13: Sedimentation into wetlands / aquatic systems	-	Insignificant	Insignificant
		EC14: Pollution into wetlands and potential to affect water quality	-	Insignificant	Insignificant
Noise	N1: Noise disturbance		-	Very Low	Very Low
Air Quality	AQ1: Impact of dust		-	Low	Insignificant
Traffic	T1: Impact on traffic flows and safety		-	Low	Very Low

Key observations with regard to the overall impact ratings, assuming mitigation measures are effectively implemented, are highlighted as follows:

- The predicted archaeological impact, associated with earthworks during the construction phase, is rated as *low* and negative.
- The predicted palaeontological impact, also associated with earthworks during the construction phase, is rated as *very low* and negative.

- The predicted impacts on agricultural resources, including soil erosion and loss of agricultural land, are rated as *low* and negative. The site is noted as having a low carrying capacity for grazing.
- The predicted impacts on avifauna, resulting from loss and changes to habitat, disturbance, and negative interactions with powerlines, are rated as *low* and negative.
- The predicted impacts on vegetation, due to loss of habitat and species, changes in species composition, and pollution, are rated as *medium (habitat loss) to insignificant* and negative. No plants of special concern were noted for the site.
- The predicted impacts on fauna, due to loss of habitat, ecosystem function and species, disturbance, and poaching etc., are rated as *medium (species loss) to insignificant* and negative.
- The predicted impacts on watercourses on and close to the site, due to destruction, sedimentation and pollution, are rated as *insignificant* and negative, due to the low ecological value of the watercourses.
- Both positive and negative socio-economic impacts are predicted. During construction, *positive* impacts are associated with increases in employment, skills development, local production, household income and government ability to deliver services (due to increased revenue). These are rated as *high to low* significance. During operation, the significance of these impacts increases to *medium to very high* (positive).
- The main predicted negative socio-economic impacts are associated with loss of agricultural land, and impacts on health, social relations, service delivery, access to social facilities and safety of the local community as a result of in-migration of job seekers and employees to the area. These are predicted to be *medium to insignificant* during construction and *low* during operation.
- The predicted visual impacts of the solar panels, are rated as *low* and negative during all phases of the development. The predicted visual impacts of the powerlines and substations are rated as *very low* and negative.
- The predicted impacts on air quality (due to dust) and ambient noise during construction and decommissioning is rated as having a *very low* and negative significance.
- The predicted impacts resulting from waste during construction, operation and decommissioning are rated as having a *very low* and negative significance.
- The predicted impacts on traffic flow and safety are rated as having a *very low* and negative significance during all phases of the proposed development.

A map combining the final layout map superimposed on the environmental sensitivities map showing sensitive areas of the site identified by the various specialists relative to the site layout is provided as Figure 2-8 (A3 size copy is provided in Appendix F). The map includes the following:

- PV positions and associated infrastructure;
- Laydown area footprint;
- Access roads;

- Watercourses on and around the site (wetlands and drainage lines);
- The location of sensitive environmental features on site e.g. sensitive habitat, heritage sites, wetlands, drainage lines etc. that could be affected by the facility and its associated infrastructure;
- Substation(s) and/or transformer(s) sites including their entire footprint;
- Connection routes to the distribution/transmission network;
- All existing infrastructure on site;
- Buffer areas;
- Buildings; and
- All no-go areas.

6.2 Conclusion and Authorisation Opinion

In terms of Section 31 (n) of NEMA, the EAP is required to provide an opinion as to whether the activity should or should not be authorised. In this section a qualified opinion is ventured and in this regard SRK believes that sufficient information is available for DEA to make a decision.

The fundamental decision is whether to allow a development that is in line with the country's targets with regard to renewable energy sources, which is also in line with global trends. It is also noted that the proposed development is not predicted to pose significant negative environmental or social impacts that cannot be mitigated to acceptable levels, and none of the specialists have noted any fatal flaws relating to the development. Significant positive socio-economic impacts are also predicted to result from the proposed project, and the power generated from the proposed solar facility will contribute towards stabilising the Eskom power supply grid and provide a much needed additional source of power.

With the above in mind, and in terms of meeting the objectives of sustainable development, the EAP is of the view that DEA should authorise the development of the proposed Kloofsig 1 Solar PV Facility, subject to effective implementation of the mitigation measures and EMPr proposed in this EIA.

6.3 Recommendations

The specific recommended mitigation measures are presented in the impact assessment (Section 5) and are recorded in the Draft Environmental Management Programme (Section 0) of this report.

Key recommendations, which are considered essential, are:

1. Implement the EMPr to guide construction and operations activities and to provide a framework for the ongoing assessment of environmental performance;
2. Appoint an Environmental Control Officer (ECO) to oversee the implementation of the EMPr and supervise any construction activities in particularly sensitive habitats;
3. Minimise the physical footprint of the development and areas disturbed by construction activities;

4. Obtain other permits and authorisations as may be required, including, but not limited to Water Use Authorisations.
5. The revegetation and habitat rehabilitation plan, alien invasive vegetation management plan, and open space management plan (all included in Appendix H1) must be implemented during the construction and operational phases. Rehabilitation must be undertaken as soon as possible after completion of construction activities to reduce the amount of habitat converted at any one time and to speed up the recovery to natural habitats.
6. The post-construction Avifaunal Monitoring Plan (Appendix H2) must be implemented during the operational phase.
7. The transportation plan (included as part of the Traffic Impact Assessment report in Appendix G8) for the transport of large pieces of equipment, must be implemented (mainly applicable to the construction and decommissioning phases of the development).
8. The Stormwater Control and Erosion Management plan (Appendix H3) must be implemented during the construction and operational phases.
9. The fire management plan (included in Appendix H1) must be implemented during the construction and operational phases.

7 Draft Environmental Management Programme

This chapter presents a draft Environmental Management Programme (EMPr) that describes how the environmental aspects identified in the Environmental Impact Report (EIR) should be managed in the event of environmental authorisation being granted. Although the EMPr is written as if the project has been authorised, this approach in no way presupposes that the project will be approved. Rather, the style of writing is aimed at providing a clear picture to the Department of Environmental Affairs (DEA), other organs of state, and IAPs, regarding the management of environmental aspects associated with the design, construction and operational activities of the proposed development.

The preceding chapters in this EIR form an integral part of the EMPr as they provide details of the Environmental Assessment Practitioner(s) (EAP) who compiled the EMPr, details regarding the sensitivity of the affected environment, the issues and concerns raised by Interested and Affected Parties (IAPs), the findings of the impact assessment, and mitigation measures proposed by the EAP and/ or relevant specialist(s). As such, while the EMPr provides a list of environmental specifications aimed at mitigation or enhancement of the identified impacts, and in a more general sense compliance with environmental legislation, the preceding Chapters are particularly useful for understanding the importance of the measures proposed here.

In the event that the application is authorised by DEA, then this EMPr will be finalised according to the conditions specified in the Environmental Authorisation.

The EMPr stipulates the environmental standards to be adhered to by the parties involved in the various phases of the project life cycle of the project. As such the draft EMPr comprises a section for each of the following project life cycle phases:

- Pre-construction (Section 7.1.1);
- Construction activities (including rehabilitation) (Section 7.1.2);
- Operation (Section 7.1.3); and
- Decommissioning (Section 7.1.4).

Specific management measures applicable to each phase are provided in Section 7.2, which includes where appropriate a description of the environmental aspects associated with that phase, the roles & responsibilities for implementation of the EMPr, timeframes, and monitoring requirements.

It is intended that this EMPr is used in conjunction with the following project-specific management plans, which are included as Appendix H:

- Ecological management plans (Appendix H1), consisting of:
    - Alien invasive vegetation management plan;
    - Revegetation and habitat rehabilitation management plan;
    - Open space management plan;
    - Fire management plan.
- Avifauna monitoring plan (Appendix H2);

- Stormwater management and erosion control plan (Appendix H3).

A transportation control management plan is also included as part of the Traffic Impact Assessment report in Appendix G8.

7.1 Environmental Objectives

This section specifies the impact management objectives and outcomes used to determine the extent of management action(s) required to mitigate the negative impacts identified during the impact assessment process. In general, the mitigation hierarchy of avoidance, followed by minimisation where avoidance is not possible, and lastly, mitigation of any residual negative impacts, has been followed in the planning process of the proposed development, as is evidenced by the changes to the layout in response to sensitivities identified by specialists during the initial site screening study.

7.1.1 Planning and Design (Pre-construction Phase)

As mentioned above, areas of archaeological and ecological sensitivity were identified during a site sensitivity screening study, and areas of sensitivity have largely been avoided in the proposed project layout. Buffers around these areas have been recommended by the archaeological and ecological specialists (around watercourses), and have also been taken into account in the project layout.

The management objective for impacts on the sensitive archaeological and aquatic areas identified is:

- To avoid or where this is not possible, minimise impacts within the construction footprint.

7.1.2 Construction phase

Impacts on Archaeological Resources

Although the proposed activities are located in an area of low archaeological sensitivity, it is possible that archaeological heritage material exists below the surface and could be impacted during construction (particularly during vegetation removal).

The impact management objective for this impact is:

- Preservation of archaeological resources.

Impacts on Paleontological Resources

The Tierberg Formation (Ecca Group) and Karoo dolerite bedrocks as well as the overlying superficial sediments in the study site are of low to very low palaeontological sensitivity. Given the large outcrop areas of the potentially fossiliferous formations concerned, the loss of unique or irreplaceable fossil heritage is not anticipated.

The impact management objective for this impact is:

- Preservation of palaeontological resources.

Impacts on Soil and Agriculture

A key impact on the natural resources of the study area would be the loss of arable land due to the construction of the various types of infrastructure. However, this impact is predicted to be of low significance and would be local in extent.

Due to the sporadic occurrence of duplex soils, the risk of water erosion when the topsoil is disturbed may be present.

The impact management objective for this impact is:

- Ensure that as little surface disturbance as possible occurs.

Impacts on Vegetation and Flora

The general effect of construction of the photovoltaic facility including the associated infrastructure and access roads, is that the vegetation and faunal habitat within the construction footprint area will be destroyed, or at least highly disturbed, resulting in a general loss of plant species from the specific development site. This will result in a change in plant species composition, mainly due to the increase of alien species. Karoo plant species are generally not shade tolerant which will also result in a change in species composition. The most significant impact is predicted to result from habitat loss, which is rated as high.

The impact management objectives for this impact are:

- Minimize areas of vegetation that are disturbed or cleared;
- Prevent introduction and establishment of alien vegetation; and
- Rehabilitate disturbed areas of the site as soon as possible.

Impacts on Vertebrate Fauna (mammals and herpetofauna)

Development of a PV array and associated infrastructure will result in negative impacts on ecosystem function and habitat, such as removal of vegetation as source of food and shelter, and breeding habitat, as well as loss of species that are unable to move away from the area ahead of clearing. Construction activities will also result in disturbance (lighting, traffic, noise, etc) to fauna. These in turn will impact negatively on fauna species richness and population numbers. The significance of the impact of habitat loss is predicted to be medium, while that of loss of species is high.

The impact management objective for this impact is:

- Minimize areas that are cleared or disturbed (and therefore habitat destruction); and
- Minimize disturbance or harm to animals.

Impacts on Wetlands and Aquatic Systems

Wetlands and aquatic systems are very limited on the study site. Possible impacts that the construction of the proposed development of the Kloofsig PV array may have on the identified wetlands / aquatic systems includes destruction of aquatic habitat, sedimentation and pollution of aquatic habitats.

The only significant impact (low) identified is destruction of the transformed pan, which falls within the development footprint. This pan has however been previously transformed and has lost its ecological function. All other impacts are rated as insignificant.

The impact management objective for this impact is:

- Where possible, avoid watercourses by implementing buffer zones.

Impacts on Avifauna

Vehicles and people moving about and building infrastructure in such open Nama-Karoo habitat are obvious and disturbing to birds, especially to larger and more sensitive species. Open habitat also tends to induce long flights to safety by disturbed birds, which increases the effort of recovery, especially if they are nesting. The significance of these impacts is predicted to be medium to low.

The impact management objective for this impact is:

- Minimise disturbance of habitat;
- Minimise construction-related anthropogenic impacts.

Socio-Economic Impacts

During construction, job seekers and employees from surrounding areas will migrate to the local towns, resulting in potential negative impacts on service delivery, social relations, community health, safety and security. These impacts may be significant (high) if not managed appropriately. Positive impacts of employment, skill development, increased household income, increased government revenue and local production may also be significant (very high).

The management objectives for these impacts are:

- Minimise in-migration of job seekers by managing community expectations regarding employment.
- Minimise disruptions to surrounding agricultural and other activities.
- Maximise local employment and use of local service providers.
- Maximise opportunities for skills transfer.

Visual Impacts

Due largely to its extent and incongruency with the surrounding agricultural land, the proposed development will be visible to viewers situated in close proximity, especially given the limited screening provided by the surrounding vegetation and topography. It is noted however that there are relatively few visual receptors in the area and the presence of 400 kV powerlines crossing the site means that the area is not devoid of development, and mitigation options are limited for visual impacts. The impact is rated as medium to low significance.

The impact management objective for this impact is:

- Minimise the visibility of the proposed development from potentially sensitive receptors.

Waste Management Impacts

Construction activities will involve the generation of significant quantities of construction waste such as spoil material and packaging. Domestic waste will be generated by construction personnel who will be housed on-site. Permitted wasted disposal facilities are a considerable distance from the project site and uncontrolled waste management and/or disposal of waste on the site may lead to wind-blown litter and visual impacts. This impact is rated as low.

The impact management objectives for this impact are:

- Prevent pollution of surrounding habitat; and
- Legally compliant management of solid and hazardous waste.

Impacts on Air Quality

Dust generated by construction activities has the potential to create a dust nuisance to pedestrians and residents and impair visibility on the roads thereby affecting traffic safety. It is noted however that receptors in the vicinity of the site and access roads are limited. Excess dust can also draw undue attention to the site by increasing the visibility of construction activities. This impact is rated as low but can be reduced to insignificant with proper mitigation.

The impact management objective for this impact is:

- Minimise dust generation on the site and access roads.

Noise Impacts

Noise will result mostly from the increase in vehicular traffic on the roads to the site as well as from the movement of vehicles and use of machinery (plant) for construction related activities such as drilling of holes for installation of the panels. Due to the limited presence of receptors in the area, the noise impact is rated as very low.

The impact management objective for this impact is:

- Minimise noise disturbance to surrounding receptors.

Impacts on Traffic

Transportation of materials and equipment to the site during construction will require the use of heavy vehicles, which could result in negative impacts on traffic flow and safety in the area, given the generally low current traffic volumes. It has been confirmed however that the roads in the area do have capacity for the additional load, and impacts are therefore anticipated to be low.

The impact management objectives for this impact are:

- Minimise disruptions to traffic flow.
- Ensure traffic safety is not compromised.

Rehabilitation

Progressive rehabilitation should commence immediately after construction in the relevant areas using topsoil stripped before construction. Rehabilitated areas should be monitored and measures must be implemented to ensure that topsoil does not wash away. If erosion and/or sedimentation of downstream areas occur, appropriate measures must be implemented to prevent further erosion and to trap any excessive sediments generated during and after construction.

The management objective for rehabilitation is:

- Minimise erosion and associated impacts through implementation of rehabilitation as soon as possible.
- Return areas that are not needed for operation of the facility to as close to their pre-construction state as possible.
- Maximise restoration of indigenous vegetation and habitat on disturbed areas.

7.1.3 Operational phase

Impacts on Soil and Agriculture

Erosion is a common occurrence on construction sites where soil is loosened and vegetation cover is stripped. The impact significance is rated as low.

The impact management objective for this impact is:

- Minimise erosion potential of disturbed areas.

Impacts on Avifauna

Birds may react in a number of different ways to the proposed development, primarily due to loss or changes to habitat, and disturbance due to anthropogenic activities on site. Powerlines and other project infrastructure may result in negative interactions with birds such as collisions. The significance of these impacts is predicted to be medium to low.

The impact management objectives for this impact are:

- Monitor bird interactions with arrays and other project infrastructure;
- Minimise disturbance of birds;
- Minimise negative bird interactions with powerlines and other project infrastructure;
- Limit habitat disturbance.

Impacts on Vegetation and Flora

Due to the loss of natural vegetation and plant species, a change in plant species composition is expected, mainly due to the increase of alien species. These alien species are pioneers albeit to establish and grow in disturbed or denuded areas. Although this is definitely expected to happen, the significance is low, as there are currently very few alien invasive species on the site.

Karoo plant species grow in full, bright sunlight and are not shade tolerant. It is therefore expected that the plant species composition will change. This will have a definite impact on the plant species composition on the site, especially in the shade cast by the panels. This impact is rated as medium significance.

The impact management objective for this impact is:

- Manage alien invasive plant species on site;
- Minimise changes to species composition on site.

Impacts on Vertebrate Fauna (mammals and herpetofauna)

Noise and lighting may cause disturbance of fauna, and is expected to have a low impact. Collisions and other negative interactions of bats with powerlines are poorly understood, but are rated as low significance. Increased human activities on site may lead to killing of faunal species, including hunting/trapping by workers, which is rated as having a very low significance.

The impact management objective for this impact is:

- Minimise disturbance of fauna;
- Prevent hunting or harm to wildlife on or around the site.
- Minimise negative interactions with powerlines.

Impacts on Wetlands and Aquatic Systems

Impacts on wetlands and aquatic systems on or close to the site may result from sedimentation or pollution. Both of these impacts are predicted to be insignificant.

The impact management objectives for this impact are:

- Prevent pollution of watercourses; and
- Prevent sedimentation of watercourses by managing erosion.

Socio-Economic Impacts

During operation, some job seekers and employees from surrounding areas will remain in the local towns, resulting in potential low negative impacts on service delivery. By far the most significant impacts (due partly to their long term nature) will be positive however, resulting from employment and skills development (high significance), increased local production and government revenue (very high significance), and increased household income (medium significance). Negative impacts on property values are expected to be insignificant.

The management objectives for these impacts are:

- Minimise in-migration of job seekers by managing community expectations regarding employment.
- Minimise disruptions to surrounding agricultural and other activities.
- Maximise local employment and use of local service providers.
- Maximise opportunities for skills transfer.

Visual Impacts

Due largely to its extent and incongruency with the surrounding agricultural land, the proposed development will be visible to viewers situated in close proximity, especially given the limited screening provided by the surrounding vegetation and topography. It is noted however that there are relatively few visual receptors in the area and the presence of 400 kV powerlines crossing the site means that the area is not devoid of development, and mitigation options are limited for visual impacts. The impact is rated as medium to low significance.

The impact management objective for this impact is:

- Minimise the visibility of the proposed development from potentially sensitive receptors.

Waste Management Impacts

During operation, limited volumes of waste are expected to be generated on the site, most of which will be domestic, as well as some construction waste resulting from repairs and maintenance, and small volumes of hazardous waste from replacement of transformer oils.

The impact management objectives for this impact are:

- Prevent pollution of surrounding habitat; and
- Legally compliant management of solid and hazardous waste.

Impacts on Air Quality

The impact of dust generation (mainly from vehicle traffic on gravel access roads) is expected to be of low significance.

The impact management objective for this impact is:

- Minimise dust generation.

Impacts on Traffic

During operation, the majority of project traffic will be standard sized vehicles and water trucks, which are expected to result in low impacts on traffic safety or flows.

The impact management objectives for this impact are:

- Minimise disruptions to traffic flow.
- Ensure traffic safety is not compromised.

7.1.4 Decommissioning

During decommissioning, impacts are anticipated to be similar to those during construction with regard to visual, waste, noise, air quality, biodiversity and aquatic systems, and traffic impacts. These impacts are generally expected to be low to insignificant, apart from waste (high due to the large volumes of waste produced from removal of the solar arrays and other infrastructure), and destruction or disturbance of vegetation (medium).

The management objectives are:

- Minimise disturbance caused to ecological and human receptors.
- Minimise disruptions to traffic flow and impacts on safety.
- Minimise the footprint of vegetation and habitat disturbance.
- Rehabilitate the site to as close to its pre-construction condition as possible.

7.2 Impact Management

This section specifies the impact management outcomes and impact management actions required for the aspects and potential impacts related to the proposed activities. The manner in which the impact management objectives and outcomes, identified above, will be achieved. Where applicable actions will include activities to:

- Avoid, modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation;
- Comply with any prescribed environmental management standards or practices;
- Comply with any applicable provisions of the Act regarding closure, where applicable; and
- Comply with any provisions of the Act regarding financial provisions for rehabilitation, where applicable.

The above are detailed in Table 7-1, Table 7-2 and Table 7-3 for the construction, operational and decommissioning phases respectively.

Table 7-1: Mitigation and management measures for the construction phase

Aspect	Potential impact	Mitigation or enhancement measure	Time-frame	Responsibility
Clearing and disturbance of vegetation	Loss of agricultural land (Impact SA1)	• Ensure that as little surface disturbance as possible occurs, so that grazing land is minimally affected.	Duration of construction	Contractor Monitored by ECO
	Increased susceptibility to erosion (Impact SA2)	• Ensure that as little surface disturbance as possible occurs. Where vegetation is removed for construction, specific measures would need to be put in place, which would include: minimum removal of vegetation; soil conservation measures; re-vegetation as soon as possible; regular monitoring of erosion. • Implement stormwater control and erosion management plan	Duration of construction	Contractor Monitored by ECO
	Degradation of avifaunal habitat (Impact AV4)	• Minimize the areas cleared for construction activities by remaining within the terrestrial footprint of each particular development. This includes the areas excavated for array supports, cabling/piping and used by staff during construction. • Locate materials in an ecologically secure site, ideally within habitat that is or will be transformed by the development rather than on additional natural habitat nearby. If feasible, make the laydown areas within the last-to-be-developed array areas, so as to avoid unnecessary clearing of areas that will require early rehabilitation. • Remove any waste or rubble from the site as soon as possible, especially on decommissioning. • All building materials, mixes and chemicals should be held within impervious rims to prevent seepage/spillage. • Physical barriers must be constructed around fuel depots and generators to prevent spilled fuel from spreading or coming into contact with surface or ground water. Chemicals and equipment for the treatment of fuel spillages must be available on site at all times.	Duration of construction	Contractor Monitored by ECO
	Habitat destruction and loss of plant species (Impact EC1)	• Restrict construction activities to the development site. • Minimize areas cleared for construction and building activities, including the powerline servitude and all areas used by staff during construction. • Wherever possible, any activities that can damage vegetation (e.g. tracks, unloading, storage, construction etc.) should be limited to specific allocated local sites and only within the footprint of the development area. • Clearly demarcate activity-specific construction areas to control and limit movement of personnel, vehicles and materials to contain the extent of the impacts to the lowest level possible. • Avoid clearing the corridors between the panels. • Keep the number of access routes and temporary routes within the development site to a minimum to decrease the land area that will be	Duration of construction	Contractor Monitored by ECO

Aspect	Potential impact	Mitigation or enhancement measure	Time-frame	Responsibility
		transformed, thus reducing impacts and remediation. • Conserve the (limited) areas that will not be developed to retain as much as possible natural habitat for flora and fauna. • Sequential construction strategy i.e. phasing the construction of the site (rows of panels) and rehabilitating immediately after each phase. • Not leaving bare soil surfaces exposed to erosion for lengthy periods.		
	Change in plant species composition due to alien invasive vegetation (Impact EC3)	• Prevent introduction of alien woody plant species. Be aware of the fact that seeds of invasive plants can be transported by vehicles as well as staff clothing. • Eradicate invasive species. • Declared alien species that may become established during construction and operation phases must be identified and managed in accordance with the Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983), the implementation of a monitoring programme in this regard is recommended, being the responsibility of the ECO. • Re-vegetate exposed soils as soon as possible to stabilise the top soils, or apply rock fragments or other suitable material (e.g. plant material that was removed by clearing) to reduce the exposure of top soils to events that may initiate excessive erosion. • Use only indigenous (to the area) plant material. • Rehabilitate as a continual process, to maximize viability of the natural seed bank and reduce loss of top soil during storage. • Implement the alien invasive vegetation management plan	Duration of construction	Contractor Monitored by ECO
	Loss of faunal habitat and ecosystem function (Impact EC7)	• Restrict construction activities to the development site. • Minimize areas cleared for construction and building activities, including the powerline servitude and all areas used by staff during construction. • Wherever possible, any activities that can damage vegetation (e.g. tracks, unloading, storage, construction etc.) should be limited to specific allocated local sites and only within the footprint of the development area. • Clearly demarcate activity-specific construction areas to control and limit movement of personnel, vehicles and materials to contain the extent of the impacts to the lowest level possible. • Avoid clearing the corridors between the panels.	Duration of construction	Contractor Monitored by ECO
	Loss of faunal species (Impact EC8)	• Restrict construction activities to the development site. • Minimize areas cleared for construction and building activities, including the powerline servitude and all areas used by staff during construction. • Wherever possible, any activities that can damage vegetation (e.g. tracks,	Duration of construction	Contractor Monitored by ECO

Aspect	Potential impact	Mitigation or enhancement measure	Time-frame	Responsibility
		unloading, storage, construction etc.) should be limited to specific allocated local sites and only within the footprint of the development area. • Clearly demarcate activity-specific construction areas to control and limit movement of personnel, vehicles and materials to contain the extent of the impacts to the lowest level possible. • Avoid clearing the corridors between the panels. • Keep the number of access routes and temporary routes within the development site to a minimum to decrease the land area that will be transformed, thus reducing impacts and remediation. • Conserve the (limited) areas that will not be developed to retain as much as possible natural habitat for fauna.		
	Destruction and sedimentation of aquatic systems (Impacts EC12&13)	• Avoid activities in the 32 m buffer area around the watercourses. • Limit the construction footprint and rehabilitate disturbed areas as soon as possible	Duration of construction	Contractor Monitored by ECO
	Visual impacts and change in sense of place (Impact SE8, V1-3)	• The construction footprint must be minimised. • Where vegetation is to be cleared on site, erosion control measures should be in place, to reduce the potential for visually scarring of the landscape by erosion. • Concurrent revegetation of the disturbed areas should be considered where possible. • Dust control measures should be implemented.	Duration of construction	Contractor Monitored by ECO
	Dust generation (Impact AQ1)	• Areas shall be cleared of vegetation or topsoil only when required, and shall be left without vegetation cover for the minimum amount of time; • When necessary, appropriate dust control measures (such as wetting or covering of soil) shall be implemented.	Duration of construction	Contractor Monitored by ECO
Earthworks (excavations)	Damage or destruction of archaeological resources (Impacts A1)	• If concentrations of historical and pre-colonial archaeological heritage material and/or human remains (including graves and burials) are uncovered during construction, all work must cease immediately and be reported to the South African Heritage Resource Agency (SAHRA). Phase 2 mitigation in the form of test-pitting/sampling or systematic excavations and collections of the pre-colonial heritage material will then be conducted to establish the contextual status of the sites and possibly remove the archaeological deposit before development activities continue; and • A person must be trained as a site monitor to report any archaeological sites found during the development. Construction managers/foremen and/or the Environmental Control Officer (ECO) should be informed before construction starts on the possible types of heritage sites and cultural material they may	Duration of construction	Contractor Monitored by ECO

Aspect	Potential impact	Mitigation or enhancement measure	Time-frame	Responsibility
		encounter and the procedures to follow when they find sites. • Avoid the section of the watercourse to the north of the eastern power line which was identified as being of medium local archaeological sensitivity and cordon it off with security tape. • Restrict construction activities in the eastern power line area to the disturbed zone between the telephone lines and the gravel road. • If dense concentrations of stone artefacts are uncovered during construction, the ECO should notify SAHRA. • If any human remains, graves or stone burial cairns are found during construction, work in that area must cease and the ECO must immediately notify SAHRA. If the burials cannot be avoided, exhumation by a suitably qualified and accredited professional archaeologist would need to be done under a permit issued by SAHRA. Mitigation is at the cost of the developer.		
	Damage or destruction of palaeontological resources (Impact P1)	• Safeguarding of chance fossil finds (preferably in situ) during the construction phase by the responsible ECO, followed by reporting of finds to SAHRA. • Recording and judicious sampling of significant chance fossil finds by a qualified palaeontologist, together with pertinent contextual data (stratigraphy, sedimentology, taphonomy). • Curation of fossil material within an approved repository (museum / university fossil collection) by a qualified palaeontologist.	Duration of construction	Contractor Monitored by ECO
Presence of workers and machinery on site and construction activities	Disturbance of birds due to noise & lighting (Impact AV2)	• Limit on-site activities to daytime where possible. • Minimize the use of equipment that results in noise generation as far as possible. • Restrict construction staff to an allocated area and avoid access to surrounding or sensitive habitats. • Provide adequate ablution facilities to avoid use of natural (sensitive) areas as toilets. • Minimise the number of vehicles using access and maintenance roads as far as possible. • Invertebrates flying at night are attracted to lights and these should be kept to a minimum so as not to impact on activities of nocturnal predatory or avian prey species. • All outside lighting should be directed to the minimal area necessary and away from sensitive areas. Fluorescent and mercury-vapour lighting should be avoided and sodium vapour (yellow) lights used wherever possible.	Duration of construction	Contractor Monitored by ECO
	Disturbance of fauna due to noise & lighting (Impact	• Bats (and birds) and invertebrates flying at night are attracted to lights, and these should be kept to a minimum.	Duration of construction	Contractor Monitored by ECO

Aspect	Potential impact	Mitigation or enhancement measure	Time-frame	Responsibility
	EC9)	• Outside lighting should be designed to minimize impacts on fauna. • Fluorescent and mercury vapour lighting should be avoided and sodium vapour (yellow) lights should be used wherever possible.		
	Harm to fauna due to poaching or hunting (Impact EC11)	• Education of the construction staff about the value of wildlife and environmental sensitivity. • The contractor must ensure that no animals are disturbed, trapped, hunted or killed. • Conservation-orientated clauses should be built into contracts for construction personnel, complete with penalty clauses for non-compliance. • Restrict the movement of construction vehicles and construction personnel to designated construction areas only.	Duration of construction	Contractor Monitored by ECO
	Noise disturbance (Impact N1)	• Construction activities that are likely to result in noise levels in excess of 7 dB above ambient noise, at a distance of 100 m from the sources should be restricted to normal working hours (i.e. 6:00 to 18:00, Monday to Saturday) according to the Noise Control Regulations in terms of the Environmental Conservation Act (Act 73 of 1989) to reduce the noise impact to an acceptable level. Deliveries to the site should also be limited to these times.	Duration of construction	Contractor Monitored by ECO
	Impact of fuel and chemical spills on vegetation (Impact EC4)	• Clear accidental spillage of fuel or chemicals immediately. • Ensure measures are in place (e.g. driptrays, bunding) to prevent leaks and spills during storage and handling of hazardous liquids.	Duration of construction	Contractor Monitored by ECO
	Disruption of agricultural activities (Impact SE2)	• Put adequate measures to prevent the sheep from accessing the access road (i.e. fencing), as well as to ensure that the sheep could be moved over the road to other pastures, when required • Consult with the affected farm owners and impose strict rules in terms of the movement of construction and delivery vehicles from and to the site along the access road (i.e. maximum speed limit, headlights, hours of movement, etc.)	Duration of construction	Contractor Monitored by ECO
	Generation of construction waste (Impact W1)	• A waste management plan should be in place and should address classification of waste streams, segregation at source, control of waste on site before disposal, removal of wastes from site, and record keeping; • The Contractor must identify and separate materials that can be reused or recycled to minimise waste, e.g. metals, packaging and plastics, and provide separate marked bins/ skips for these items. These wastes must then be sent for recycling and records kept of recycling; • No disposal of wastes, other than at registered landfill sites; • No waste may be burned; • Sufficient portable on-site weather & vermin proof bins with lids need to be provided and appropriately placed and emptied regularly (contents to be	Duration of construction	Contractor Monitored by ECO

Aspect	Potential impact	Mitigation or enhancement measure	Time-frame	Responsibility
		disposed of at a licensed landfill site, and proof of disposal retained for auditing purposes); • Ensure that construction materials (e.g. bags of cement) are suitably stored and protected to avoid wastage; and • Excess excavated material that cannot be used for backfill should not be allowed to accumulate on site and should be disposed of at a formal landfill site or suitable spoil site identified in conjunction with the ECO.		
Transportation of materials and equipment to and from the site	Dust generated due to vehicles (Impact AQ1)	• Vehicle speeds should be limited to 40 km/h on unpaved surfaces to reduce dust generation; • When transporting fine materials, dust tarps should be installed on vehicles; and • When necessary, gravel roads shall be surfaced.	Duration of construction	Contractor Monitored by ECO
	Traffic safety and flow impacts (Impact T1)	• Regular maintenance of affected routes • Traffic safety signage as required on and around the site • Strict adherence to speed limits and other road rules.	Duration of construction	Contractor Monitored by ECO
	Wear and tear of road infrastructure (Impact SE10)	• Engage with local municipality to discuss the potential impact on local road quality and the possible mitigation measures.	Duration of construction	Contractor Monitored by ECO
Employment of workers	Increased employment (Impact SE3) (+ve)	• Local labour should be employed as far as feasible to maximise the benefits to the local community. For that purpose, establish if a skills database exists within the local area, and: ▪ If the database exists, it should be made available to contractors - information sharing will ensure that the proposed development is understood, enabling those individuals with fitting skills, if any, to make their services and/or knowledge available to the project proponent ▪ If no database exists, set-up a skills desk at the local municipal office and in the nearby communities to identify skills available in the community, which will assist in recruiting local labour during both construction and operation. • Where feasible, training and skills development programmes targeted at the locals should be initiated prior to commencement of the construction phase • The recruitment process should promote gender equality. • Where possible and feasible, ensure that goods are procured from local businesses so as to increase chances of indirect job creation • Consultation with local authorities is essential so as to manage job creation expectations and ensure that all eligible workers in the primary study area are informed of the opportunities	Duration of construction	Contractor Monitored by ECO

Aspect	Potential impact	Mitigation or enhancement measure	Time-frame	Responsibility
	Enhancement of skills and knowledge (Impact SE4) (+ve)	• Where possible, local procurement of labour should be applied so as to ensure that benefits accrue to local community • Contractors involved in the project should be encouraged to offer on-the-job training and share knowledge with the workers	Duration of construction	Contractor Monitored by ECO
	Increased household income (Impact SE13) (+ve)	• Recruit local labour as far as possible to ensure that the benefits accrue to local households within the community • Employ labour-intensive methods as far as possible • Where possible, sub-contract to local companies	Duration of construction	Contractor Monitored by ECO
In-migration of job seekers to the area	Impact on health of the local community (Impact SE5)	• Conduct awareness campaigns among construction workers and local community members (specifically targeting the youth and females) on health issues, including HIV/AIDS • Make condoms available to employees and all contracted workers for free • Developing a Code of Conduct for all employees related to the project, which includes no tolerance of activities such as alcohol and drug abuse • A Monitoring Forum (MF) should be created between the parties of interest who are directly and indirectly impacted by the project (i.e. farm owners, local councillors, project developers, local social workers, etc.)	Duration of construction	Contractor Monitored by ECO
	Impact on social relations (Impact SE6)	• Locals should be informed upfront about employment opportunities so that there are no unrealistic expectations on the part of the community • Ensure clear communication of the project information and effective public participation processes to minimise the possibility of an influx of migrant workers	Duration of construction	Contractor Monitored by ECO
	Impact on safety and security (Impact SE7)	• Ensure clear communication of the project information and effective public participation processes to minimise the possibility of an influx of migrant workers • Set up a strict access control system to the site and ensure that it prevents any chance of loitering by potential job seekers or other unauthorised people on the farm and adjacent farms • Manage the movement of workers/vehicles to and from the site and ensure that they are only on site during the reasonable working hours • Prior construction, rules and regulations regarding presence of construction workers on site need to be devised in consultation with the land owners of directly affected and adjacent properties • During construction, the rules and regulations must be clearly communicated to all workers and contractors, as well as penalties or consequences for not abiding by the rules; personal property must be respected • Any losses, personal of livestock related, incurred by the land owners of the	Duration of construction	Contractor Monitored by ECO

Aspect	Potential impact	Mitigation or enhancement measure	Time-frame	Responsibility
		direct affected or adjacent farms should be compensated if proven to be related to the project		
	Impact on social facilities (Impact SE11)	• Ensure effective communication of the project information throughout all stages to effectively manage expectations of local communities, local authorities and local land owners • Ongoing communication with the Local Municipality to ensure that they are aware of the potential demands that might arise from the development of the PV facility • Provision of a mobile clinic services to the workers	Duration of construction	Contractor Monitored by ECO
	Impact on basic service delivery (Impact SE12)	• Ensure effective communication of the project information throughout all stages of the development to ensure management of the expectations • Ongoing communication with the Local Municipality to ensure that they are aware of the potential demands that might arise from the development of the PV facility • Establish a health facility for the duration of the construction period to provide services to the construction crew and alleviate pressure on the local facilities	Duration of construction	Contractor Monitored by ECO
Increased revenue	Increased local production (Impact SE9) (+ve)	• Where possible procure goods and services from the local SMMEs	Duration of construction	Contractor Monitored by ECO

Table 7-2: Mitigation and management measures for the operational phase

Aspect	Potential impact	Mitigation or enhancement measure	Time-frame	Responsibility
Clearing and disturbance of vegetation	Increased susceptibility to erosion (Impact SA2)	• Ensure that as little surface disturbance as possible occurs. Where vegetation is removed for construction, specific measures would need to be put in place, which would include: minimum removal of vegetation; soil conservation measures; re-vegetation as soon as possible; regular monitoring of erosion. • Implement stormwater control and erosion management plan	Duration of operation	Developer's ER
	Change in plant species composition due to alien invasive vegetation (Impact EC3)	• Prevent introduction of alien woody plant species. Be aware of the fact that seeds of invasive plants can be transported by vehicles as well as staff clothing. • Eradicate invasive species. • Declared alien species that may become established during construction and operation phases must be identified and managed in accordance with the Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983), the implementation of a monitoring programme in this regard is recommended, being the responsibility of the ECO. • Re-vegetate exposed soils as soon as possible to stabilise the top soils, or	Duration of operation	Developer's ER

Aspect	Potential impact	Mitigation or enhancement measure	Time-frame	Responsibility
		apply rock fragments or other suitable material (e.g. plant material that was removed by clearing) to reduce the exposure of top soils to events that may initiate excessive erosion. • Use only indigenous (to the area) plant material. • Rehabilitate as a continual process, to maximize viability of the natural seed bank and reduce loss of top soil during storage. • Implement the alien invasive vegetation management plan		
	Visual impacts and change in sense of place (Impact SE8, V1-3)	• The disturbance footprint must be minimised. • Where vegetation is to be cleared on site, erosion control measures should be in place, to reduce the potential for visually scarring of the landscape by erosion. • Concurrent revegetation of the disturbed areas should be considered where possible. • Dust control measures should be implemented.	Duration of operation	Developer's ER
Presence of project infrastructure	Changes to avian habitat under the arrays (Impact AV1)	• Monitor and report any bird/animal interactions with all aspects of the array, to allow adaptive management and remedial action, and also to compile databases relevant to the further phases and developments of these little-studied effects of the technology on semi-arid habitats. • As far as possible, ensure that the edges and undersides of panels (poles/legs, frames, wiring) do not provide unsuitable perch/roost/nest sites for birds or other animals. • Monitor other bird uses of the structures, such as use of shade for resting, or where unnaturally high input of nutrients or seeds may alter vegetation structure, composition and/or attractiveness.	Duration of operation	Developer's ER
	Negative bird-powerline interactions (Impact AV3)	• The new 132 kV powerline route and design should be assessed for high sensitivity areas for potential bird-powerline interactions by an avifaunal specialist taking into account the Birdlife SA guidelines, before construction commences. • Bird anti-collision devices for diurnal, nocturnal and/or auditory warning should be installed where power lines cross movement corridors, the exact locations for these interventions to be guided by regular search, location, identification and reporting of interactions or casualties	Duration of operation	Developer's ER
	Negative bat-powerline interactions (Impact EC10)	• Ensure that powerlines are made safe to bats by applying standard Eskom measures.	Duration of operation	Developer's ER
	Impact of shading on plant species (Impact EC5)	• If possible, space panel rows sufficiently to enable patches of vegetation between the rows to remain relatively intact and only minimally affected by shading.	Duration of operation	Developer

Aspect	Potential impact	Mitigation or enhancement measure	Time-frame	Responsibility
	Loss of agricultural land (Impact SE1)	• The project developer should design the infrastructure layout in a manner that limits the footprint of the facility and all associated infrastructure; this should also be done in consultation with the land owner • If feasible, assist the owners of the farm with relocation of the sheep to nearby farms to ensure minimal loss in livestock production	Duration of operation	Developer
	Impact on property values (Impact SE14)	• Ensure that other specialists' recommendations regarding mitigations of noise, dust pollution and visual effects are implemented • Employ as many local labour as possible to curb the increase in demand for temporary accommodation and limit the growth in property prices	Duration of operation	Developer's ER and HR
Presence of workers and machinery on site and operation activities	Disturbance of birds due to noise & lighting (Impact AV2)	• Limit on-site activities to daytime where possible. • Minimize the use of equipment that results in noise generation as far as possible. • Restrict construction staff to an allocated area and avoid access to surrounding or sensitive habitats. • Provide adequate ablution facilities to avoid use of natural (sensitive) areas as toilets. • Minimise the number of vehicles using access and maintenance roads as far as possible. • Invertebrates flying at night are attracted to lights and these should be kept to a minimum so as not to impact on activities of nocturnal predatory or avian prey species. • All outside lighting should be directed to the minimal area necessary and away from sensitive areas. Fluorescent and mercury-vapour lighting should be avoided and sodium vapour (yellow) lights used wherever possible.	Duration of operation	Developer's ER
	Disturbance of fauna due to noise & lighting (Impact EC9)	• Bats (and birds) and invertebrates flying at night are attracted to lights, and these should be kept to a minimum. • Outside lighting should be designed to minimize impacts on fauna. • Fluorescent and mercury vapour lighting should be avoided and sodium vapour (yellow) lights should be used wherever possible.	Duration of operation	Developer's ER
	Harm to fauna due to poaching or hunting (Impact EC11)	• Education of staff about the value of wildlife and environmental sensitivity. • Ensure that no animals are disturbed, trapped, hunted or killed. • Conservation-orientated clauses should be built into contracts for maintenance or repair personnel, complete with penalty clauses for non-compliance. • Restrict the movement of vehicles and personnel to designated development areas only.	Duration of operation	Developer's ER

Aspect	Potential impact	Mitigation or enhancement measure	Time-frame	Responsibility
	Impact of fuel and chemical spills on vegetation (Impact EC4)	• Clear accidental spillage of fuel or chemicals immediately. • Ensure measures are in place (e.g. driptrays, bunding) to prevent leaks and spills during storage and handling of hazardous liquids.	Duration of operation	Developer's ER
	Generation of waste (Impact W2)	• The developer must identify and separate materials that can be reused or recycled to minimise waste e.g. metals, packaging and plastics, and provide separate marked bins/ skips for these items. These wastes must then be sent for recycling and records kept of recycling; • No dumping within the surrounding area shall be permitted, and no waste may be buried or burned on site; and • Sufficient portable on-site weather & vermin proof bins with lids need to be provided and appropriately placed and emptied regularly (contents to be disposed of at a licensed landfill site, and proof of disposal retained for auditing purposes).	Duration of operation	Developer's ER
Transportation of materials and equipment to and from the site	Traffic safety and flow impacts (Impact T1)	• Regular maintenance of affected routes • Traffic safety signage as required on and around the site • Strict adherence to speed limits and other road rules.	Duration of operation	Developer
Employment of workers	Increased employment (Impact SE3) (+ve)	• Where possible, maximize the number of local labour employed for the jobs at the solar PV facility • Identify potential candidates from the local community to occupy permanent positions long before commencement of operations and, if necessary, send them for additional training	Duration of operation	Developer's HR
	Enhancement of skills and knowledge (Impact SE4) (+ve)	• Vocational skills transfer/training programmes should be developed and made available for the local labour • Investigate the needs of the local community with respect to skills and address these though the skills development programme as part of the Enterprise Development and Social Development initiatives	Duration of operation	Developer's HR
	Increased household income (Impact SE13) (+ve)	• Recruit local labour as far as possible to ensure that the benefits accrue to local households within the community • Where possible, sub-contract to local companies	Duration of operation	Developer's HR and procurement
Increased revenue	Increased local production (Impact SE9) (+ve)	• Where possible procure goods and services from the local SMMEs	Duration of operation	Developer

Table 7-3: Mitigation and management measures for the decommissioning phase

Aspect	Potential impact	Mitigation or enhancement measure	Time-frame	Responsibility
Disturbance of soil and vegetation	Increased susceptibility to erosion (Impact SA2)	• Ensure that as little surface disturbance as possible occurs. Where vegetation is removed for construction, specific measures would need to be put in place, which would include: minimum removal of vegetation; soil conservation measures; re-vegetation as soon as possible; regular monitoring of erosion. • Implement stormwater control and erosion management plan	Duration of decommissioning	Contractor Monitored by ECO
	Habitat destruction and disturbance	• Ensure that contractors are contractually bound to responsible repair of the environment. Clearing of constructed materials should be complete, with no rubble or waste be left on the site. • Rehabilitation of all disturbed areas after decommissioning, to return the site to as close to its pre-construction condition as possible.	Duration of decommissioning	Contractor Monitored by ECO
	Change in plant species composition due to alien invasive vegetation (Impact EC3)	• Prevent introduction of alien woody plant species. Be aware of the fact that seeds of invasive plants can be transported by vehicles as well as staff clothing. • Eradicate invasive species. • Declared alien species that may become established during construction and operation phases must be identified and managed in accordance with the Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983), the implementation of a monitoring programme in this regard is recommended, being the responsibility of the ECO. • Re-vegetate exposed soils as soon as possible to stabilise the top soils, or apply rock fragments or other suitable material (e.g. plant material that was removed by clearing) to reduce the exposure of top soils to events that may initiate excessive erosion. • Use only indigenous (to the area) plant material. • Rehabilitate as a continual process, to maximize viability of the natural seed bank and reduce loss of top soil during storage. • Implement the alien invasive vegetation management plan	Duration of decommissioning	Contractor Monitored by ECO
	Dust generation (Impact AQ1)	• Areas shall be cleared of vegetation or topsoil only when required, and shall be left without vegetation cover for the minimum amount of time; • When necessary, appropriate dust control measures (such as wetting or covering of soil) shall be implemented.	Duration of decommissioning	Contractor Monitored by ECO
	Visual impacts (Impact V1-3)	• The disturbance footprint must be minimised. • Where vegetation is to be cleared on site, erosion control measures should be in place, to reduce the potential for visually scarring of the	Duration of decommissioning	Contractor Monitored by ECO

Aspect	Potential impact	Mitigation or enhancement measure	Time-frame	Responsibility
		landscape by erosion. • Concurrent revegetation of the disturbed areas should be considered where possible. • Dust control measures should be implemented.		
Removal of project infrastructure	Generation of waste (Impact W3)	• All infrastructure, equipment, plant, fencing, temporary services and foreign materials with no ongoing purpose on the site should be removed from the site and recycled or properly disposed of; and • Waste material should be removed entirely from the development area and disposed of at a registered disposal facility.	Duration of decommissioning	Contractor Monitored by ECO
	Traffic safety and flow impacts (Impact T1)	• Regular maintenance of affected routes • Traffic safety signage as required on and around the site • Strict adherence to speed limits and other road rules.	Duration of decommissioning	Contractor Monitored by ECO
Presence of workers and machinery on site	Disturbance of birds due to noise & lighting (Impact AV2)	• Limit on-site activities to daytime where possible. • Minimize the use of equipment that results in noise generation as far as possible. • Restrict construction staff to an allocated area and avoid access to surrounding or sensitive habitats. • Provide adequate ablution facilities to avoid use of natural (sensitive) areas as toilets. • Minimise the number of vehicles using access and maintenance roads as far as possible. • Invertebrates flying at night are attracted to lights and these should be kept to a minimum so as not to impact on activities of nocturnal predatory or avian prey species. • All outside lighting should be directed to the minimal area necessary and away from sensitive areas. Fluorescent and mercury-vapour lighting should be avoided and sodium vapour (yellow) lights used wherever possible.	Duration of decommissioning	Contractor Monitored by ECO
	Disturbance of fauna due to noise & lighting (Impact EC9)	• Bats (and birds) and invertebrates flying at night are attracted to lights, and these should be kept to a minimum. • Outside lighting should be designed to minimize impacts on fauna. • Fluorescent and mercury vapour lighting should be avoided and sodium vapour (yellow) lights should be used wherever possible.	Duration of decommissioning	Contractor Monitored by ECO
	Harm to fauna due to poaching or hunting (Impact EC11)	• Education of the construction staff about the value of wildlife and environmental sensitivity. • The contractor must ensure that no animals are disturbed, trapped,	Duration of decommissioning	Contractor Monitored by ECO

Aspect	Potential impact	Mitigation or enhancement measure	Time-frame	Responsibility
		hunted or killed. • Conservation-orientated clauses should be built into contracts for construction personnel, complete with penalty clauses for non-compliance. • Restrict the movement of construction vehicles and construction personnel to designated construction areas only.		
	Impact of fuel and chemical spills on vegetation (Impact EC4)	• Clear accidental spillage of fuel or chemicals immediately. • Ensure measures are in place (e.g. driptrays, bunding) to prevent leaks and spills during storage and handling of hazardous liquids.	Duration of decommissioning	Contractor Monitored by ECO
	Noise disturbance (Impact N1)	• Construction activities that are likely to result in noise levels in excess of 7 dB above ambient noise, at a distance of 100 m from the sources should be restricted to normal working hours (i.e. 6:00 to 18:00, Monday to Saturday) according to the Noise Control Regulations in terms of the Environmental Conservation Act (Act 73 of 1989) to reduce the noise impact to an acceptable level. Deliveries to the site should also be limited to these times.	Duration of decommissioning	Contractor Monitored by ECO

7.3 Monitoring, Reporting and Auditing

Site inspections by an Environmental Control Officer (ECO) must be conducted monthly during construction to ensure continued compliance with the conditions of the environmental authorisation and the measures contained in the approved EMPr. Feedback on compliance must be provided to the contractor, developer and engineering representative after each inspection.

Quarterly audit reports are to be prepared by the ECO and submitted to the developer, engineering representative, contractor, and competent authority.

7.4 Environmental Awareness Plan

On-site training must be provided for all contractors and personnel during both the construction and operational phases of the project. No personnel may be allowed onto site without having been instructed on the requirements of the approved EMPr and the Environmental Authorisation conditions.

The training must deal specifically with triggers that would require the implementation of mitigation measures contained in the EMPr. These include, but are not limited to:

- Identification and avoidance of environmentally sensitive features on/ near the site, specifically watercourses and wetlands as well as archaeological sensitive areas;
- Identification of potential heritage resources (see app for guidelines for the identification of archaeological and historical material);
- Materials handling practices; and
- Waste management practices.

It is incumbent upon the contractor to convey the sentiments of the EMPr to all personnel involved in the construction operations (including sub-contractors) and the specific provisions of the EMPr. This should be done via regular toolbox talks as well as more formal training sessions, and attendance registers maintained for auditing purposes.

7.5 Organisational Structure

The general roles and responsibilities of various parties associated with the proposed development are outlined below.

7.5.1 The Developer: Kloofsig Solar (Pty) Ltd

Kloofsig Solar shall ultimately be responsible for the implementation of the EMPr. They shall appoint a representative, the Responsible Person (RP), who shall:

a) Ensure that the contractor is duly informed of the EMPr and associated responsibilities and implications of this EMPr;

b) Monitor the contractor's activities with regard to the requirements outlined in the EMPr;

c) Act as a point of contact for local residents and community members;

d) Ensure that the contractor remedies problems in a timely manner and to the satisfaction of the authorities; and

e) Notify the authorities and the Environmental Control Officer (ECO) should problems arise that are not remedied effectively, or of any change in the development or changes in project specification that could significantly impact negatively on the environment.

7.5.2 The Contractor

The contractor(s) must ensure that all aspects of the contract comply with both this EMPr and other relevant environmental legislation. In addition to any other responsibilities, the contractor(s) shall be responsible for the following:

a) Appointing an Environmental Representative (on site), who irrespective of other duties, will also be responsible to oversee all activities associated with the contract;

b) Ensuring that the Environmental Representative has the means with which to carry out his/ her tasks;

c) Ensuring all activities on the site are undertaken in accordance with the EMPr;

d) Informing all employees and sub-contractors of their roles and responsibilities in terms of the EMPr;

e) Ensuring that all employees and sub-contractors comply with this EMPr; and

f) The contractor has a duty to demonstrate respect and care for the environment in which they are operating. They will be responsible for the cost of rehabilitation, to the satisfaction of the ECO, of any environmental damage that may result from non-compliance with the EMPr, environmental regulations and relevant legislation.

7.5.3 The Contractor's Environmental Representative

The Contractor's Environmental Representative (ER) shall be responsible for implementation of this EMPr and any other environmental requirements that may be identified by the ECO, and agreed to by Kloofsig Solar, during the course of the contract. The ER shall have received basic environmental awareness training, either as part of this contract, or previously. In addition to any other responsibilities, the general duties of the ER are as follows:

a) Ensuring that all personnel (including sub-contractors) are duly informed of the requirements contained in this EMPr, and the associated responsibilities and implications of this EMPr;

b) Ensuring that all records needed to demonstrate compliance with the EMPr requirements are obtained, safely stored, and are readily available for inspection by the ECO and/ or Kloofsig Solar. These records are detailed in this EMPr;

c) Consulting with the ECO regarding interpretation of the EMPr and any other aspects of the contract that may impact significantly on the environment;

d) Ensuring that all personnel (including sub-contracted personnel) demonstrate respect and care for the environment in which they are operating;

e) Acting as a point of contact for local residents and community members; and

f) Ensuring that a reporting system is in place and that community representatives can be informed of the correct procedures to lodge complaints.

It is anticipated that these ER duties would be assigned to a member of the on-site personnel that would ordinarily be appointed for the duration of construction related activities by the Contractor, and that these ER duties would be in addition to the other (possibly primary) responsibilities of that person.

7.5.4 The Environmental Control Officer

An Environmental Control Officer (ECO), who is a qualified environmental professional with the relevant environmental expertise, and independent of the developer, shall be appointed for the duration of the construction activities. The ECO's duties are as follows:

a) Being familiar with the environmental management requirements contained in this EMPr as well as the Environmental Authorisation;

b) Undertaking the pre-construction and post-construction site inspections, which may result in recommendations for additional clean-up and rehabilitation measures;

c) Monitoring the contractor's activities with regard to compliance with the requirements outlined in the EMPr, by way of monthly audits, and reporting on the findings of these audits to the developer and relevant authorities (if required in terms of the Environmental Authorisation);

d) Providing ad-hoc environmental advice, including environmental legal requirements, to Kloofsig Solar and the Contractor(s) regarding issues that may arise during the Contract; and

e) Submit a post-construction Audit Report to the contractor for comment prior to submission to the relevant authorities' archives. Comments from the relevant parties will be included in the Final Audit Report.

7.6 Environmental Procedures and Specifications

The contractor(s) is deemed to have familiarised themselves with all legislation pertaining to the environment, including any provincial or local government ordinances applicable to the contract.

It should be kept in mind that good housekeeping goes beyond the employment of sensible construction methods to ensure safety on site, but includes care for and preservation of the environment.

7.6.1 Compliance Auditing

a) The appointed ECO and Contractor's ER shall conduct a pre-construction site inspection to identify sensitive environments, no-go areas, locations of site camps, etc.;

b) The ECO shall prepare a pre-construction audit report, which will include photographs of the general condition of the key features of the site. These photographs shall be used for

comparison purposes on completion of the contract, i.e. after rehabilitation of construction areas;

c) The ECO shall conduct monthly site audits of all construction related activities;

d) On completion of construction activities, the ECO shall conduct a site inspection, together with the Contractor's ER. Any items requiring attention shall be included in an Post-Construction Audit Report; and

e) On completion of the defects liability period, the ECO shall accompany a Kloofsig Solar representative and the Contractor with a view to determining whether outstanding matters from the Post-Construction Audit Report have been adequately addressed.

7.6.2 Community Liaison

a) The ER shall act as community liaison officer and his/ her contact details shall be displayed on the contractors board;

b) A complaints register (including the action taken in response to the complaint) shall be kept on site by the ER; and

c) All complaints received shall be forwarded to the ECO and Kloofsig Solar. All issues raised should be appropriately addressed and recorded.

7.6.3 Environmental Incidents

a) The ER shall maintain a register of all environmental incidents occurring as a result of the activities associated with the contract. Environmental incidents that shall be recorded include (but are not limited to):
   - Fires;
   - Accidents;
   - Spills of hazardous materials, contaminating soil or water resources;
   - Non-compliances with applicable legislation; and
   - Non-compliances with this EMPr.

b) Each environmental incident shall be investigated by the ECO and an environmental incident report shall be forwarded to the Contractor(s) and Kloofsig Solar. Such incident report shall be presented within five working days of the incident occurring;

c) Environmental incident reports shall include (as a minimum) a description of the incident, the actions taken to contain any damage to the environment, personnel, or the public, and the actions taken to repair/ remediate any such damage; and

d) Prescribe additional measures that may be required to remediate damage resulting from the incident and/ or to prevent similar incidents occurring in the future.

7.6.4 Training

The Contractor(s) is responsible for ensuring that the sentiments of the EMPr are conveyed to all personnel (including sub-contracted personnel). It is recommended that regular training sessions/toolbox talks (including basic environmental awareness training at induction) be conducted

to fulfil this purpose. Training registers shall be kept as proof for auditing purposes. The environmental training should, as a minimum, include (but not be limited to) the following:

a) The importance of conformance with all environmental policies;

b) The environmental impacts, actual or potential, of the proposed activities;

c) The environmental benefits of improved personal performance;

d) Their roles and responsibilities in achieving conformance with the environmental policy and procedures and with this EMPr, including associated procedures and emergency preparedness and response requirements;

e) The potential consequences of departure from specified operating procedures; and

f) The mitigation measures required to be implemented when carrying out their work activities.

7.6.5 Record Keeping

a) The engineer and the contractor shall continuously monitor the contractor's adherence to the approved impact prevention procedures and the engineer shall issue to the contractor a notice of non-compliance whenever transgressions are observed. The contractor must document the nature and magnitude of the non-compliance in a designated register, the action taken to discontinue the non-compliance, the action taken to mitigate its effects and the results of the actions. The non-compliance shall be documented and reported to the engineer in the monthly audit reports and to the relevant authority; and

b) Copies of the Environmental Authorisation and EMPr for the proposed development shall be kept on site and made available for inspection by visiting officials from the relevant environmental departments.

7.6.6 Compliance and Penalties

a) The contractor shall act immediately when a notice of non-compliance is received and correct the cause of the non-compliance. Complaints received regarding activities on the construction site pertaining to the environment shall be recorded in a dedicated register and the response noted with the date and action taken. This record shall be submitted with the monthly reports and an oral report given at the monthly site meetings;

b) Any non-compliance with the agreed procedures of the EMPr is a transgression of the various statutes and laws that define the manner by which the environment is managed. Therefore any avoidable non-compliance, dependant on severity, shall be considered sufficient grounds for contact to be made with relevant provincial or national authorities; and

c) The engineer's decision with regard to what is considered a violation, its seriousness and the action to be taken against the contractor shall be final. Failure to redress the cause shall be reported to the relevant authority. The responsible provincial or national authorities shall ensure compliance and impose penalties relevant to the transgression as allowed for within their statutory powers.

7.7 Health & Safety

It is noted here that this EMPr is not a Health and Safety Plan. It is the contractor's responsibility to ensure that a Health and Safety Plan, as per the requirements of the Occupational Health and Safety Act, is prepared prior to any physical work occurring on site. The contractor shall at all times observe proper and adequate safety precautions on site and shall be deemed responsible for security of the site. The proper health and safety regulations will be applied to all sub-contractors and staff.

8 The Way Forward

The public participation process so far has given IAPs the opportunity to assist with identification of issues and potential impacts.

The Executive Summary of this Draft EIR has been distributed to registered IAPs. A printed copy of this report will be available for public review at the Vanderkloof Public Library.

The report can also be accessed as an electronic copy on SRK Consulting's webpage via the 'Public Documents' link http://www.srk.co.za/en/page/za-public-documents

Written comment on this Draft EIR should be sent by **12h00 on 9 February 2017** to:

Wanda Marais
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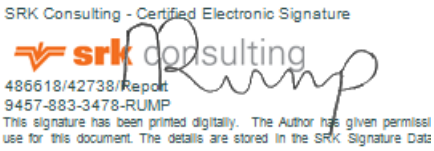
The Draft Environmental Impact Report (this report) has been submitted to DEA and the other relevant authorities, for comment before compilation of the Final Environmental Impact Report.

Once IAPs have commented on the information presented in the DEIR, the Final Environmental Impact Report (FEIR) will be produced and submitted to DEA to use in order to make a decision about the proposed development. The public is therefore urged to submit comments, as the comments will affect the FEIR and the decision taken by DEA.

Prepared by:



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All data used as source material plus the text, tables, figures, and attachments of this document have been reviewed and prepared in accordance with generally accepted professional engineering and environmental practices.

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