ENVIRONMENTAL IMPACT ASSESSMENT FOR THE PROPOSED DE AAR SOLAR ONE PHOTOVOLTAIC POWER PROJECT, NORTHERN CAPE

FINAL ENVIRONMENTAL IMPACT REPORT

Prepared for:
Department of Environmental Affairs

On behalf of:
Business Venture Investments 1421 (Pty) Ltd

Prepared by:
CCA Environmental (Pty) Ltd

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Prepared for:
Department of Environmental Affairs
Private Bag X447
Pretoria, 0001

On behalf of:
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Bluefin Building, Harbour Road
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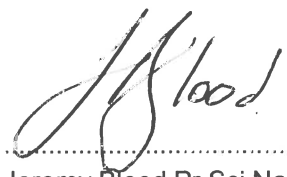
PROJECT INFORMATION

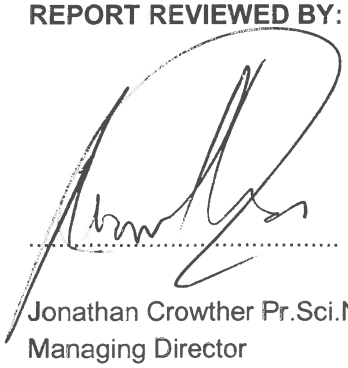
TITLE	Environmental Impact Assessment for the Proposed De Aar Solar One Photovoltaic Power Project, Northern Cape: Final Environmental Impact Report
APPLICANT / PROPONENT	Business Venture Investments 1421 (Pty) Ltd
ENVIRONMENTAL CONSULTANT	CCA Environmental (Pty) Ltd
REPORT REFERENCE	RV01AP/FEIR/Rev 0
NEAS REFERENCE NO.	DEA/EIA/0000362/2012
DEA REFERENCE NO.	12/12/20/2313
REPORT DATE	10 August 2012

REPORT COMPILED BY: Jeremy Blood



Jeremy Blood Pr.Sci.Nat., CEAPSA
Associate

REPORT REVIEWED BY: Jonathan Crowther



Jonathan Crowther Pr.Sci.Nat., CEAPSA
Managing Director

EXPERIENCE OF ENVIRONMENTAL ASSESSMENT PRACTITIONER

NAME	Jonathan Crowther
RESPONSIBILITY ON PROJECT	Project leader and quality control.
QUALIFICATIONS	B.Sc. Hons (Geol.), M.Sc. (Env. Sci.)
PROFESSIONAL REGISTRATION	Pr.Sci.Nat., CEAPSA
EXPERIENCE IN YEARS	24
EXPERIENCE	Jonathan Crowther has been involved in environmental consulting since 1988 and is currently the Managing Director of CCA Environmental (Pty) Ltd. He has expertise in a wide range of environmental disciplines, including Environmental Impact Assessments (EIA), Environmental Management Plans / Programmes, Environmental Planning & Review, Environmental Auditing & Monitoring, Environmental Control Officer, Public Consultation & Facilitation. He has project managed a number of offshore oil and gas EIAs for various exploration and production activities in South Africa and Namibia. He also has extensive experience in projects related to roads, property developments and waste landfill sites.

NAME	Jeremy Blood
RESPONSIBILITY ON PROJECT	Project management, report writing and specialist study review.
QUALIFICATIONS	B.Sc. Hons (Bot.), M.Sc. (Cons. Ecol.)
PROFESSIONAL REGISTRATION	Pr.Sci.Nat., CEAPSA
EXPERIENCE IN YEARS	13
EXPERIENCE	Jeremy Blood has been working as an environmental assessment practitioner since 1999 and has project managed a number of large-scale projects covering a range of environmental disciplines, including Environmental Impact Assessments (EIA), Environmental Management Plans / Programmes, Environmental Auditing & Monitoring and Environmental Control Officer related work in South Africa, Mozambique, Namibia and Kenya. He has expertise in a wide range of projects relating to mining (gas, heavy mineral mining and borrow pits), housing / industrial developments and infrastructure projects (e.g. roads, railway line, power lines, pipelines).

EXECUTIVE SUMMARY

1. INTRODUCTION

1.1 COMMENT ON THE FINAL ENVIRONMENTAL IMPACT REPORT AND WAY FORWARD

This Executive Summary incorporates the main findings of the Final Environmental Impact Report (EIR) prepared for the proposed De Aar Solar One Photovoltaic Power Project located outside De Aar in the Northern Cape (see Figure 1). The compilation of the Final EIR has been informed by comments received during the comment period on the Draft EIR. It should be noted that all significant changes to the original Draft EIR are underlined and in a different font (Times New Roman) to the rest of the text.

The Final EIR has been distributed for a 30-day review / comment period from **13 August 2012 to 12 September 2012**. Copies of the full report have been made available at the following locations:

1. De Aar Public Library, 27 Station Street, De Aar; and
2. On the CCA website www.ccaenvironmental.co.za.

Any written comments on the Final EIR must be submitted directly to the Department of Environmental Affairs (DEA), and copied to CCA, by **no later than 12 September 2012**. Contact details of both DEA and CCA are presented below.

Director: Environmental Impact Evaluation Department of Environmental Affairs Private Bag X447 PRETORIA, 0001 Tel: (012) 310 3911 / 395 1694 Fax: (012) 320 7539 E-mail: nnkosi@environment.gov.za Attention Nyiko Nkosi Reference: 12/12/20/2313 NEAS Reference: DEA/EIA/0000362/2012	CCA Environmental (Pty) Ltd PO Box 10145 Caledon Square, 7905 Tel: (021) 461 1118 / 9 Fax: (021) 461 1120 E-mail: jeremy@ccaenvironmental.co.za Attention: Jeremy Blood

The Final EIR will be submitted to DEA for consideration and decision-making. After DEA has reached a decision, all I&APs registered on the project database will be notified of the outcome of the application and the reasons for the decision. A statutory Appeal Period in terms of Chapter 7 of the EIA Regulations 2010 will follow the issuing of the decision.

1.2 BACKGROUND TO THE PROPOSED PROJECT

Business Venture Investments 1421 (Pty) Ltd is proposing to develop the De Aar Solar One Photovoltaic Power Project on Portion 3 of Farm Hartebeestplaats 135. RV & Associates was appointed to prepare the preliminary design of the proposed photovoltaic power plant and associated infrastructure. In summary, the proposed photovoltaic power plant would consist of a 25 to 30 megawatt peak alternating current (MWp AC) plant (capacity is subject to the final choice of technology). The proposed plant would be connected to the existing Eskom Hydra substation via a 132 kilovolt (kV) overhead power line of approximately 2 to 2.5 km long.

The proposed development is a listed activity in terms of the EIA Regulations 2010 promulgated in terms of Chapter 5 of the National Environmental Management Act, 1998 (No. 107 of 1998) (NEMA), as amended, and a Scoping and EIA process is required in order for the Department of Environmental Affairs (DEA) to consider the application in terms of NEMA. CCA Environmental (Pty) Ltd (CCA) was appointed to act as the independent environmental assessment practitioner (EAP) for undertaking the required Scoping and EIA process.

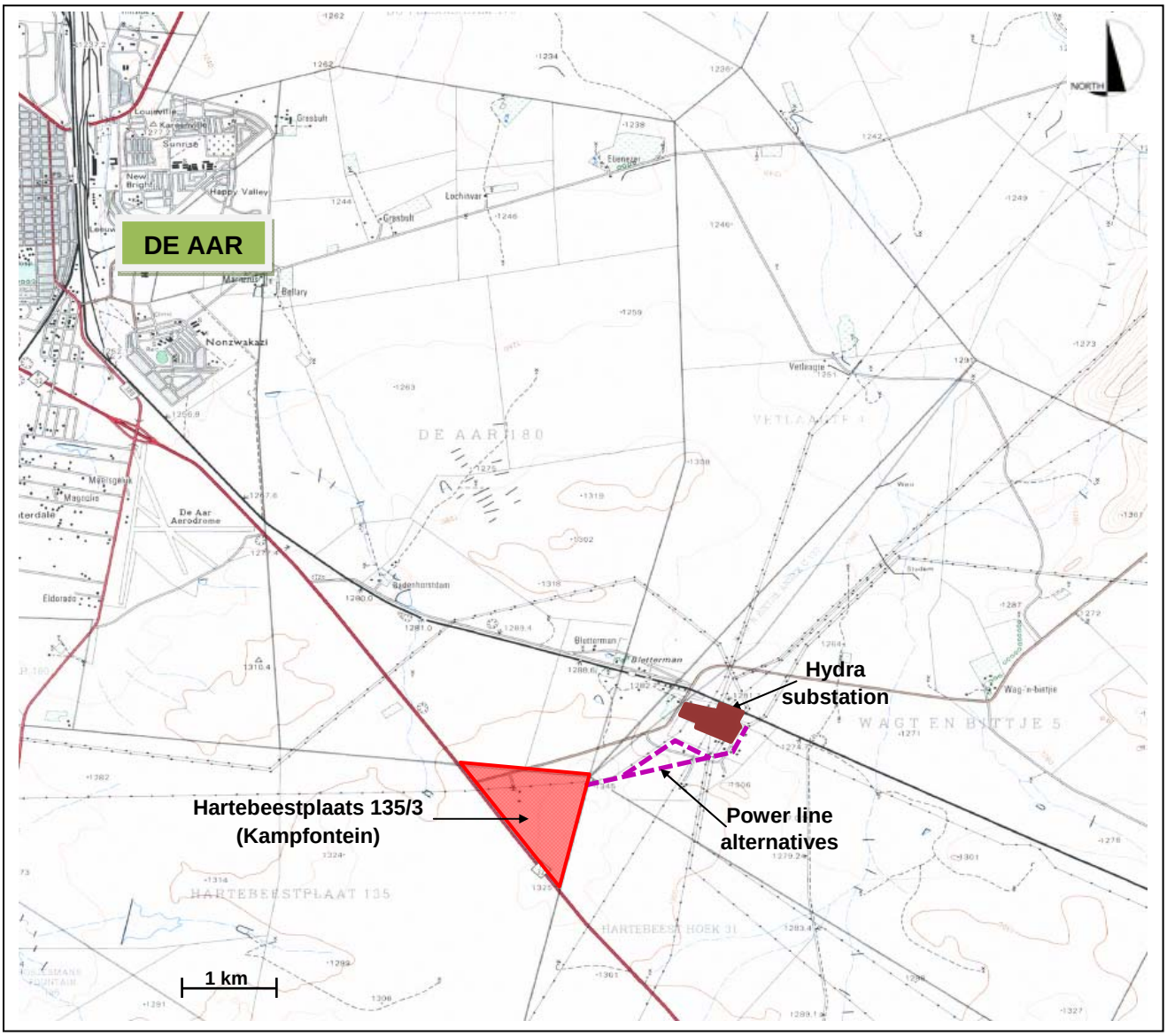


Figure 1: 1:50 000 Map extract showing the location of the proposed De Aar Solar One Photovoltaic Power Plant on Portion 3 of Farm Hartebeestplaats 135 near De Aar, Northern Cape. The proposed power line alternatives are also shown.

1.3 TERMS OF REFERENCE FOR THE SCOPING AND EIA

The Terms of Reference for the Scoping and EIA are to:

- Undertake a formal public participation process, which specifically addresses the distribution of information to I&APs; provide an opportunity for I&APs to raise any concerns or issues and to provide an opportunity for I&APs to comment on draft and final reports;
- Undertake the necessary specialist studies to address and assess key concerns or issues identified during the Scoping Study;

- Integrate all the information into an EIR to allow an informed decision to be taken concerning the proposed project; and
- Ensure that the study complies with the requirements of NEMA and the EIA Regulations 2010.

1.4 NEED AND DESIRABILITY

1.4.1 The need for renewable energy in South Africa

Energy is critical to virtually every aspect of the economic and social development of South Africa. Providing affordable, adequate and reliable modern energy supplies to most South Africans remains a major challenge. South Africa is faced with a situation in which the demand for electricity continues to grow within a supply-constrained environment. The investment in renewable energy and energy efficiency is considered important to reduce the negative economic, social and environmental impacts of energy production and consumption in South Africa (Winkler, 2005). Many renewable energy projects are particularly well suited to off-grid applications and, certainly in South Africa, could improve the flexibility of the grid by distributing generation across the country, closer to some key loads (Winkler, 2005).

1.4.2 Legislative Support

A review of the relevant legislation, policies and documents pertaining to the energy sector indicate that solar energy and the establishment of photovoltaic power plants are supported at a national, provincial and local level.

At national level the National Energy Act, 2008 promotes the diversity of supply of energy and its sources, including solar. The White Paper on Renewable Energy (2003) indicates that the Government's long-term goal is the establishment of a renewable energy industry producing modern energy carriers that will offer in future years a sustainable, fully non-subsidised alternative to fossil fuels. Government has recognised the country's high level of renewable energy potential and has set a medium-term (10-year) target of 10 000 GW hours of renewable energy by 2013. Government has allocated 43% of new energy generation facilities in South Africa to renewables and has set a target of an additional 14 749 MW of renewable energy in the electricity blend in South Africa by 2030 (Integrated Resource Plan, 2010). The proposed project would contribute towards meeting this target, as well as the target set by the Department of Energy of a 30% share of all new power generation being derived from Independent Power Producers.

At a provincial level, the Northern Cape Provincial Growth and Development Strategy (NCPGDS) makes reference for the need to ensure the availability of inexpensive energy for the Northern Cape. It also states that the development of new sources of energy through the promotion of the adoption of energy applications that display a synergy with the province's natural resource endowments must be encouraged. In this regard the NCPGDS notes "*the development of energy sources such as solar energy, the natural gas fields, bio-fuels, etc., could be some of the means by which new economic opportunity and activity is generated in the Northern Cape*". The Provincial Spatial Development Framework further notes that renewable energy has been identified as a mechanism to diversify the economy and thereby promoting a green economy in the Northern Cape Province.

At a local level the Emthanjeni Local Municipality (ELM) Integrated Development Plan (IDP) lists a number of industrial and manufacturing projects that form part of the larger strategy for the economic development of the municipality. One of these projects includes the establishment of De Aar as a Renewable Energy Hub. Basic service delivery, with energy as one of the priority issues, micro- and macro-economic development, as well as land use management have been highlighted as key performance areas to be addressed within the ELM. The establishment of the proposed project has the potential to support a number of key strategies in the ELM IDP.

1.4.3 Utilisation of Available Resources

Although South Africa is currently highly dependent on the burning of fossil fuels (about 77% of the country's primary energy needs provided by coal), the country is subject to some of the highest levels of solar radiation in the world, with an average daily solar radiation that varies between 4.5 and 6.5 kilowatt hours per square meter (kWh/m^2). The area of the Northern Cape around De Aar has some of the highest solar radiation intensities in South Africa. Government has committed to invest in renewable energy initiatives and to the efficient use of available resources. It is also committed to broadening the energy mix, thereby moving away from being fossil-dominated to a more balanced combination, which places a high premium on the use of more efficient technologies and renewable-energy resources.

1.4.4 National Emission Targets

South Africa is among the top 20 emitters of greenhouse gases in the world and is the largest emitter in Africa, largely because of the economy's dependence on fossil fuels. Renewable energy can contribute to reductions in local air pollution, with co-benefits of reducing emissions of greenhouse gases which contribute to climate change. Although the South African economy depends greatly on fossil fuels for energy generation and consumption, the Government has indicated that South Africa needs to proactively move the economy towards becoming less carbon-intensive. It has developed the White Paper on Renewable Energy and Clean Energy Development, together with an energy-efficiency programme, to support diversification in pursuit of a less carbon-intensive energy economy.

1.4.5 Benefits

The proposed project would contribute to aligning local policies with internationally agreed strategies and standards as set by the United Nations Framework Convention on Climate Change (UNFCCC), Kyoto Protocol, and United Nations Convention on Biological Diversity (UNCBD) all of which South Africa is a signatory. It is the intention to register the proposed project as a Clean Development Mechanism (CDM) project with dual objectives:

- To help developed countries fulfill their commitments to reduce emissions; and
- To assist developing countries in achieving sustainable development.

Once the project is registered as a CDM project it would generate greenhouse gas (GHG) emission reductions (carbon credits) as soon as it starts commercial operation. The sale of carbon credits would generate an additional income for the proposed project.

Locally, the establishment of the proposed project would strengthen the existing electricity grid for the area, providing power in a short space of time (potentially less than two years to commissioning). Should the proposed project be approved it would result in long-term benefits for the De Aar area, e.g. creation of employment and business opportunities.

2. EIA APPROACH AND METHODOLOGY

2.1 LEGISLATIVE REQUIREMENTS

Key legislation that provides the framework and guidelines for undertaking this study includes:

- National Environmental Management Act (No. 107 of 1998) and EIA Regulations 2010;
- National Heritage Resources Act (No. 25 of 1999); and
- National Water Act (No. 73 of 1989).

This legislation also guides the relevant authorities in their decision-making process.

2.2 SCOPING AND EIA PROCESS

2.2.1 Scoping Study Phase

The Scoping Study Phase was undertaken between June 2011 and June 2012.

The Scoping Study process undertaken followed the requirements of NEMA and the EIA Regulations 2010. This involved an open, participatory approach to the study and full involvement of I&APs to ensure that all impacts were identified and that planning and decision-making takes place in an informed, transparent and accountable manner.

The Final Scoping Report (FSR), which was prepared in compliance with Section 28 of the EIA Regulations 2010, was submitted to DEA on 16 March 2012 for consideration and acceptance. The FSR was also distributed for a 30-day review / comment period (excluding public holidays) from 19 March 2012 to 23 April 2012. DEA was notified, in writing, on the 24 April 2012 that no comments were received on the FSR during the 30-day public review / comment period.

The FSR was accepted by DEA on 14 June 2012. DEA requested that CCA proceed with the EIA Phase as outlined in the Plan of Study for EIA.

2.2.2 EIA Phase

Specialist studies
Eight specialist studies were undertaken to address the potential impacts associated with the key issues raised during the Scoping Study. Specialist studies involved the gathering of data relevant to identifying and assessing environmental impacts that may occur as a result of the proposed project. These impacts were then assessed according to pre-defined rating scales. Specialists also recommended appropriate mitigation / control or optimisation measures to minimise potential negative impacts or enhance potential benefits, respectively.

Compilation of Draft EIR and release for review and comment
The specialist assessments and other relevant information were integrated into a Draft EIR. The Draft EIR was distributed for a 40-day review and comment period from 21 June 2012 to 31 July 2012 in order to provide I&APs and authorities with an opportunity to comment on any aspect of the proposed project and the findings and recommendations of the Draft EIR.

Compilation of Final EIR
After closure of the comment period, the Draft EIR was updated into a Final EIR. Written comments were received have been collated, and responded to, in a Comments and Responses Report.

3. PROPOSED PROJECT DESCRIPTION

The proposed project would consist of a 25 to 30 MWp AC photovoltaic power plant, which would be connected to the existing Hydra substation via a 132 kV overhead power line.

3.1 THE SITE

The proposed photovoltaic power plant would be situated on Portion 3 of Farm Hartebeestplaats 135 (locally referred to as Kampfontein), which is located approximately 6 km south-east of De Aar (see Figure 1). The property is approximately 117 ha in extent. The proposed power plant would cover an area of between 75 and 80 ha.

3.2 TECHNOLOGY

Photovoltaics is a method of generating electrical power by converting solar radiation into direct current electricity using semiconductors that exhibit the photovoltaic effect, which is the process of converting light (photons) to electricity (voltage). Photovoltaic power generation employs solar panels or modules composed of a number of solar cells connected in series containing a photovoltaic material. Crystalline or thin film modules would be used for the proposed project.

Module specifications would ultimately depend on the technology used, but it is anticipated that the modules would have dimensions in the order of 1 m x 2 m (i.e. 2 m^2). Modules would be mounted on racks to form solar arrays. Solar arrays would be orientated in a northern direction, offset at a maximum of 15 degrees either to the east or west and would have a maximum height of approximately 2.5 to 3 m (technology dependent) above ground level and placed approximately 7.4 m apart (see Figure 3). The racks would have either a ballasted or piled foundation, which will be determined once the geotechnical survey has been completed. The use of a tracker system is also being considered. A tracker system could increase the performance of modules during early morning and late afternoon periods.

Modules would be arranged in 1.25 MW blocks of approximately 3.5 ha each and would be tilted at a 30 degree angle, covering a total area of between 75 and 80 ha (including rack frame). Solar arrays would be placed over the vegetation, where possible. However, vegetation over 60 cm in height would need to be removed beneath the modules. In addition, vegetation within the proposed footprint of rack foundations, access roads, pylons and the internal underground cables (some of which are in the road verges) would also have to be removed.

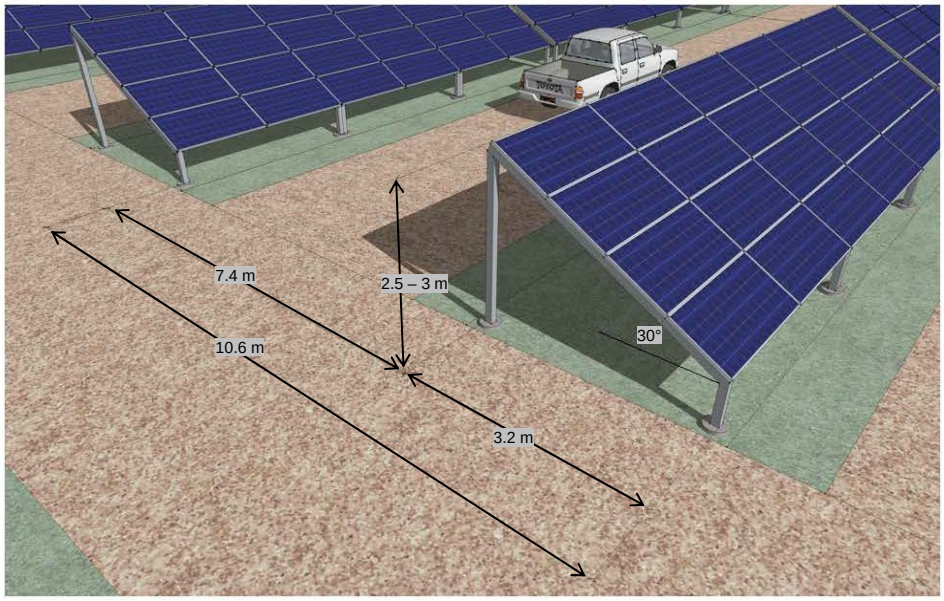


Figure 3: Illustration of the array layout and spacing.

3.3 LAYOUT

Although the final layout would primarily be determined by the technology choice and detailed design considerations, an indicative layout of the proposed photovoltaic power plant is presented in Figure 3. This layout has been informed by the recommendations made in the specialist baseline studies that were undertaken during the Scoping Study Phase.

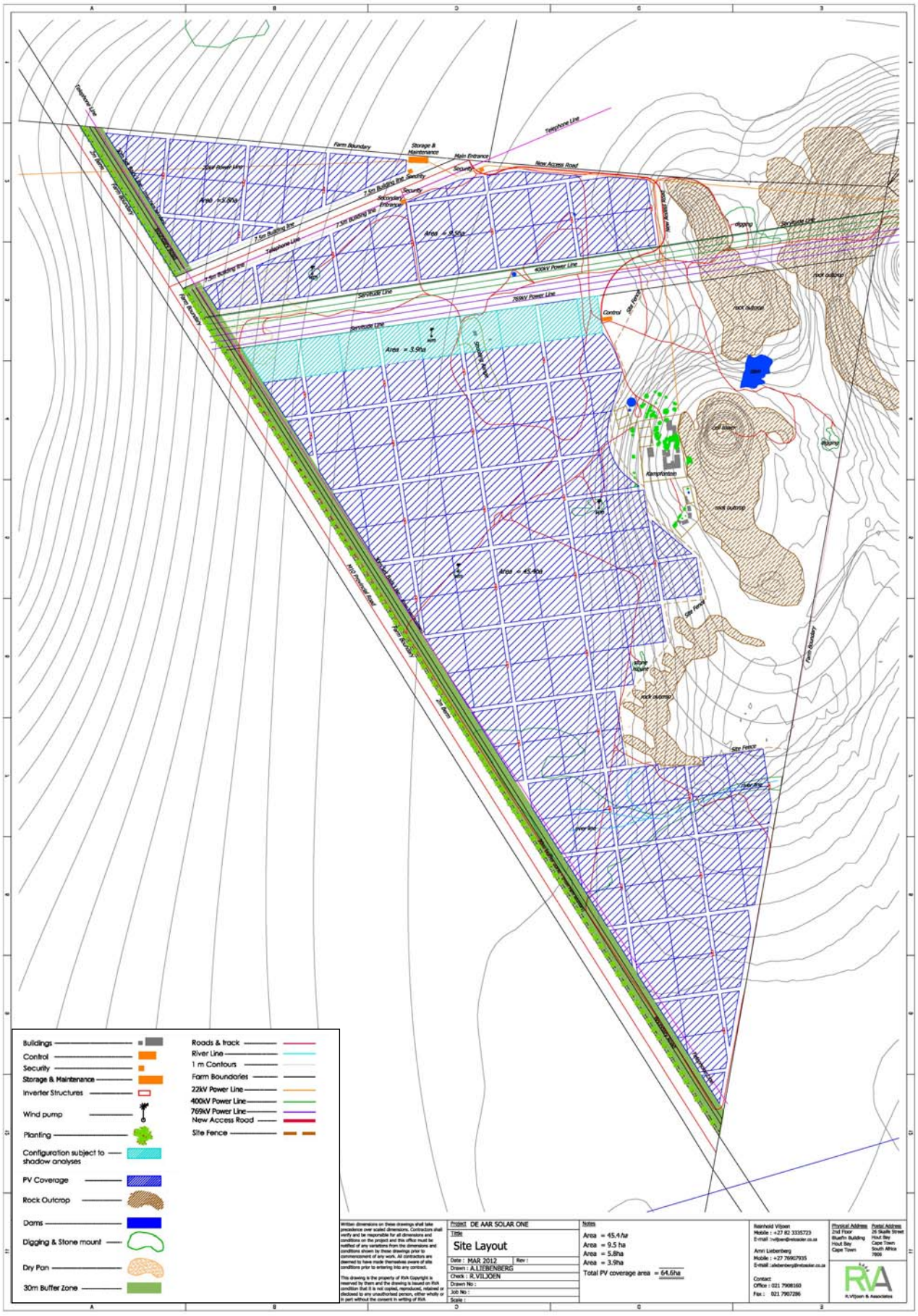


Figure 3: Proposed layout for the photovoltaic power plant on Farm Hartebeestplaats 135/3.

3.4 ASSOCIATED INFRASTRUCTURE

3.4.1 Power line

The proposed photovoltaic plant would be connected to the Hydra substation, approximately 1.5 km east of the site, via a 132 kV power line. Three alternative connection options to the Hydra substation are being considered (see Figure 4) ranging from approximately 2 to 2.5 km in length, with Option 1a being the proponent's preferred alternative. The proposed power line would require a servitude over private land (38 m wide over a distance of ± 225 m) and negotiations have commenced with the landowner in this regard. The remainder of the power line would be routed over land owned by Eskom.

Monopole steel towers with a height of approximately 17.5 m to 21 m would be used for the proposed power line.

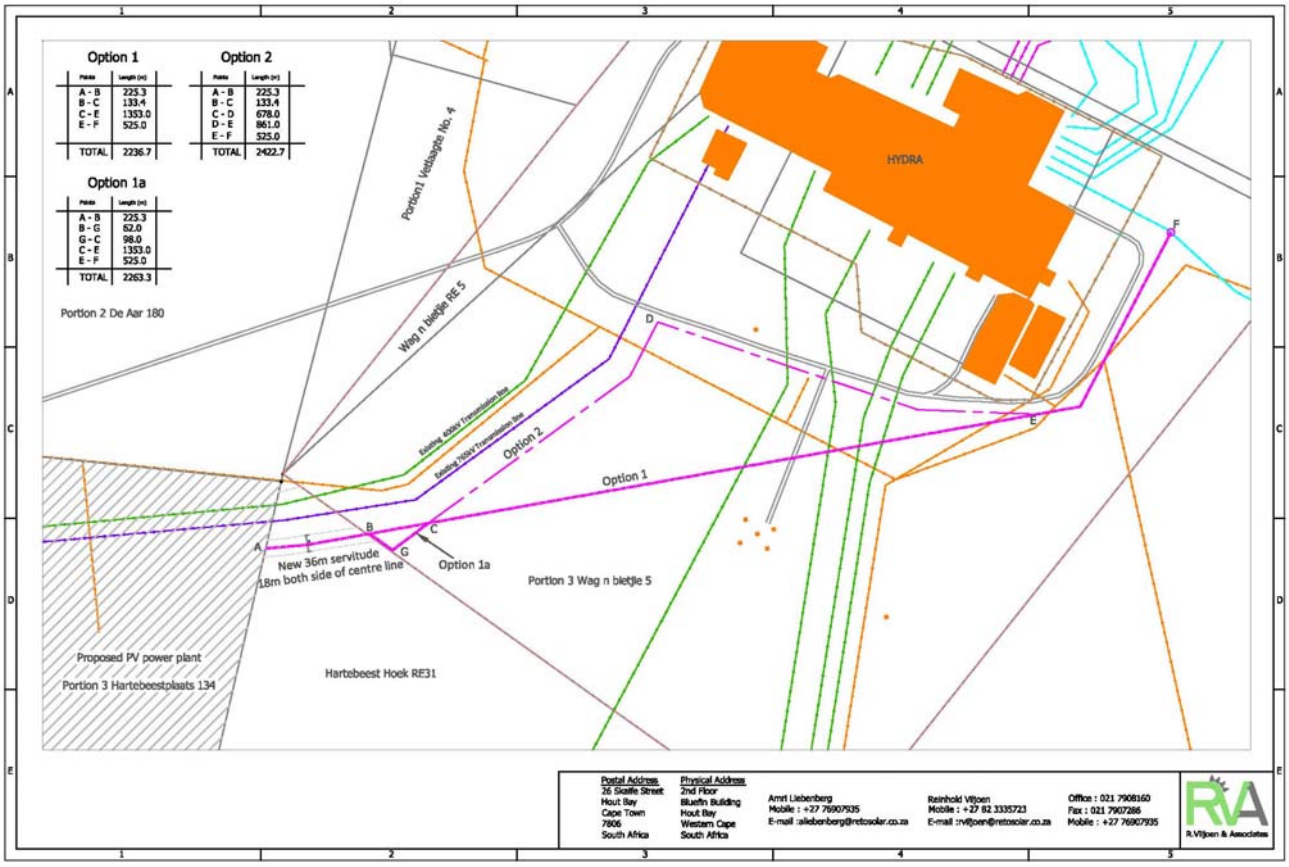


Figure 4: Three alternative power line route options and connection points to the Hydra substation. Existing power line connections are also indicated.

3.4.2 Transformer and inverter

A transformers (22/132 kV 75 MVA sub-station) and photovoltaic inverters (250 kW) would be required for each 1.25 MW block of modules. The inverters convert the variable DC output of the modules into a utility frequency AC current that can be fed into the commercial electrical grid or used by a local, off-grid electrical network.

3.4.3 Access roads

Access to the site would be via the existing Hydra substation access road off the N10 and the existing farm access road, which enters the site from the north.

Access roads totalling an estimated 14.5 km would be required between the individual solar arrays during the construction phase. It is anticipated that a third of these roads would remain as permanent during the operation phase (± 5 km).

The permanent roads would be in the order of 4 to 7 m wide and surfaced with permeable pavers, which would facilitate the infiltration of stormwater into the soil. Precast box culverts or pipes would be required where the access roads pass through the drainage channels on site. Any fill material required would be obtained from local approved sources.

3.4.4 Buildings

Various operations and maintenance buildings would be constructed, including:

- Main building (± 150 m^2), which would be shared by control and security staff;
- Store (± 500 m^2);
- Main electrical substation and transformers (max 500 m^2 fenced area);
- Inverter structures in between arrays (each ± 15 m^2) – prefabricated concrete or steel structures; and
- Transformer structures – small concrete or steel structures.

The buildings would be single storey and would be constructed from brick or stone with metal sheet roofing. The store would, however, be a simple clad portal frame type structure.

3.4.5 Fencing

The proposed plant would be fenced off with a 2.5 m high wire mesh security fence, with access gained via a security gate.

3.4.6 Services

Water supply

Groundwater would be used for construction and operational purposes. There are five existing boreholes on site, which would be used to abstract groundwater. Depending on the location of the arrays, additional boreholes may need to be sunk. Water would be stored in 5 or 10 kL storage tanks, which would be located near the office buildings. The water would pass through a simple filtration process.

It is anticipated that approximately 20 to 30 kL of water would be required per day during the operational phase. This water would be used to clean the modules / solar array and general office use (e.g. toilets, drinking water, etc.). In order to reduce the volume of water required, the cleaning of the modules using high pressure air is being investigated. Construction phase water requirements would depend on where the fabrication of certain components of the project would take place. It is currently envisaged that concrete elements would be cast on site in order to increase the community labour opportunities. This would require approximately 50 to 75 kl of water per day during the construction phase.

Electricity supply

Electricity would be obtained from Eskom via the existing supply to the site.

Sewerage treatment

A septic tank and French drain system would be used to treat sewage and wastewater from the office buildings. It is envisaged that a maximum of 2 kL of sewage and wastewater would be generated per day.

Waste disposal

All non-recyclable waste would be disposed of at the De Aar licensed landfill site.

3.5 VISUAL SCREENING

A visual buffer of 30 m has been included between the external farm boundary along the N10 and the proposed layout design (see Figure 3). In addition, a berm 2 m in height would be constructed along the N10 within the visual buffer, which would create a view shadow along a portion of the N10 adjacent to the site. Shrubs and trees would also be planted along the Hydra substation access road and along the N10 boundary fence to provide further visual screening.

3.6 REZONING AND LAND USE

The site is currently zoned *Agricultural* and would be rezoned to *Special*, or other appropriate zoning in consultation with the provincial authority in terms of the Northern Cape Planning and Development Act, 1998. A rezoning application will only be prepared and submitted to the Provincial Administration and the local municipality if the proposed project attains preferred bidder status.

3.7 PROJECT PHASES

3.7.1 Construction Phase

During construction approximately 200 to 300 people would work on site over a period of six to nine months. A large number of the workforce would be sourced from the local labour force in and around De Aar.

The appointed contractor would be required to establish a construction camp and laydown area. It is anticipated that an area of approximately 1.5 ha per phase would be required for these purposes.

3.7.2 Operational Phase

It is envisaged that approximately 30 to 40 people would be employed during the operational phase of the project. It is proposed that local labour from the surrounding community would be employed as far as possible. Limited accommodation for four to six persons would be provided within the office building complex.

3.7.3 Decommissioning Phase

The Power Purchase Agreement is only valid for a period of 20 years after which the Agreement would be renewed or the power plant decommissioned and the site rehabilitated. Extensions of the life of the plant of up to 10 to 20 years would depend on the choice of technology and the development of the technology over the first operational period. If the power plant is decommissioned the site would revert back to current land use activities (namely the grazing of small game and livestock).

During decommissioning approximately 50 to 100 people would be working on site over a period of six to 12 months. A large number of the workforce, if not all, would be sourced from the De Aar area.

4. THE AFFECTED ENVIRONMENT

4.1 THE BIOPHYSICAL ENVIRONMENT

The climate of the study area can be regarded as warm to hot with a summer rainfall and dry, cold winters. The area is characterised by wide open plains with relatively flat topography typical of the Central Karoo. The site is relatively flat with some low rocky ridges in the east and north-east of the site. The geology of the area comprises shales, mudstones and sandstones of the Adelaide Subgroup (Beaufort Group, Karoo Supergroup), which have been intruded in places by dolerite of the Jurassic age. Soil in the area comprises a mixture of red, sandy to sandy loam topsoils on hard rock with occasional calcareous topsoils on rock/calcrete. The area has a low prevailing agricultural potential.

Mucina and Rutherford (2006) identify the vegetation type on the site as Northern Upper Karoo. The vegetation type has a wide distribution and is classified as Least Threatened. The area around De Aar has been classified as an Important Bird Area (Platberg Karoo Conservancy: SA037). The study area contains no unique or important faunal habitats relative to the surrounding area, it appears to have a low faunal species diversity and population densities are expected to be low.

The site is located in the Lower Orange Water Management Area, which forms part of the Department of Water Affairs' greater water supply system, and in quaternary catchment D62D. The main aquatic feature within the larger study area is the Brak River, which is a seasonal tributary within the Orange River System. Two small ephemeral streams / drainage channels with predominately a sandy / silty substrate cross the site. These drainage channels are considered to be of low ecological importance and sensitivity.

Karoo aquifers are heterogeneous with hydraulic properties varying significantly over short distances. The harvest potential of these aquifers in the vicinity of the site has been set at 11 000 m^3/km^2/annum (Baron et al., 1998). De Aar is entirely dependent on groundwater for its water supply (Woodford, 2007). Well fields comprising some 68 boreholes and two springs are distributed around the town, the closest to the study site being boreholes in De Aar (approximately 6.5 km to the north) and those on the Farm Riet Fountain (approximately 9 km to the east). Total municipal groundwater abstraction amounts to about 5 500 kilolitres per day (KL/d) (DWA, 2011). Boreholes on the site are relatively low yielding (about 1.2 L/s).

4.2 SOCIO-ECONOMIC ENVIRONMENT

The proposed project is located in the Pixley ka Seme District Municipality and ELM of the Northern Cape Province. The largest towns within the ELM are De Aar, Britstown and Hanover. The administrative centre of the Municipality is De Aar, which lies approximately 300 km south-east of the provincial capital of Kimberley.

The community services sector is the largest employer (36%), followed by the transport sector (24%), finance (13%), trade (11%) and the agricultural sector (7%). Unemployment within the ELM is estimated at approximately 23% of the total labour force, which is below the Northern Cape average of approximately 27%, while 43.5% of the population is not economically active.

The Pixley ka Seme District Municipality's total population was estimated at 166 849 people, with the ELM accounting for approximately 23% (38 228). The average population growth between 2001 and 2010 was estimated at 0.60%. According to the ELM IDP (2010), the municipal population is largely Coloured (57.5%), followed by Black African (35.3%), White (7.1%) and Asian (<1%).

The site is currently used primarily to graze small game and livestock and as a small guest lodge. Other notable land uses in the area include livestock farming on adjacent properties in all directions from the site, the Hydra substation approximately 1.5 km east of the site, and the De Aar airfield approximately 5 km north-

west of the site. The Bletterman railway station, which is located adjacent to the Hyrda substation approximately 2 km to the north-east of the site, is no longer operational. The visual character of the area and its sense of place have been altered by these existing infrastructure and adjacent land uses.

4.3 HERITAGE AND CULTURAL ENVIRONMENT

The De Aar area is evident of the occurrence of rock art engravings and the associated Stone Age period. The two main cultural and industrial units that have been traditionally recognised during the Holocene in South Africa include the Wilton and Smithfield industries (Deacon, 1974). No significant archaeological sites or artefacts were identified on site. A scattered stone tool was identified on the dolerite outcrop to the east of the existing farmstead.

De Aar played a significant role during the Anglo-Boer War and the two battles of significance occurred in the area, namely the Battle of Stormberg and the Battle of Colenso. De Aar was used as a central storage place for ammunition and horses.

The study area has a rural character consisting of open grassland and low scrub vegetation. It is an arid landscape with scattered farmsteads surrounding the site. The area is already visually disturbed by existing visual clutter of the power lines, pylons and the large Hydra substation to the north-east of the site.

5. IMPACT ASSESSMENT

The findings of the eight specialist studies have been integrated and synthesised into this Final EIR. The potential impacts related to each phase of the proposed project are summarised in Table 1 below.

6. SUMMARY FINDINGS OF EIA

6.1 FIT WITH LEGISLATION, POLICY AND PLANNING

A review of the relevant legislation, policies and documents pertaining to the energy sector indicate that solar energy and the establishment of photovoltaic power plants are supported at a national, provincial and local level. In this regard De Aar has been identified as a Renewable Energy Hub. Thus the establishment of the proposed project is supported by the relevant policy and planning documentation and has the potential to support a number of key strategies in the district and local IDPs.

6.2 CONSTRUCTION AND DECOMMISSIONING PHASES

The majority of the impacts associated with the construction and decommissioning phases would be very localised (i.e. occurring on site only) and of short-term duration (i.e. reversible). All impacts associated with these two phases, except one, are considered to be **INSIGNIFICANT** or of **VERY LOW to LOW** significance with mitigation. The most significant construction phase impact is related to the creation of employment for between 200 and 300 people for a period of six to nine months and business opportunities particularly in the local service industry, which is considered to be of **MEDIUM (POSITIVE)** significance with mitigation.

Table 1: Summary of the significance of the potential impacts associated with the proposed De Aar Solar One Photovoltaic Power Plant.

No.	Potential impact			Significance	
				Without mitigation	With mitigation
1. Construction phase					
1.1	Vegetation	1.1.1 Loss of vegetation		Assessed as part of 2.1 below.	
1.2	Fauna	1.2.1 Direct mortality		VL	**VL**
1.3	Freshwater	1.3.1 Disturbance and loss of freshwater habitat		L	**VL**
1.4	Groundwater	1.4.1 Abstraction		Insig-VL	**INSIG**
		1.4.2 Contamination		VL	**INSIG**
1.5	Socio-economic	1.5.1 Creation of employment and business opportunities		L (+ve)	**M (+VE)**
		1.5.2 Influx of job seekers		M	**L**
		1.5.3 Loss of farm labour		VL	**VL**
		1.5.4 Stock theft, poaching and damage to farm infrastructure		VL	**VL**
		1.5.5 Veld fires		M	**VL**
		1.5.6 Movement of construction vehicles		VL	**VL**
2. Operation phase					
2.1	Vegetation	2.1.1 Loss of vegetation		M	**M**
		2.1.2 Change of species composition		M	**M**
2.2	Fauna	2.2.1 Loss and alteration of faunal habitats		L	**L**
		2.2.2 Bird strikes and interactions		L-M	**L-M**
		2.2.3 Barrier effect		Insig.	**INSIG.**
2.3	Freshwater	2.3.1 Disturbance and loss of freshwater habitat		L	**VL**
		2.3.2 Flow modification		L	**VL**
		2.3.3 Runoff modification		L-M	**L**
2.4	Groundwater	2.4.1 Recharge		M	**INSIG-VL**
		2.4.2 Abstraction		Insig-VL	**INSIG**
		2.4.3 Contamination		M-H	**L**
2.5	Socio-economic	2.5.1 Development of a clean, renewable energy facility		M (+ve)	**M (+VE)**
		2.5.2 Creation of employment and business opportunities		L (+ve)	**L (+VE)**
		2.5.3 Influx of job seekers		M	**L**
		2.5.4 Visual impact / Sense of place	Solar arrays	M-H	**M**
			Power lines	M	**M**
			Buildings	L-M	**L-M**
		2.5.5 Tourism		L (-ve & +ve)	**L (-VE & +VE)**
		2.5.6 Civil aviation		VL	**VL**
		2.5.7 Establishment of a Community Trust		L (+ve)	**M-H (+VE)**
		2.5.8 Loss of grazing and increase risk of erosion		L	**L**
2.6	Heritage & cultural	2.6.1 Loss of heritage resources		M	**L**
		2.6.2 Cultural landscape		L-M	**L**
3. Decommissioning phase					
3.1	Socio-economic	3.1.1 Loss of jobs and business opportunities		L	**L (NEUTRAL)**
3.2	Heritage & cultural	3.2.1 Loss of heritage resources		L-M	**L**

VL – Very Low; L = Low; M = Medium; H = High; Insig= Insignificant All impacts are negative unless otherwise indicated

6.3 OPERATION PHASE

The assessment is based on an indicative layout as presented in Figure 3. This layout is the result of an iterative design process, which has been informed to a certain extent by recommendations made in the specialist baseline studies that were undertaken during the Scoping Study Phase. The proposed layout has avoided the rocky outcrop areas, which are considered to be more sensitive from a vegetation, fauna and visual perspective. In addition, a 30 m wide buffer with a 2 m high berm has been incorporated into the proposed layout in order to reduce the visual impact. The visual impact is further reduced by the proposed planting of vegetation along N10 and Hydra substation access road.

The assessment has also considered a number of alternatives, including:

- Technology: The proposed project would use either silicone crystalline or thin-film modules, configured on fixed frames or on trackers;
- Access roads: An estimated 14.5 km of access roads would be required between the individual solar arrays. Although the exact location of these within the proposed layout is unknown at this stage, the assessment assumes that these could be located anywhere within the proposed layout footprint; and
- Power line: Three alternative power line route options from the north-eastern corner of the site to the Hydra substation are proposed, with Option 1a being the proponent's preferred alternative.

In general the impacts associated with the operation phase are long-term, as the Power Purchase Agreement is valid for a period of 20 years, after which the Agreement can be renewed or the power plant decommissioned. The key negative impacts related to the operation phase include:

- *Loss of vegetation and possible change in species composition:* The Northern Upper Karoo vegetation found in the study area is widespread and is classified as Least Threatened. The impacts related to the clearing of an estimated 14 ha of vegetation within the development footprint and the possible change in species composition due to increased shading and reduced rainfall underneath the modules / solar arrays are considered to be **MEDIUM** significance with mitigation; and
- *Visual impact:* The area already has a number of existing visual intrusions in the rural landscape, particularly the numerous power lines that pass through the area and the Hydra substation. The existing visual clutter has increased the visual absorption capacity of the area. The visual impacts related to both the solar arrays and the power line are considered to be of **MEDIUM** significance with mitigation.

The key positive impacts related to the operation phase include:

- *Development of a clean, renewable energy facility:* South Africa currently relies on coal-powered energy to meet more than 90% of its energy needs. As a result South Africa is one of the highest per capita producers of carbon emissions in the world and Eskom, as an energy utility, has been identified as the world's second largest producer carbon emissions. Although the overall contribution of the proposed project is relatively small it would help to offset the total carbon emissions associated with energy generation in South Africa. This impact is considered to be of **MEDIUM (POSITIVE)** significance; and
- *Establishment of a Community Trust:* The establishment of a Community Trust funded by the proposed project could fund development initiatives in the area and support local and community development. The 20-year timeframe also allows local municipalities and communities to undertake long-term planning for the area. This impact is considered to be of **MEDIUM to HIGH (POSITIVE)** significance with mitigation.

The remaining negative impacts are considered to be **INSIGNIFICANT** or range from **VERY LOW to LOW-MEDIUM** significance with mitigation, while the positive impacts are considered to be of **LOW (POSITIVE)** significance. The significance ratings are associated, to a large extent, with the following:

- The relatively small scale of the project (i.e. 25 to 30 MW capacity covering an area of 75 to 80 ha);

- The disturbed nature of the site (including heritage resources, watercourses and vegetation);
- There are no unique or important faunal habitats found on site relative to the surrounding area; and
- No species of conservation concern (vegetation or fauna), except for the possible occurrence of the Ludwig's Bustard (listed as *Vulnerable* and *Endangered*), were found to or expected to occur on site.

The assessment summary provided above and in Table 1 relates to all alternatives (technologies, access roads and power lines), as well as slight changes to the indicative layout, provided the modules / solar arrays avoid the proposed freshwater buffers and the rocky outcrop areas. Although all power line alternatives are assessed to be of similar significance, Option 2 is the preferred alternative from an avifaunal perspective as it runs parallel to the existing power lines for a greater distance compared to Option 1 (the proponent's preferred alternative) and 1a.

6.4 CUMULATIVE IMPACT

De Aar has been identified as a Renewable Energy Hub. As a result, a number of photovoltaic power projects are proposed in the area, most of these being concentrated around the existing Hydra substation, south-east of the town. These projects, together with the proposed project, would have a cumulative impact on the biophysical and socio-economic environment.

The cumulative impact on the vegetation, freshwater resources and groundwater are considered to range from **VERY LOW to LOW** significance with mitigation. All cumulative impacts on terrestrial fauna are considered to be of **LOW** significance, except the potential increase in bird strikes which is considered to be of **MEDIUM** significance. This rating is related to the additional power line infrastructure that would be installed and the potential increase in mortality of Ludwig's Bustard (listed as *Vulnerable* and *Endangered*), which is specifically vulnerable to power line collisions.

The key cumulative socio-economic impacts include:

- A reduction in carbon emissions via the use of renewable energy and associated benefits in terms of global warming and climate change is considered to be of **HIGH (POSITIVE)** significance;
- The visual impact associated with the projects on the areas sense of place and landscape character is considered to be of **MEDIUM to HIGH** significance;
- The influx of potential job seekers could have a **MEDIUM** significant impact on existing social networks and community structures;
- Although the cumulative impact associated with the creation of local employment (estimated to be in the order of 150 to 200 jobs) and business opportunities is considered to be **LOW (POSITIVE)** significance, it would go a long way to offsetting the negative socio-economic impacts, such as job losses, associated with the scaling down of the railway linked activities in De Aar over the last 10-15 years; and
- The establishment of Community Trusts, funded by revenue from these projects, provides an opportunity to generate a reliable and steady revenue stream over a 20-year period. This revenue could be used to fund development initiatives in the area and support the local economic and community development. This benefit is considered to be of **HIGH (POSITIVE)** significance.

The cumulative impact on heritage resources and the cultural landscape is considered to be of **MEDIUM** and **LOW** significance, respectively.

6.5 NO-GO ALTERNATIVE

The No-Go alternative relates to the option of not developing the proposed power plant and associated infrastructure (i.e. the Status Quo). If the proposed project is not developed, the current land use activities are assumed to continue in the long-term, including grazing and watering small game and livestock, and operating a small guest lodge, shooting range and a brickworks.

There would be no additional impacts on the vegetation, fauna, freshwater, groundwater and heritage resources on site provided that current management and farming practices remained as at present in terms of grazing intensity and carrying capacity. However, the no-go option would represent a lost opportunity for South Africa to supplement its current energy needs with clean, renewable energy given South Africa's position as one of the highest per capita producer of carbon emissions in the world. There would also be a lost opportunity in terms of the employment and business opportunities associated with the proposed project and the benefits associated with the establishment of a Community Trust. The no-go option would represent a negative social cost of **HIGH** significance.

6.6 RECOMMENDATION / OPINION OF ENVIRONMENTAL ASSESSMENT PRACTITIONER

The key principles of sustainability, including ecological integrity, equity and social justice, and economic efficiency, are integrated below as part of the supporting rationale for recommending an opinion on whether the proposed project should be approved.

- Ecological integrity

  The use of renewable energy (e.g. solar and wind) is considered to have significant ecological benefits. South Africa is among the top 20 emitters of greenhouse gases in the world, largely because of the economy's dependence on fossil fuels. The proposed photovoltaic power project, together with a number of others proposed in the area, would help to offset the total carbon emissions associated with energy generation in South Africa. Reduced carbon emissions through the use of renewable energy would have benefits in terms of global warming and climate change. In terms of site location, the proposed project is located in an area that has some of the highest solar radiation intensities in South Africa and is considered to be an efficient use of available resources.

  The proposed project would result in the clearing of an estimated 14 ha and the shading of a further approximately 50 ha of Northern Upper Karoo vegetation. However, in terms of positioning on site, the proposed layout has avoided the more sensitive rocky outcrop areas of the site and is located largely in the more disturbed areas. This vegetation type is widespread and classified as Least Threatened, and there are no unique or important faunal habitats found on site relative to the surrounding area. Although the localised impact on the vegetation is considered to be the most significant biophysical impact, it is deemed to be largely reversible at the end of the project when the power plant is decommissioned and the site rehabilitated. Mitigation has been proposed to further minimise the impact on the biophysical environment, e.g. freshwater buffers are proposed around the drainage channels on site.

  The proposed power line would add to the potential risk of bird strikes and electrocution, especially to the Ludwig's Bustard (listed as *Vulnerable* and *Endangered*). However, this impact is not considered to be a "new" impact in the area, due to the numerous existing power lines linking to the Hydra substation. This impact has been mitigated by locating the proposed power line parallel to the existing high voltage power lines on site as far as possible.

  In summary, the proposed project would result in the loss of some ecological integrity in the study area, but it is considered to be small and localised.

- Equity and social justice

  The landowner has entered into a 20-year lease agreement with the proponent and as such the loss of productive farmland would be offset by the income the farmer would receive from the lease agreement. The effect on the landowner would be further offset as it is the intention to allow small game and / or livestock to graze between the modules / solar arrays.

  The proposed project would create a number of local employment and business opportunities. These benefits to the local economy would extend over the operational lifespan of the proposed project. It is anticipated that a large number of the low and medium skilled employment opportunities could be sourced from the local labour force in and around De Aar with the implementation of a skills development and training programme, especially during the construction phase. In terms of business opportunities for local companies, procurement would create business opportunities for the regional and local economy. However, given the technical nature of and high import content associated with the proposed project, the opportunities for the local economy are likely to be limited. A percentage of the monthly wage bill earned by permanent staff would be spent in the regional and local economy, which would benefit local businesses in De Aar (and possibility Britstown and Hanover).

  No indigenous groups live on site and the proposed project would not impact any public resources or community access routes. The proposed abstraction and use of groundwater would not affect the water supply of De Aar or neighbouring farmers, which are entirely dependent on groundwater.

  The proposed project would alter the local visual landscape / rural character of the site, which would have a visual impact in the immediate surrounding area and especially along the N10 national road. This impact is mitigated to a certain extent by the existing visual clutter in the rural landscape, which has increased the visual absorption capacity for the proposed project, as well as the proposed berm along the N10. The potential visual impact may in turn have an impact on tourism. This is, however, considered to be of similar significance to the potential benefit tourism may incur if De Aar becomes a Renewable Energy Hub with the anticipated attraction of visitors.

  Thus, in terms of the issue of equity and social justice, the proposed project is considered to result in the equitable distribution of positive and negative impacts with no one group or community being adversely affected.

- Economic efficiency

  South Africa is facing a rising demand for power and is looking for other energy sources, including renewable energy, to decrease its dependence on the coal-fired power that provides most of the country's electricity. As such, renewable energy technologies are anticipated to play a key role in meeting South Africa's energy needs into the future. However, renewable energy sources are often criticised for being too costly, when compared with other technologies (e.g. coal). Solar energy is currently not considered to be entirely efficient as it has to be cross-subsidised by other generation means. This said, it is expected that in the long-term renewable energy will become more economically efficient as technologies develop (including the storage of electricity), technology costs decrease and the cost of other forms of electricity generation increase.

  The proposed project complements and supports a number of key local economic development and socio-economic initiatives. One of the key economic opportunities identified for the area is the establishment of De Aar as a Renewable Energy Hub. This is seen as a critical component to the revitalisation of both the broader District and the town of De Aar, as it would create significant economic opportunities for the area and go a long way to offsetting the negative socio-economic impacts associated with the downscaling of Transnet railway operations over the last 10 to 15 years.

The proposed project is considered ideally located in order to link into the national grid, due to its close proximity to the existing Hydra substation. Locally, the establishment of the proposed project would strengthen the existing electricity grid for the area, providing power in a short space of time (potentially less than two years to commissioning).

From the above sustainability criteria, the nature and extent of the proposed development, compliance with the relevant legal, policy and planning documentation (i.e. "need and desirability") and the findings of the specialist studies, it is the opinion of CCA that the proposed De Aar Solar One Photovoltaic Power Project is supported from an environmental perspective and should be considered for Environmental Authorisation, subject to the implementation of the identified recommendations.

7. RECOMMENDATIONS

This section summarises the key mitigation measures recommended as part of the EIA.

7.1 GENERAL CONSIDERATIONS

- All phases of the proposed project (including construction, operational and decommissioning) must comply with the Environmental Management Programme (EMP) compiled as part of the EIA. The EMP includes the majority of the recommendations related to the construction and operation phases (some of which are listed below), as well other measures considered necessary to minimise the potential impacts on the environment.

7.2 KEY DESIGN CONSIDERATIONS

Layout considerations

- The final layout is to avoid the more sensitive rocky outcrop areas, as currently proposed.
- The proposed footprint of the modules / solar array, and associated operation activities, should remain, as far as possible, outside of the proposed freshwater buffers.
- A set back (buffer) of at least 10 m (or as required by the municipal by law) from all farm boundaries must be included in the proposed layout design.
- The substation, maintenance and storage buildings should be clustered and located in low-lying areas, as proposed.

Groundwater abstraction, usage and contamination

- Groundwater tests (including drawdown tests and 48 hr constant discharge pumping tests) are to be undertaken on at least four existing boreholes in order to determine the exact borehole yields and the most appropriate pumping regime during construction and operation.
- The proposed septic tank and soak-away system must be sited at least 50 m from the nearest production borehole.
- Water-saving devices (e.g. dual flush toilets, waterless urinals, etc.) should be installed in the offices.
- Opportunities for the reuse and recycling of water during operation should be investigated.
- All components (e.g. inverters and transformer, chemical and fuel storage facilities, etc.) that have a potential to contaminate groundwater are to be established on low permeability, bunded surfaces.

Stormwater drainage

- All access roads must be designed to ensure that stormwater flow is not impeded. In this regard, culvert or pipes are to be sufficiently wide to accommodate and distribute the flow.

- The stormwater management plan must incorporate the following in order to manage stormwater before it leaves the site:
  - > All existing drainage channels are to be incorporated into the stormwater drainage system;
  - > Stormwater is to be, where possible, directed into natural vegetated areas;
  - > The existing local stormwater retention structures on site are to be included in the design. In this regard, the stormwater drainage channel along the N10 and a portion of the existing dam (size to be determined by estimated stormwater volume for the developed site) in the north-western corner of the site are to be retained in the proposed buffer along the N10. The formalised drainage channel may need to be moved slightly to accommodate the proposed berm; and
  - > Overflow from the dam is to continue down the existing drainage channel and under the N10.

Fauna

- The solar arrays and mounting systems should, if possible, be designed to not create opportunities for birds to construct nests.

Aesthetics

- The proposed berm along the N10 must have a sinuous, undulating shape with variable heights to look as natural as possible. In addition, rocks from the construction areas could be placed on the berm to simulate the characteristic outcrops of the area and help to create faunal habitats.
- Detailed specifications for the berm and all screen planting must be prepared by a qualified landscape architect. Planting on the proposed berm should only use locally occurring species to blend with the surrounding landscape
- Cables should be located underground as far as possible.
- The design of the buildings should be compatible in scale and form with rural buildings in the area.
- All yards and storage areas should be enclosed by masonry walls.
- The colour of the solar array structures, such as the supports and the rear of the panels, should be in the dark grey or green range in order to minimise visibility and avoid reflectivity.
- Signage related to the development should be discrete and confined to the entrance gate/s. No other corporate or advertising signage and billboards is to be permitted, particularly along the N10.
- External lighting should be confined to the maintenance and storage areas. Lights should be low-level and fitted with reflectors to avoid light spillage.

7.3 KEY BIOPHYSICAL CONSIDERATIONS

- Multiple boreholes should be used for shorter durations during construction and operation in order to reduce the extent of the radius of influence.
- Disturbed areas are to be rehabilitated after construction with suitable indigenous plant species. A suitably experience rehabilitation / landscaping contractor should be appointed to compile a rehabilitation plan for those areas damaged by construction activities.
- The option of establishing an Environmental Rehabilitation Trust Fund to cover the costs of decommissioning and rehabilitation of disturbed areas should be investigated. The Trust Fund could be funded by a percentage of the revenue generated from the sale of energy over the 20-year operational life of the facility.
- An avifaunal monitoring programme is to be established for the first 12 months of operation in order to contribute to the research database. Details of the monitoring programme are included in the EMP.
- The establishment of invasive alien vegetation on site, particularly within the drainage channels, is to be monitored and removed on an ongoing basis.

7.4 KEY SOCIO-ECONOMIC CONSIDERATIONS

Employment and training

- Where reasonable and practical, a 'locals first' employment policy should be implemented, especially for semi- and low-skilled job categories, during the construction and operation phases. Details of the proposed employment policy are included in the EMP.
- Local contractors/sub-contractors with BEE criteria should be considered for appointment. A database of local companies which qualify as potential service providers should be developed prior to the commencement of the construction tender process. These companies should be notified of the tender process and invited to bid for project-related work.
- Training and skills development programmes for locals during the construction and operation phases should be implemented.

Transport

- The option of using rail to transport components and equipment to De Aar from Cape Town, Durban and Johannesburg should be investigated.

Establishment of a Community Trust

- Opportunities for establishing a Community Trust should be investigated, in consultation with the ELM. The following should be investigated and implemented:
  - > The criteria for identifying and funding community projects and initiatives in the area should be investigated. The criteria should be aimed at maximising the benefits for the community as a whole and not individuals within the community; and
  - > Strict financial management controls, including annual audits, should be implemented to ensure that the funds generated for the Community Trust from the proposed project are managed for benefit of the community as a whole.

Tourism

- The option of establishing a renewable energy interpretation centre at entrance to the site should be investigated. The centre should include a viewing area where passing visitors can stop and view the site.

7.5 KEY HERITAGE CONSIDERATIONS

- A basic heritage management plan must be implemented prior to and during construction. The specifics of this plan have been included in the EMP.

7.6 LICENCE AND PERMIT REQUIREMENTS

- Water use licence applications must be submitted to the Department of Water Affairs (Northern Cape Regional Office) in order to:
  - > confirm the need for a Water Use Licence for altering the bed and banks of a watercourse (Water Use Activity 21i) for the access roads; and
  - > apply for the abstraction and use of groundwater during construction and operation.
- A sampling permit must be obtained from the South African Heritage Resources Agency prior any sampling required as per the heritage management plan.
- A permit must be obtained from the relevant Provincial Authority for any abnormal loads (e.g. inverter buildings and transformers).

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BID	Background Information Document
CCA	CCA Environmental (Pty) Ltd
CPA	Communal Property Association
CDM	Clean Development Mechanism
DEA	Department of Environmental Affairs
DEA&DP	Department of Environmental Affairs & Development Planning
DSR	Draft Scoping Report
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EIR	Environmental Impact Report
EMC	Environmental Management Committee
EMP	Environmental Management Programme
FSR	Final Scoping Report
GHG	Greenhouse Gas
I&APs	Interested and Affected Parties
IDP	Integrated Development Plan
IRP	Integrated Resource Plan
MWp AC	Peak megawatt alternating current
NEMA	National Environmental Management Act
NHRA	National Heritage Resources Act
RVA	RV & Associates
SDF	Spatial Development Framework

1. INTRODUCTION

This chapter describes the purpose of this report, provides background to the proposed project, presents the Terms of Reference for this study, identifies the assumptions and limitations, describes the need and desirability and explains the report structure. It also presents the way forward in the Scoping and Environmental Impact Assessment (EIA) process and describes the opportunity for comment.

1.1 PURPOSE OF THIS REPORT

This Final Environmental Impact Report (EIR) has been compiled as part of a Scoping and EIA process that is being undertaken for the proposed De Aar Solar One Photovoltaic Power Project located outside De Aar in the Northern Cape (see Figure 1.1). It summarises the process followed to date, provides a description of the proposed project, addresses the issues raised by Interested and Affected Parties (I&APs) during the Scoping Study, presents the findings of the specialist studies and provides an environmental assessment of the potential impacts of the proposed project. The compilation of this report has also been informed by comments received during the comment period on the Draft EIR. All comments received on the Draft EIR have been collated in a Comments and Responses Report, which is included as Appendix 2.4 of this report. It should be noted that all significant changes to the original Draft EIR are underlined and in a different font (Times New Roman) to the rest of the text.

This report will be submitted to the Department of Environmental Affairs (DEA) for consideration and decision-making at the same time it is released for public review and comment (see Section 1.6). Any comments received on the Final EIR will be forwarded directly to DEA for consideration.

1.2 BACKGROUND TO THE PROPOSED PROJECT

Business Venture Investments 1421 (Pty) Ltd is proposing to develop the De Aar Solar One Photovoltaic Power Project on Portion 3 of Farm Hartebeestplaats 135. RV & Associates (RVA) was appointed to prepare the preliminary design of the proposed photovoltaic power plant and associated infrastructure. In summary, the proposed photovoltaic power plant would consist of a 25 to 30 megawatt peak alternating current (MWp AC) plant (capacity is subject to the final choice of technology). The proposed plant would be connected to the existing Eskom Hydra substation via a 132 kilovolt (kV) overhead power line of approximately 2 to 2.5 km long.

The proposed development is a listed activity in terms of the EIA Regulations 2010 promulgated in terms of Chapter 5 of the National Environmental Management Act, 1998 (No. 107 of 1998) (NEMA), as amended, and a Scoping and EIA process is required in order for DEA to consider the application in terms of NEMA.

Business Venture Investments 1421 (Pty) Ltd has appointed CCA Environmental (Pty) Ltd (CCA) as the independent environmental assessment practitioner (EAP) to undertake a Scoping and EIA process for the proposed project.

1.3 TERMS OF REFERENCE

The Terms of Reference for the Scoping and EIA are to:

- Undertake a formal public participation process, which specifically addresses the distribution of information to I&APs; provide an opportunity for I&APs to raise any concerns or issues and to provide an opportunity for I&APs to comment on draft and final reports;

- Undertake the necessary specialist studies to address and assess key concerns or issues identified during the Scoping Study;
- Integrate all the information into an EIR to allow an informed decision to be taken concerning the proposed project; and
- Ensure that the study complies with the requirements of NEMA and the EIA Regulations 2010.

1.4 ASSUMPTIONS AND LIMITATIONS

The Scoping and EIA process assumptions and limitations are listed below:

- The Scoping and EIA process assumes that CCA has been provided with all relevant project description information by the project team and that it was correct, technically feasible and valid at the time it was provided;
- There will be no significant changes to the project description or surrounding environment between the completion of the Scoping and EIA process and the implementation of the proposed project that could substantially influence the findings, recommendations with respect to mitigation and management, etc.;
- Specialists have been provided with all the relevant information in order to produce accurate and unbiased assessments; and
- The Scoping and EIA process assumes that all recommended mitigatory measures would be implemented as proposed.

1.5 NEED AND DESIRABILITY

In terms of Regulation 8 of the EIA Regulations 2010, DEA must take the need for and desirability of a proposed activity into consideration, amongst other things, when considering an Application for Authorisation. The concept of “need and desirability” can essentially be equated to the wise, sustainable use of land (i.e. is this the right time and is it the right place for locating the type of land-use/activity being proposed?). The consideration of “need and desirability”, therefore, requires the consideration of the strategic context of the development proposal along with the broader societal needs and the public interest (DEA&DP, 2010).

The sections below consider the context within which the “need and desirability” of the proposed activity should be considered. Specific questions as set out in the Department of Environmental Affairs and Development Planning (DEA&DP) Need and Desirability Guideline are responded to in Table 1.1.

1.5.1 THE NEED FOR RENEWABLE ENERGY IN SOUTH AFRICA

Energy is critical to virtually every aspect of the economic and social development of South Africa. Providing affordable, adequate and reliable modern energy supplies to most South Africans remains a major challenge. South Africa is faced with a situation in which the demand for electricity continues to grow within a supply-constrained environment.

The investment in renewable energy and energy efficiency is considered important to reduce the negative economic, social and environmental impacts of energy production and consumption in South Africa (Winkler, 2005). Many renewable energy projects are particularly well suited to off-grid applications and, certainly in South Africa, could improve the flexibility of the grid by distributing generation across the country, closer to some key loads (Winkler, 2005). In addition, renewable energy would provide a cleaner source of energy compared to coal (see Section 1.5.4).

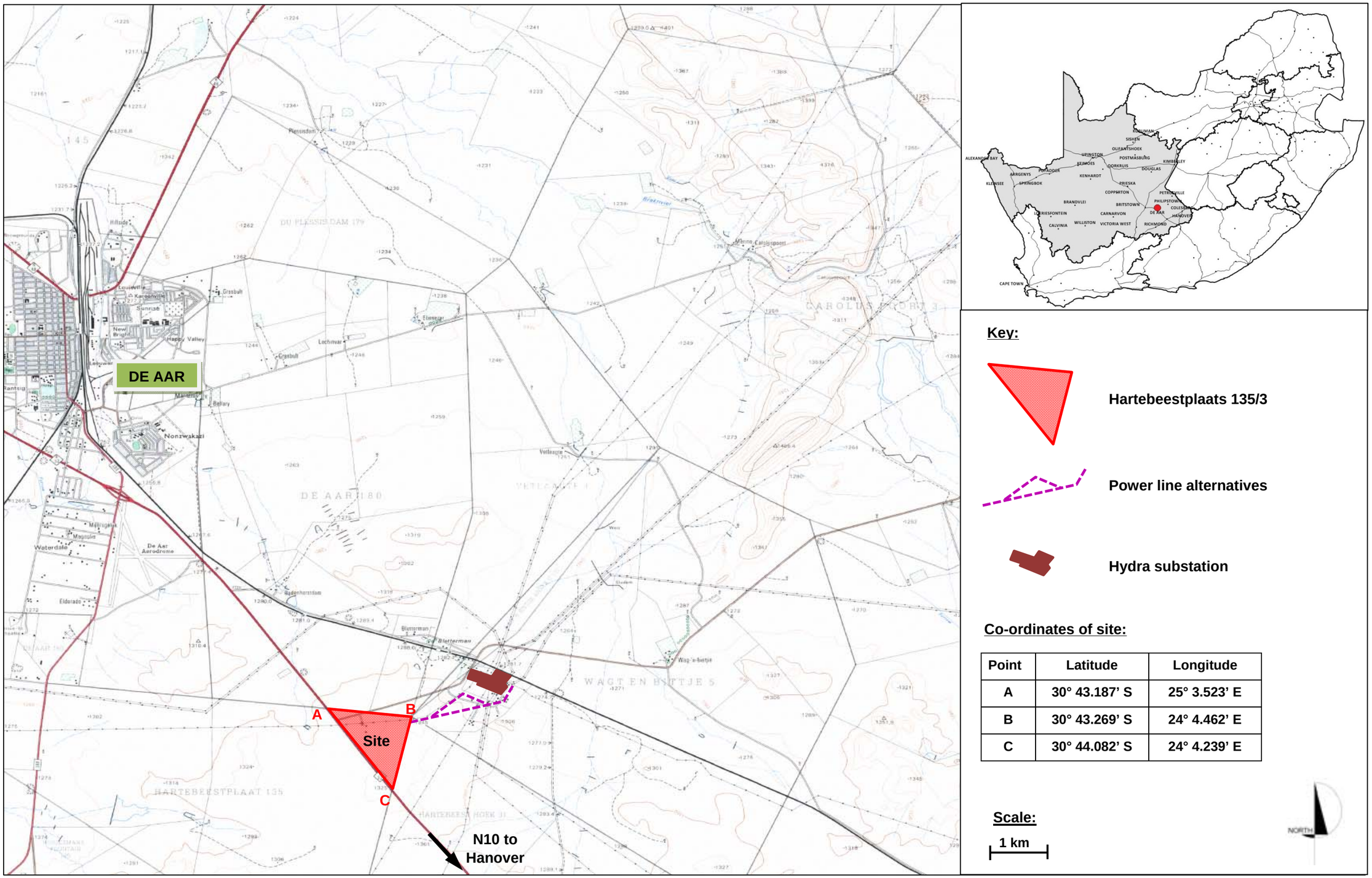


Figure 1.1: **1:50 000 Map extract showing the location of the proposed De Aar Solar One Photovoltaic Power Plant on Portion 3 of Farm Hartebeestplaats 135 near De Aar, Northern Cape. The proposed power line alternatives are also shown.**

1.5.2 LEGISLATIVE SUPPORT

A review of the relevant legislation, policies and documents pertaining to the energy sector indicate that solar energy and the establishment of photovoltaic power plants are supported at a national, provincial and local level.

1.5.2.1 *National Energy Act, 2008*

One of the objectives of the National Energy Act, 2008 (No. 34 of 2008) is to promote diversity of supply of energy and its sources. In this regard, the preamble makes direct reference to renewable resources, including solar (see extract below).

"The ensure that diverse energy resources are available, in sustainable quantities, and at affordable prices, to the South African economy, in support of economic growth and poverty alleviation, taking into account environmental management requirements …; to provide for … increased generation and consumption of renewable energies …"

1.5.2.2 *White Paper on the Energy Policy of the Republic of South Africa (1998)*

Investment in renewable energy initiatives, such as the proposed De Aar Solar One Photovoltaic Power Project, is supported by the White Paper on Energy Policy for South Africa. In this regard the document notes:

"Government policy is based on an understanding that renewables are energy sources in their own right, are not limited to small-scale and remote applications, and have significant medium and long-term commercial potential".

"Renewable resources generally operate from an unlimited resource base and, as such, can increasingly contribute towards a long-term sustainable energy future".

The support for renewable energy policy is guided by a rationale that South Africa has a very attractive range of renewable resources, particularly solar and wind, and that renewable applications are in fact in most cases the most cost effective; more so when social and environmental costs are taken into account.

Government policy on renewable energy is thus concerned with meeting the following challenges:

- Ensuring that economically feasible technologies and applications are implemented;
- Ensuring that an equitable level of national resources is invested in renewable technologies, given their potential and compared to investments in other energy supply options; and
- Addressing constraints on the development of the renewable industry.

The White Paper also acknowledges that South Africa has neglected the development and implementation of renewable energy applications, despite the fact that the country's renewable energy resource base is extensive and many appropriate applications exist.

The White Paper also notes that renewable energy applications have specific characteristics that need to be considered. Advantages include:

- Minimal environmental impacts in operation in comparison with traditional supply technologies; and
- Generally lower running costs and high labour intensities.

Disadvantages include:

- Higher capital costs in some cases;
- Lower energy densities; and
- Lower levels of availability, depending on specific conditions, especially with sun and wind based systems.

1.5.2.3 *White Paper on Renewable Energy (2003)*

The White Paper on Renewable Energy (2003) recognises that the medium- and long-term potential of renewable energy is significant. Government's long-term goal is the establishment of a renewable energy industry producing modern energy carriers that will offer in future years a sustainable, fully non-subsidised alternative to fossil fuels. In the White Paper, the South African Government recognised the country's high level of renewable energy potential and set a medium-term (10-year) target of 10 000 gigawatt (GW) hours of renewable energy by 2013 (to be produced mainly from biomass, wind, solar and small-scale hydro). This is approximately 4% (1 667 MW) of the total estimated electricity demand (41 539 MW) for 2013.

1.5.2.4 *Integrated Resource Plan 2010 (IRP 2010)*

In May 2011, the Department of Energy (DoE) gazetted the Electricity Regulations on New Generation Capacity in terms of the Electricity Regulation Act, 2006 (No. 4 of 2006) (ERA). In terms of the New Generation Regulations the Integrated Resource Plan (IRP) was developed by the DoE. The objective of the IRP 2010 is to develop a sustainable electricity investment strategy for generation capacity and transmission infrastructure for South Africa over the next 25 years. The IRP 2010 is intended to, *inter alia*, consider environmental and other externality impacts and the effect of renewable energy technologies.

The IRP 2010 sets out the new generation capacity requirements per technology, taking energy efficiency and the demand-side management projects into account. This required new generation capacity must be met through the technologies and projects listed in the IRP and all Independent Power Producer (IPP) procurement programmes will be undertaken in accordance with the specified capacities and technologies listed in the IRP.

The IRP 2010 allocates 43% of new energy generation facilities in South Africa to renewables. The IRP 2010 allows for an additional 14 749 MW of renewable energy in the electricity blend in South Africa by 2030. While there are a number of renewable energy options (including, *inter alia*, wind, solar and hydropower) being pursued in South Africa, many more renewable energy projects are required to meet the targets set by the IRP 2010.

With regards to photovoltaic solar energy the IRP 2010 expresses the need for firm commitment to this sector in order to facilitate the connection of the first units to the grid in 2012. It also identifies the need to provide security of investment in order to ramp up a sustainable local industry cluster.

One of the key conclusions of the IRP 2010 is that an accelerated roll-out of renewable energy options should be allowed in order to derive the benefits of localisation in these technologies. The proposed project, which is an IPP project, would contribute towards meeting the national energy target as set by the DoE, of a 30% share of all new power generation being derived from IPPs.

1.5.2.5 *Northern Cape Provincial Growth and Development Strategy (2004-2014)*

At a provincial level the Northern Cape Provincial Growth and Development Strategy (NCPGDS) makes reference for the need to ensure the availability of inexpensive energy for the Northern Cape. The NCPGDS notes that in order to promote economic growth in the Northern Cape the availability of electricity to key industrial users at critical localities at rates that enhance the competitiveness of their industries must be ensured. At the same time, the development of new sources of energy through the promotion of the adoption of energy applications that display a synergy with the province's natural resource endowments must be encouraged. In this regard the NCPGDS notes "*the development of energy sources such as solar energy, the natural gas fields, bio-fuels, etc., could be some of the means by which new economic opportunity and activity is generated in the Northern Cape*". The NCPGDS also highlights the importance of close co-operation between the public and private sectors in order for the economic development potential of the Northern Cape to be realised.

The NCPGDS also highlights the importance of enterprise development and noted that current levels of private sector development and investment in the Northern Cape are low. It also noted that the Northern Cape lags in the key policy priority areas of small, medium and micro enterprise (SMME) development and Black Economic Empowerment. The proposed project has the potential to create opportunities to promote private sector investment and the development of SMMEs in the Northern Cape.

1.5.2.7 *Northern Cape Climate Response Strategy*

The Northern Cape Government is in the process of finalising a Provincial Climate Change Response Strategy. The key aspects of this strategy are, however, summarised in the MEC's (Northern Cape Provincial Government: Environment and Nature Conservation) 2011 budget speech.

Key points from the MEC's speech included the Northern Cape Provincial Government's commitment to develop and implement policy in accord with the National Green Paper for the National Climate Change Response Strategy (2010) and an acknowledgement of the Northern Cape Province's extreme vulnerability to climate-change driven desertification. The renewable energy sector, including solar and wind energy (but also biofuels and energy from waste), is explicitly identified as an important element of the Provincial Climate Change Response Strategy (www.info.gov.za/speech/DynamicAction?pageid=461&sid=22143&tid=45200).

1.5.2.8 Northern Cape Provincial Spatial Development Framework (2011)

The Northern Cape Provincial Spatial Development Framework (2011) notes that the Northern Cape Province's major energy challenges include securing energy supply to meet growing demand, providing everybody with access to energy services and tackling the causes and impacts of climate change. In this regard, the development of large-scale renewable energy supply schemes is strategically important for increasing the diversity of domestic energy supplies for the Northern Cape Province and avoiding energy imports while minimising the environmental impacts. The Provincial Spatial Development Framework further notes that renewable energy has been identified as a mechanism to diversify the economy and thereby promoting a green economy in the province.

The Provincial Spatial Development Framework also notes that the tourism sector is identified as one of the key sectors with the capacity to 'grow, transform and diversify the provincial economy'. Care therefore needs to be taken to ensure that the development of large renewable energy projects, such as the proposed project; do not affect the tourism potential of the Province.

1.5.2.9 Pixley ka Seme District Municipality Integrated Development Plan (IDP) (2009-2012)

According to the Pixley ka Seme District Municipality IDP, a key development objective is to provide access to electricity to all households in the District by 2014. To achieve this, the District Municipality aims to fast track the delivery of free basic electricity and co-ordinate the maintenance and upgrading of the existing electricity infrastructure. While no specific mention is made of the promotion of alternative energy sources, the proposed project would potentially support a number of the development goals and objectives of the District.

1.5.2.10 District Renewable Energy Hub (Draft Concept Document)

The Local Economic Development Division of the Pixley ka Seme District Municipality has proposed the development of a Renewable Energy Hub along the N10 corridor and around the town of De Aar. The proposal is set out in a District Renewable Energy Hub Draft Conceptual Document (26 February 2010). The draft concept document outlines the proposed strategy, which is in line with both the National and Provincial policy with respect to renewable energy generation.

The draft concept document indicates that the District is well positioned for renewable energy development (including solar, wind, biomass and hydro-electric) due to the ample availability of suitable land, the existence of adequate existing infrastructure (particularly with respect to the existing railway hub) to facilitate the growth of the industrial and manufacturing sectors, exposure to high insolation rates and steady winds, as well as access to both surface and groundwater resources.

The Renewable Energy Hub is seen as a critical component to the revitalisation of both the broader District and the town of De Aar. In this regard, it is envisaged that the Hub will attract both local and foreign investors and research institutions, which, in turn, will help to alleviate the increasing demand on electricity nationally, as well as South Africa's dependence on fossil fuel. In addition, the Hub will create employment and downstream business opportunities for local entrepreneurs.

The establishment of the proposed project has the potential to support a number of key strategies in the draft concept document.

1.5.2.11 *Emthanjeni Local Municipality IDP*

At a local level the Emthanjeni Local Municipality (ELM) IDP lists a number of industrial and manufacturing projects that form part of the larger strategy for the economic development of the municipality. One of these projects includes the establishment of De Aar as a Renewable Energy Hub. Basic service delivery, with energy as one of the priority issues, micro- and macro-economic development, as well as land use management have been highlighted as key performance areas to be addressed within the ELM. The establishment of the proposed project has the potential to support a number of key strategies in the ELM IDP.

1.5.3 UTILISATION OF AVAILABLE RESOURCES

Although South Africa is currently highly dependent on the burning of fossil fuels (about 77% of the country's primary energy needs provided by coal), the country is subject to some of the highest levels of solar radiation in the world, with an average daily solar radiation that varies between 4.5 and 6.5 kilowatt hours per square meter (kWh/m^2) (see Figure 1.2). Government has committed to invest in renewable energy initiatives and to

the efficient use of available resources. It is also committed to broadening the energy mix, thereby moving away from being fossil-dominated to a more balanced combination, which places a high premium on the use of more efficient technologies and renewable-energy resources.

As can be seen in Figure 1.2, areas of the Northern Cape, and the area around De Aar in particular, have some of the highest solar radiation intensities in South Africa.

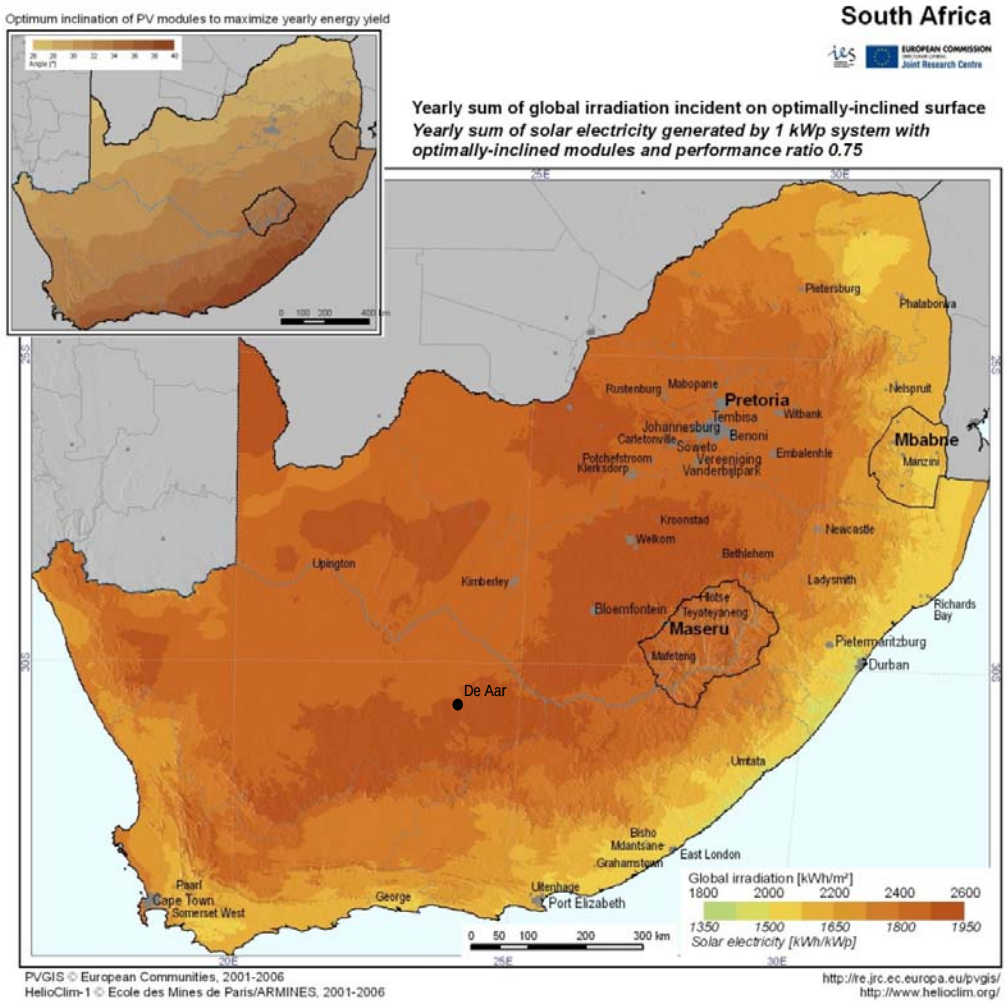


Figure 1.2 Annual solar irradiation levels for South Africa (HelioClim).

1.5.4 NATIONAL EMISSION TARGETS

Depending on the way electricity is produced, transported and used, it can contribute to both local environmental degradation, such as air pollution, and global environmental problems, principally climate change (Winkler, 2005).

South Africa is among the top 20 emitters of greenhouse gases in the world and is the largest emitter in Africa, largely because of the economy's dependence on fossil fuels. The Energy Minister Dipuo Peters has indicated that although South Africa will probably continue to make use of coal as its primary source of energy, it will increasingly explore clean energy initiatives as it moves towards a lower-carbon economy (http://www.southafrica.info/cop17/coal-201211.htm).

Renewable energy can contribute to reductions in local air pollution, with co-benefits of reducing emissions of greenhouse gases which contribute to climate change. Although the South African economy depends greatly on fossil fuels for energy generation and consumption, the Government has indicated South Africa needs to proactively move the economy towards becoming less carbon-intensive (http://www.info.gov.za/aboutsa/energy.htm). It has developed the White Paper on Renewable Energy and Clean Energy Development, together with an energy-efficiency programme, to support diversification in pursuit of a less carbon-intensive energy economy.

At the 17th Conference of the Parties (COP 17) to the United Nations Framework Convention on Climate Change (UNFCCC), which took place in Durban from 28 November to 9 December 2011, Energy Minister Dipuo Peters maintained, however, that the government was committed to reducing the country's total carbon emissions, citing President Jacob Zuma's pledge in Copenhagen two years ago that South Africa would reduce greenhouse gas emissions by 34% over the next decade and by 42% by 2025.

1.5.5 BENEFITS

Renewable energy is recognised internationally as a major contributor in protecting the climate, nature and the environment, as well as providing a wide range of environmental, economic and social benefits that can contribute towards long-term global sustainability. The proposed project would contribute to aligning local policies with internationally agreed strategies and standards as set by the UNFCCC, Kyoto Protocol[1], and United Nations Convention on Biological Diversity (UNCBD) all of which South Africa is a signatory. Business Venture Investments 1421 (Pty) Ltd proposes to register the project as a Clean Development Mechanism (CDM) project with dual objectives:

- To help developed countries fulfill their commitments to reduce emissions; and
- To assist developing countries in achieving sustainable development.

Once the project is registered as a CDM project it would generate greenhouse gas (GHG) emission reductions (carbon credits) as soon as it starts commercial operation. The sale of carbon credits would generate an additional income for the proposed project.

Locally, the establishment of the proposed project would strengthen the existing electricity grid for the area, providing power in a short space of time (potentially less than two years to commissioning). Should the proposed project be approved it would result in long-term benefits for the De Aar area. The project would create between 200 and 300 employment opportunities during the construction phase and between 30 and 40 employment opportunities during the operational phase.

[1] The **Kyoto Protocol** is a protocol to the United Nations Framework Convention on Climate Change (UNFCCC), aimed at fighting global warming. The UNFCCC is an international environmental treaty with the goal of achieving "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system."[I]The Protocol was initially adopted on 11 December 1997 in Kyoto, Japan and entered into force on 16 February 2005. As of November 2009, 187 states have signed and ratified the protocol (Wikipedia).

Table 1.1: Questions included in the DEA&DP Need and Desirability Guideline document and responses related to the proposed De Aar Solar One Photovoltaic Power Project.

NEED	RESPONSE
1. Is the land use (associated with the activity applied for) considered within the timeframe intended by the existing approved Spatial Development Framework (SDF) agreed to by the relevant environmental authority, i.e. is the proposed development in line with the projects and programmes identified as priorities within the IDP?	Yes. The property is currently zoned for agricultural use. For the project to be realised, the Applicant would lease the land and apply for rezoning of the property. The proposed project would contribute to the economic stability of the area by establishing a sustainable industry on a property that has low agricultural potential. At a provincial level, the Northern Cape Provincial Spatial Development Framework (see Section 1.5.2.8) notes that the Northern Cape Province's major energy challenges include securing energy supply to meet growing demand, providing everybody with access to energy services and tackling the causes and impacts of climate change. In this regard, the development of large-scale renewable energy supply schemes is strategically important for increasing the diversity of domestic energy supplies for the Northern Cape Province and avoiding energy imports while minimising the environmental impacts. The PSDF further notes that renewable energy has been identified as a mechanism to diversify the economy and thereby promoting a green economy in the province. The Northern Cape Provincial Growth and Development Strategy (NCPGDS) (see Section 1.5.2.5) states that the development of new sources of energy through the promotion of the adoption of energy applications that display a synergy with the province's natural resource endowments must be encouraged. In this regard the NCPGDS notes that the development of energy sources such as solar energy could be a means by which new economic opportunity and activity is generated in the Northern Cape. The NCPGDS also highlights the importance of close co-operation between the public and private sectors in order for the economic development potential of the Northern Cape. The ELM IDP lists a number of industrial and manufacturing projects that form part of the larger strategy for the economic development of the municipality. One of these projects includes the establishment of De Aar as a Renewable Energy Hub. Basic service delivery, with energy as one of the priority issues, micro- and macro-economic development as well as land use management have been highlighted as key performance areas to be addressed within the ELM. The establishment of the proposed photovoltaic power plant has the potential to support a number of key strategies in the ELM IDP. The proposed project would create 200 to 300 employment opportunities (mainly unskilled and semi-skilled) during the construction phase and between 30 and 40 during the operational phase. A large number of the workforce would be sourced from the surrounding areas. Specific training would also be provided for more technical tasks.

NEED	RESPONSE
2. Should development, or if applicable, expansion of the town/area concerned in terms of this land use (associated with the activity applied for) occur at this point in time?	Yes, the ELM IDP recognises the need for economic growth and the creation of employment opportunities for local people.
3. Does the community/area need the activity and the associated land use concerned (is it a societal priority)?	Yes, the area has an unemployment rate of 26% (Census 2001 data) and the site is not currently suitable for profitable agricultural activities. The proposed project would create a relatively large number of temporary and permanent (for the lifespan of the project) employment opportunities for the local De Aar community. The area around De Aar has also been identified as a Renewable Energy Hub in the ELM IDP.
4. Are there necessary services with appropriate capacity currently available (at the time of application) or must additional capacity be created to cater for the development?	The proposed project would strengthen the local electricity grid for the area and thus improve the available electrical services. In terms of water requirements, the proposed project would utilise groundwater from existing boreholes on the property. Depending on availability, additional boreholes may be required.
5. Is this development provided for in the infrastructure planning of the municipality, and if not, what will the implication be on the infrastructure planning of the municipality (priority and placements of services)?	No. The proposed project would, however, not require any major municipal services during its operational phase.
6. Is this project part of a national programme to address an issue of national concern or importance?	Yes. The proposed project would strengthen the local electricity grid for the area and contribute to meeting the national renewable energy targets set by the Department of Energy (DoE).
DESIRABILITY	**RESPONSE**
1. Is the development the best practicable environmental option for this land/site?	Yes. Due mainly to the prevailing unfavourable climatic conditions for arable agriculture, as well as the prevalence of soils with limited depth, the farm does not have a high agricultural potential. The size of the property also does not allow for large-scale profitable agricultural activities. The close proximity of the site to the Hydra substation also makes it ideal for the proposed project.
2. Would the approval of this application compromise the integrity of the existing approved Municipal IDP and SDF as agreed to by the relevant authorities?	No. The proposed project is in line with the initiatives of the ELM IDP to support economic growth, create job opportunities for local communities and establish De Aar as a Renewable Energy Hub.
3. Would the approval of this application compromise the integrity of the existing environmental management priorities for the area (e.g. as defined in EMFs), and if so, can it be justified from in terms of sustainability considerations?	No. The ELM does not have an EMF in place.
4. Do location factors favour this land use (associated with the activity applied for) at this place?	Yes. The site was selected based on the following criteria: • The high solar irradiation levels recorded for the area (see Figure 1.2); • Existing available infrastructure, i.e. roads, proximity to the Hydra substation; • Horizons, gradient, slope orientation; • Soil quality and conditions; and • Accessibility.
5. How will the activity or the land use associated with the activity applied for, impact on sensitive natural and cultural areas (built and rural/natural environment)?	Potential impacts associated with the proposed project are assessed in Chapter 5.
7. Will the proposed activity or the land use associated with the activity applied for, result in unacceptable opportunity costs?	No. Potential impacts associated with the proposed project are assessed in Chapter 5.
8. Will the proposed land use result in unacceptable cumulative impacts?	No. Potential cumulative impacts associated with the proposed project are assessed in Section 5.6.

1.6 COMMENT ON THE FINAL EIR AND WAY FORWARD IN THE EIA PROCESS

This Final EIR has been distributed for a 30-day review / comment period from **13 August 2012 to 12 September 2012** in order to provide I&APs and authorities with an opportunity to comment on any aspect of the EIA and the proposed project. Copies of the full report have been made available at the following locations:

1. De Aar Public Library, 27 Station Street, De Aar; and
2. On the CCA website www.ccaenvironmental.co.za.

Any written comments on the Final EIR must be submitted directly to DEA, and copied to CCA, by **no later than 12 September 2012**. Contact details of both DEA and CCA are presented below.

Director: Environmental Impact Evaluation Department of Environmental Affairs Private Bag X447 PRETORIA, 0001 Tel: (012) 310 3911 / 395 1694 Fax: (012) 320 7539 E-mail: nnkosi@environment.gov.za Attention Nyiko Nkosi Reference: 12/12/20/2313 NEAS Reference: DEA/EIA/0000362/2012	CCA Environmental (Pty) Ltd PO Box 10145 Caledon Square, 7905 Tel: (021) 461 1118 / 9 Fax: (021) 461 1120 E-mail: jeremy@ccaenvironmental.co.za Attention: Jeremy Blood

Any comments received on the Final EIR will be forwarded directly to DEA for consideration. After DEA has reached a decision, all I&APs registered on the project database will be notified of the outcome of the application and the reasons for the decision. A statutory Appeal Period in terms of Chapter 7 of the EIA Regulations 2010 will follow the issuing of the decision.

1.7 STRUCTURE OF THIS REPORT

This report consists of seven chapters, the contents of which are outlined below.

Section	Contents
Executive Summary	Provides an overview of the main findings of the EIR.
Chapter 1	**Introduction** Describes the purpose of this report, provides background to the proposed project, presents the Terms of Reference for this study, identifies the assumptions and limitations, describes the need and desirability and explains the report structure. It also presents the way forward in the Scoping and EIA process and describes the opportunity for comment.
Chapter 2	**EIA approach and methodology** Covers the legislative requirements of the Scoping and EIA process, describes the objectives of the study and presents the Scoping Study and EIA process undertaken.
Chapter 3	**Project description** Provides a description of the proposed project, including the proposed photovoltaic power plant and related infrastructure, and alternatives.
Chapter 4	**Description of the affected environment** Describes the existing biophysical and social environment that could be affected by the proposed project.

Section	Contents
Chapter 5	**Impact description and assessment** Describes and assesses the potential impacts of the proposed project alternatives on the socio-economic and biophysical environment. It also presents mitigation or optimisation measures that could be used to reduce the significance of any negative impacts or enhance any benefits, respectively.
Chapter 6	**Conclusions and recommendations** Provides conclusions to the EIA and summarises the recommendations for the proposed project.
Chapter 7	**References** Provides a list of the references used in compiling this report.
Appendices	Appendix 1: DEA acceptance of Final Scoping Report Appendix 2: Public Participation Process Appendix 2.1: I&AP Database Appendix 2.2: I&AP Notification letters Appendix 2.3: Written comments Appendix 2.4: Comments and Responses Report Appendix 3: Convention for assigning significance ratings of impacts Appendix 4: Specialist Studies Appendix 4.1: Botanical Impact Assessment Appendix 4.2: Terrestrial Faunal Assessment Appendix 4.3: Freshwater Assessment Appendix 4.4: Groundwater Assessment Appendix 4.5: Soil and Agricultural Potential Assessment Appendix 4.6: Social Impact Assessment Appendix 4.7: Visual Impact Assessment Appendix 4.8: Heritage Impact Assessment Appendix 5: Title Deed Appendix 6: Environmental Management Programme

2. EIA APPROACH AND METHODOLOGY

This chapter outlines the key legislative requirements and guiding principles underpinning the Scoping and EIA and outlines the methodology and I&AP participation process followed in the study.

2.1 LEGISLATIVE REQUIREMENTS

2.1.1 NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998, AND EIA REGULATIONS 2010

Section 2 of NEMA sets out a range of environmental principles that are to be applied by all organs of state when taking decisions that significantly affect the environment. Included amongst the key principles is that all development must be socially, economically and environmentally sustainable and that environmental management must place people and their needs at the forefront of its concern, and serve their physical, psychological, developmental, cultural and social interests equitably. NEMA also provides for the participation of I&APs and stipulates that decisions must take into account the interests, needs and values of all I&APs.

Chapter 5 of NEMA outlines the general objectives and implementation of Integrated Environmental Management (IEM), which provides a framework for the integration of environmental issues into the planning, design, decision-making and implementation of plans and development proposals. Section 24 provides a framework for granting of environmental authorisations. In order to give effect to the general objectives of IEM, the potential impacts on the environment of listed activities must be considered, investigated, assessed and reported on to the competent authority. Section 24(4) provides the minimum requirements for procedures for the investigation, assessment and communication of the potential impact of activities.

The EIA Regulations 2010 promulgated in terms of Chapter 5 of NEMA and published in Government Notice (GN) No. R543 provides for the control of certain listed activities. These activities are listed in GN No. R544 (Listing Notice 1), R545 (Listing Notice 2) and R546 (Listing Notice 3) of 18 June 2010, and are prohibited until environmental authorisation has been obtained from the competent authority. Such environmental authorisation, which may be granted subject to conditions, will only be considered once there has been compliance with GN No. R543.

GN No. R543 sets out the procedures and documentation that need to be complied with when applying for environmental authorisation. A *Basic Assessment* process must be applied to an application if the authorisation applied for is in respect of an activity(ies) listed in GN No. R544 and / or R546 and a *Scoping and EIA* process must be applied to an application if the authorisation applied for is in respect of an activity(ies) listed in GN No. R545. Since the proposed project includes activities listed in all three GNs (see Table 2.1), it is necessary that a Scoping and EIA process be undertaken in order for DEA to consider the application in terms of NEMA. It should be noted that the listed activities applicable to the proposed project and presented in Table 2.1 are slightly different to those presented in the Application Form, submitted to DEA in June 2011, due to a change in the project scope, as well as the information obtained from the site visit and specialist reports.

Table 2.1: List of applicable activities in terms of GN R544, R545 and R546.

Activity No.	Activity Description	Description of activity in relation to the proposed project
GN No. 544		
10	*The construction of facilities or infrastructure for the transmission and distribution of electricity (i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts …*	The proposed project includes the construction of a 132 kV power line from the proposed photovoltaic power plant to Eskom's existing Hydra substation.

Activity No.	Activity Description	Description of activity in relation to the proposed project
11	*The construction of: (x) buildings exceeding 50 m^2 in size; and (xi) infrastructure or structures covering 50m^2 or more, where such construction occurs within a watercourse or within 32 m of a watercourse, measured from the edge of the watercourse ...*	Some of the proposed infrastructure (e.g. modules, pylons, internal access roads, etc.) would be located within 32 m of a watercourse / drainage line.
GN No. 545		
1	*The construction of facilities or infrastructure for the generation of electricity where the electricity output is 20 megawatts (MW) or more*.	The proposed project would entail the construction of a photovoltaic power plant with a capacity of 25 to 30 MWp AC.
15	*Physical alteration of undeveloped, vacant or derelict land for residential, retail, commercial, recreational, industrial or institutional use where the total area to be transformed is 20 hectares or more..*	The proposed project would entail the construction of a photovoltaic power plant that would transform an area of between 75 and 80 ha.
GN No. 546		
14	*The clearance of an area of 5 hectares or more of vegetation where 75 % or more of the vegetation cover constitutes indigenous vegetation, …* *(a) in the Northern Cape* *(i) All areas outside urban areas.*	The proposed project is located outside the urban edge and would involve the clearance of more than 5 ha of indigenous vegetation.

2.1.2 NATIONAL HERITAGE RESOURCES ACT, 1999

Section 38(1) of the National Heritage Resources Act, 1999 (No. 25 of 1999) (NHRA) lists development activities that would require authorisation by the responsible heritage resources authority. Activities considered applicable to the proposed project are presented in Table 2.2:

Table 2.2: List of applicable activities in terms of Section 38(1) of the National Heritage Resources Act, 1999.

Activity No.	Activity Description	Description of activity in relation to the proposed project
38(1)(a)	*The construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300 m in length*	The proposed project would include the construction of power lines and roads exceeding 300 m in length.
38(1)(c)	*Any development or other activity which will change the character of a site:* *(i) exceeding 5 000 m^2 in extent; or* *(ii) involving three or more existing erven or subdivisions thereof*	The proposed photovoltaic power plant would change the character the site in excess of 5 000 m^2.
38(1)(d)	*The re-zoning of a site exceeding 10 000 m^2 in extent*	The property would be rezoned to *Special* or other appropriate zoning in terms of the Northern Cape Planning and Development Act, 1998.

The NHRA requires that a person who intends to undertake a listed activity notify the relevant provincial heritage authority at the very earliest stages of initiating such as development. The relevant provincial heritage authority would then in turn, notify the person whether a Heritage Impact Assessment should be submitted. However, according to Section 38(8) of the NHRA, a separate report would not be necessary if an evaluation of the impact of such development on heritage resources is required in terms of the Environment Conservation Act (now replaced by NEMA) or any other applicable legislation. The decision-making authority should, however, ensure that the heritage evaluation fulfils the requirements of the NHRA and take into account in its decision-making any comments and recommendations made by the relevant heritage resources authority.

In terms of Section 34(1) of the Act, no person may, without a permit issued by the responsible heritage resources authority, alter or demolish any structure or part of a structure which is older than 60. In terms of Section 35(4) of the Act, no person may, without a permit issued by the responsible heritage resources authority, destroy, damage, excavate, alter or remove from its original position, or collect, any archaeological material or object. In terms of Section 36(3) of the Act, no person may, without a permit issued by the responsible heritage resources authority, destroy, damage, alter, exhume or remove from its original position or otherwise disturb any grave or burial ground older than 60 years, which is situated outside a formal cemetery administered by a local authority.

2.1.3 NATIONAL WATER ACT, 1989

The National Water Act, 1989 (No. 73 of 1989) (NWA) provides a legal framework for the effective and sustainable management of water resources[2] in South Africa. It serves to protect, use, develop, conserve, manage and control water resources as a whole, promoting the integrated management of water resources with the participation of all stakeholders. In terms of this Act, all water resources are the property of the State and the EIA process is used as a fundamental management tool.

A Water Use Licence is required for any new water use that is not listed in Schedule 1 or that is not covered by a General Authorisation. Water uses requiring registration and authorisation are listed in Table 2.3. In terms of the proposed project, a Water Use Licence would be required for the abstracting more 20 m^3 of groundwater per day (Water Use Activity 21a). A water use licence authorisation application would need to be submitted to the Department of Water Affairs (DWA) Northern Cape Regional Office for approval. DWA has, however, indicated that due to the high number of renewable energy projects, they have resolved to only process water use authorisations received from developers that have attained preferred bidder status. Developers who wish to submit application for water use authorisations may do so, with the understanding that their applications will only be processed when they have confirmed their status.

The construction of access roads through the drainage channels (Water Use Activity 21c and 21i) could possibly be Generally Authorised. However, an application for authorisation would need to be submitted to DWA in order to confirm the need for a Water Use Licence.

Table 2.3: List of applicable water use activities in terms of the National Water Act, 1989.

Water Use No.	Water Use Description	Description of the water use in relation to the proposed project
21(a)	*Abstraction of water from a water resource*	Groundwater would be abstracted for the proposed project, as there is no Municipal water available on site. Based on the quantity of groundwater abstracted, this water use will require Water Use Licence.
21(c)	*Impeding and diverting the flow of water in a watercourse*	Internal access roads would be constructed between the solar arrays, some of which would be required to cross the two drainage channels on site. The construction of the access roads could possibly be Generally Authorised. Confirmation required from DWA.
21(i)	*Altering the bed, banks, course or characteristics of a watercourse*	See Activity 21(c) above.

[2] A water resource includes a watercourse, surface water, estuary or aquifer, and, where relevant, its bed and banks. A watercourse means a river or spring; a natural channel in which water flows regularly or intermittently; a wetland lake or dam, into which or from which water flows; and any collection of water that the Minister may declare to be a watercourse.

2.1.4 OTHER RELEVANT LEGISLATION AND POLICIES

In addition to the foregoing, the proponent must also comply with the provisions of other relevant international and national legislation, conventions and regulations, which includes, but not limited to, the following:

- Constitution of the Republic of South Africa (No. 108 of 1996)
  Section 24 of the Constitution states that "*everyone has the right to an environment that is not harmful to their health or well-being*" and "*to have the environment protected, for the benefit of present and future generations, through reasonable legislative* [e.g. NEMA] *and other measures that prevent pollution and ecological degradation, promote conservation, and secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development*".

- National Environmental Management Act: Biodiversity Act, 2004
  The National Environmental Management Act: Biodiversity Act, 2004 (No. 10 of 2004) (NEMBA) provides for the management and conservation of South Africa's biodiversity by protecting species and ecosystems, specifically those that are threatened or critically endangered. In terms of Section 57(1) of the Act a person may not carry out a restricted activity (which includes the cutting, uprooting, damaging or destroying of) involving a specimen of a threatened or protected species without a permit.

  No threatened or protected species were found on site (see Vegetation Assessment in Appendix 4.1). Therefore, no permit is required in terms of NEMBA to remove or destroy threatened or protected species.

- Conservation of Agricultural Resources Act, 1983
  The Conservation of Agricultural Resources Act, 1983 (No. 43 of 1983) (CARA) provides for the conservation of the natural agricultural resources by the maintenance of the production potential of land, by the combating and prevention of erosion and weakening or destruction of the water sources, and by the protection of the vegetation and the combating of weeds and invader plants. The proposed project would need to ensure that the agricultural production of the remainder of the site is maintained, soil erosion is prevented and rehabilitated, where necessary, and water bodies and natural vegetation on site are protected.

- National Environmental Management: Air Quality Act, 2004
  The National Environmental Management: Air Quality Act, 2004 (No. 39 of 2004) (NEMAQA) provides for the control of air pollution and requires that certain activities, which result in atmospheric emissions and have or may have a significant detrimental effect on the environment, obtain an atmospheric emission licence. There are no activities applicable to the proposed project.

  Part V of the Act deals with the control of dust, which can have an impact on local air quality during construction activities. The Act requires that these impacts be controlled during construction and operation of a project.

- National Environmental Management: Waste Act, 2008
  The National Environmental Management: Waste Act, 2008 (No. 59 of 2008) (NEMWA) regulates all aspects of waste management and has an emphasis on waste avoidance and minimisation. NEMWA creates a system for listing and licensing waste management activities. Listed waste management activities above certain thresholds are subject to a process of impact assessments and licensing. Activities listed in Category A require a *Basic Assessment*, while activities listed in Category B require a *Scoping and EIA*. There are no activities applicable to the proposed project.

- Occupational Health and Safety Act, 1993
  The Occupational Health and Safety Act, 1993 (No. 85 of 1993) provides for the health and safety of persons at work and the protection of persons other than persons at work against hazards to health and safety arising out of or in connection with the activities of persons at work. The Applicant would need to comply with this Act during construction and operation.

- Northern Cape Planning and Development Act, 1998
  The Northern Cape Planning and Development Act, 1998 (No. 7 of 1998) provides procedures and regulations that complement the Development Facilitation Act, 1995, to ensure effective and co-operative planning and land development within the provincial and local spheres of government in the Northern Cape.

  The site is currently zoned *Agricultural* and would be rezoned to Special or another appropriate zoning in terms of the Northern Cape Planning and Development Act, 1998, in order to accommodate the current land use of pastoral agriculture and the proposed project. A rezoning application will only be prepared and submitted to the Provincial Administration and the local municipality if the proposed project attains preferred bidder status.

- National Energy Act, 2008
  The National Energy Act, 2008 (No. 34 of 2008) provides for, *inter alia*, ensuring that diverse energy resources are available, in sustainable quantities and at affordable prices, to the South African economy in support of economic growth and poverty alleviation, as well as the increased generation and consumption of renewable energies (including solar). One of the objectives of the Act is to promote diversity of supply of energy and its sources.

- Electricity Regulation Act, 2006
  Electricity Regulation Act, 2006 (No. 4 of 2006) provides for, *inter alia*, the establishment of a national regulatory framework for the electricity supply industry; the National Energy Regulator to be the custodian and enforcer of the national electricity regulatory framework; and the licencing and registration of generation, transmission, distribution, trading and the import and export of electricity. Objectives include, *inter alia*, achieving the efficient, effective, sustainable and orderly development and operation of electricity supply infrastructure in South Africa; to ensure that the interests and needs of present and future electricity customers and end users are safeguarded and met; and to promote the use of diverse energy sources and energy efficiency.

- White Paper on the Energy Policy of the Republic of South Africa (1998)
  The investment in renewable energy initiatives is supported by the White Paper on the Energy Policy of the Republic of South Africa (1998). The policy acknowledges that South Africa has a very attractive range of renewable resources, particularly solar and wind, and that renewable energy applications are the least costly with regards to social and environmental costs. The policy has as its aims to ensure that economically feasible technologies and applications are implemented, that an equitable level of national resources is invested in renewable technologies and that the constraints on the development of the renewable industry are addressed.

- White Paper on Renewable Energy (2003)
  The White Paper on Renewable Energy (November, 2003) supplements the White Paper on Energy Policy, which recognises that the medium- and long-term potential of renewable energy is significant. This Paper sets out Government's vision, policy principles, strategic goals and objectives for promoting and implementing renewable energy in South Africa.

  The White Paper notes that while South Africa is well-endowed with renewable energy resources that have the potential to become sustainable alternatives to fossil fuels, these have thus far remained largely untapped. As signatory to the Kyoto Protocol, Government is determined to make good the

country's commitment to reducing greenhouse gas emissions. To this purpose, Government has committed itself to the development of a framework in which a national renewable energy framework can be established and operate.

Apart from the reduction of greenhouse gas emissions, the promotion of renewable energy sources is aimed at ensuring energy security through the diversification of supply. Government's long-term goal is the establishment of a renewable energy industry producing modern energy carriers that will offer in future years a sustainable, fully non-subsidised alternative to fossil fuels. The medium-term (10-year) target set in the White Paper is:

"…10 000 GWh (0.8 Mtoe) renewable energy contribution to final energy consumption by 2013, to be producedmainly from biomass, wind, solar and small-scale hydro. The renewable energy is to be utilised for power generation and non-electric technologies such as solar water heating and bio-fuels. This is approximately 4% (1667 MW) of the projected electricity demand for 2013 (41 539 MW)."

- National Integrated Resource Plan for Electricity (2010-2030)

  The current iteration of the IRP for South Africa, initiated by the DoE after a first round of public participation in June 2010, led to the Revised Balanced Scenario (RBS) that was published in October 2010. The document outlines the proposed generation new build fleet for South Africa for the period 2010 to 2030. This scenario was derived based on the cost-optimal solution for new build options (considering the direct costs of new build power plants), which was then "balanced" in accordance with qualitative measures such as local job creation. In addition to all existing and committed power plants, the RBS included a nuclear fleet of 9.6 GW; 6.3 GW of coal; 11.4 GW of renewables; and 11.0 GW of other generation sources.

  A second round of public participation was conducted in November/December 2010, which led to several changes to the IRP model assumptions. The main changes were the disaggregation of renewable energy technologies to explicitly display solar photovoltaic, concentrated solar power (CSP) and wind options; the inclusion of learning rates, which mainly affected renewables; and the adjustment of investment costs for nuclear units, which until then represented the costs of a traditional technology reactor and were too low for a newer technology reactor (a possible increase of 40%).

  Additional cost-optimal scenarios were generated based on the changes. The outcomes of these scenarios, in conjunction with the following policy considerations, led to the Policy-Adjusted IRP:
  > The installation of renewables (solar photovoltaic, CSP and wind) were brought forward in order to accelerate a local industry;
  > To account for the uncertainties associated with the costs of renewables and fuels, a nuclear fleet of 9.6 GW was included in the IRP;
  > The emission constraint of the RBS (275 million tons of carbon dioxide per year after 2024) was maintained; and
  > Energy efficiency demand-side management measures were maintained at the level of the RBS.

- IPP Procurement Process

  In August 2009, the DoE gazetted the Electricity Regulations on New Generation Capacity under the Electricity Regulation Act, 2006. The Regulations establish rules and guidelines that are applicable to the undertaking of an IPP Bid Programme and the procurement of an IPP for new generation capacity. The Regulations also facilitate the fair treatment and non-discrimination between IPPs and the buyer of the energy. In terms of the Regulations, DoE will develop new generation capacity requirements per technology. New generation capacity must be met through the technologies and projects listed in the IRP and all IPP procurement programmes will be executed in accordance with the specified capacities and technologies listed in the IRP.

2.2 SCOPING AND EIA PROCESS

The Scoping Study and EIA phases are described in detail below. A flowchart indicating the Scoping and EIA process is presented in Figure 2.1.

2.2.1 SCOPING STUDY PHASE

The Scoping Study had an emphasis on public involvement and involved an open, participatory approach to ensure that all issues and concerns were identified and the proposed project is as environmentally acceptable as possible. The Scoping Study Phase was undertaken between June 2011 and June 2012.

2.2.1.1 Objectives

The main purpose of the Scoping Study was to obtain agreement between I&APs, the relevant authorities and the project team on the key issues and alternatives to be addressed in the EIA phase. This Scoping Study had the following specific objectives:

1. To provide a reasonable opportunity for I&APs to be involved in the study;
2. To ensure that all potential key environmental issues and impacts that would result from the proposed project were identified;
3. To identify any potential environmental issues and impacts related to the proposed project requiring further investigation in the EIA;
4. To identify feasible alternatives related to the project proposal; and
5. Through the above, to ensure informed, transparent and accountable decision-making by the relevant authorities.

2.2.1.2 Scoping Study process and tasks undertaken to date

The Scoping Study process undertaken followed the requirements of NEMA and the EIA Regulations 2010, as set out in GN No. R543. This involved an open, participatory approach to the study and full involvement of I&APs to ensure that all impacts were identified and that planning and decision-making takes place in an informed, transparent and accountable manner. The Scoping Study process that was followed is summarised in Box 2.1.

The Final Scoping Report (FSR), which was prepared in compliance with Section 28 of the EIA Regulations 2010, was submitted to DEA on 16 March 2012 for consideration and acceptance. The FSR was also distributed for a 30-day review / comment period (excluding public holidays) from 19 March 2012 to 23 April 2012. DEA was notified, in writing, on the 24 April 2012 that no comments were received on the FSR during the 30-day public review / comment period.

The FSR was accepted by DEA on 14 June 2012 (see Appendix 1). DEA requested that CCA proceed with the EIA Phase as outlined in the Plan of Study for EIA.

2.2.1.2 Issues and concerns identified during the Scoping Study

The key issues and concerns identified by the project team during the Scoping Study are provided in Table 2.4. This information provided the basis on which the specialist studies and terms of references were determined.

Box 2.1: Tasks undertaken during the Scoping Study process.

- **Application and baseline studies:**
- An Application Form for Environmental Authorisation and Declaration of Interest were submitted to DEA, and a copy sent to the Department of Environment Affairs and Nature Conservation (Northern Cape), on behalf of the Applicant, on 2 June 2011. DEA accepted the application on 6 July 2011.
- A baseline site visit was undertaken by CCA on 13 December 2011. The purpose of the site visit was to determine the environmental characteristics of the study area, to identify potential environmental issues and concerns, and to identify potential layout / routing alternatives.
- Six baseline specialist studies (including vegetation, fauna, soil, heritage, visual and social) were undertaken to determine the environmental characteristics of the study area and to identify potential layout / routing alternatives.
- **Draft Scoping Report (DSR) and associated public participation:**
- A preliminary I&AP database was compiled which consisted of authorities (local, regional and national), Non-Governmental Organisations, Community-based Organisations and other key stakeholders. This database continued to grow during the Scoping Study Phase. The I&APs registered on the project database to date are included in Appendix 2.1.
- A DSR was prepared in compliance with Section 28 of the EIA Regulations 2010 and released for a 40-day public review / comment period from 1 February 2012 to 12 March 2012. Copies of the full report were made available at the De Aar Public Library and on the CCA website. Copies of the DSR were also sent to:
  > DEA (Mr Dumisani Mthembu);
  > Department of Agriculture, Fisheries & Forestry: Land Use & Soil Management (Ms Anneliza Collett);
  > South African Heritage Resources Agency (Ms Mariagrazia Galimberti);
  > Department of Environmental Affairs & Nature Conservation, Northern Cape (Mr Julius Mutyorauta);
  > South African Heritage Resources Agency, Northern Cape (Provincial Manager);
  > Department of Mineral Resources, Northern Cape (Mr Ntsundeni Ravhugoni);
  > DWA, Northern Cape (Mr Ernest Kubayi);
  > Department of Agriculture, Land Reform and Rural Development, Northern Cape (Mr J. Roux);
  > Department of Tourism, Environment and Conservation, Northern Cape (Mr L. Festus); and
  > South African Civil Aviation Authority (Ms Lizelle Stroh).
- Advertisements announcing the proposed project, the availability of the DSR and the Information-sharing meeting were placed in regional (Die Volksblad) and local (The Echo) newspapers on 1 and 3 February 2012, respectively.
- A notification letter was sent to all I&APs registered on the project database informing them of the release of the DSR, where the report could be reviewed and the Information-sharing meeting. Copies of the DSR Executive Summary and Response Forms were enclosed with the letters.
- An Information-sharing Meeting was held in a venue above the De Aar Pharmacy, 15 Main Road, on 6 February 2012 commencing at 16h00. The purpose of this meeting was to provide a basic overview of the proposed project and allow I&APs the opportunity to raise any issues or concerns.
- Site notices (English and Afrikaans) were erected along access roads leading to the site.

Final Scoping Report (FSR) and associated public participation:

- After closure of the DSR comment period, the report was updated into a FSR in compliance with Section 28 of the EIA Regulations 2010. Comments received on the DSR and at the Information-sharing Meeting were collated into a Comments and Responses Report, which was appended to the FSR.
- The FSR was submitted to DEA on 16 March 2012 for consideration and acceptance.
- The FSR was distributed for a 30-day review / comment period (excluding public holidays) from 19 March 2012 to 23 April 2012. Copies of the full report were made available at the De Aar Public Library and on the CCA website.
- A notification letter was sent to all I&APs registered on the project database informing them of the release of the FSR and where the report can be reviewed (see Appendix 2.2). Copies of the FSR Executive Summary were enclosed with the letter. Copies of the FSR were also sent to those authorities and stakeholders that received a copy of the DSR (see Appendix 2.2).
- DEA was notified, in writing, on the 24 April 2012 that no comments were received on the FSR during the 30-day public review / comment period.

Table 2.4: Description of and comments on key issues identified during the Scoping Study.

No.	Key issues	Description of the issue and comment
1	Impact on vegetation	The proposed project would result in the clearing of vegetation within the proposed development footprint. The proposed project could also result in a number of indirect impacts on the vegetation, e.g. introduction of alien invasive plant species and the alteration of the local micro-climate beneath the modules (e.g. shading, temperature, height restriction, etc.), which may bring about changes to the species composition, diversity, vegetation structure, etc. These issues have been addressed in the Vegetation Assessment.
2	Impact of freshwater systems (including groundwater)	The proposed photovoltaic power plant could have an impact on the freshwater systems on site (e.g. roads through drainage lines). In addition, groundwater usage during the construction and operation phases could have an impact on groundwater resources. These issues have been addressed in the Freshwater and Groundwater Assessments.
3	Impact on the soil and agricultural potential	The proposed project could result in the loss of grazing and potentially arable land. Construction activities (e.g. excavations) may also increase the erosion potential of soils, which could result in the permanent loss of topsoil. These issues have been addressed in the Soil and Agricultural Potential Assessment.
4	Impact on terrestrial fauna (including avifauna)	The clearing of vegetation within the proposed development footprint would result in the loss of faunal habitat and possible mortality of faunal species. In addition, the proposed power lines could have an impact on birds through habitat alteration, electrocution and collisions. These issues have been addressed in the Terrestrial Faunal Impact Assessment.
5	Creation of employment and local expenditure	The proposed development would stimulate both direct and indirect employment opportunities during the construction and operation phases. The proposed project would also result in direct and indirect local expenditure with much of the expenditure being directed at payments to labour / employees and purchase of materials. These issues have been addressed in the Social Impact Assessment.
6	Impact of construction workers on local communities and Influx of job seekers	The presence of external construction workers and the influx of potential job seekers into the area could pose a potential risk to family structures and social networks and could result in a number of social impacts on the surrounding communities, e.g. introduction of new cultural values, changes in the demographic profile of the area, marginalisation of the community, increased crime, etc. These issues have been addressed in the Social Impact Assessment.
7	Loss of grazing land and Increased risk to livestock, grazing and associated infrastructure	Although the grazing capacity is considered to be low, the proposed project would result in the loss of grazing land. The presence and movement of construction vehicles on and off the site also poses a potential threat to farm infrastructure, such as fences and gates, which may be damaged. Stock losses may also result from gates being left open and/or fences being damaged. Veld fires pose a potential risk to pasture, while plastic waste may pose a risk to livestock if ingested. These issues have been addressed in the Social Impact Assessment.
8	Impact of construction vehicles	The proposed project could impact, both positively and negatively, on existing land use and economic activities through issues relating to electricity supply and costs, as well as the loss of land available for grazing and other agricultural activities. These issues have been addressed in the Social Impact Assessment.

No.	Key issues	Description of the issue and comment
9	Impact on sense of place and rural character of the landscape (Visual Impact)	The proposed development would potentially alter the visual landscape / rural character of the site, which is typical of the Northern Cape landscape. This could have some visual implications for the immediate surrounding area and along the N10 national road. These issues have been addressed in the Visual Impact Assessment and the Social Impact Assessment.
10	Impact on civil aviation	The potential impact on civil aviation is related to the reflection of sunlight during the day from the module surface, which can present a hazard during critical phases of flight, especially approach and landing. Comment was received from the South African Civil Aviation Authority in order to address this issue (see Appendix 2.3).
11	Generation of clean, renewable energy	Energy provision is crucial to overall development. As the demand for energy grows, the energy sector is expected to play a central role in fuelling the country's economic growth and development. The diversification of energy resources to other energy forms such as natural gas and renewable energy is in line with government policy objectives of improving energy security, flexibility of supply and environmental performance. In addition, the proposed project would help to offset the total carbon emissions associated with energy generation in South Africa and South Africa's reliance on Eskom as the only power utility. This issue has been addressed in the Social Impact Assessment.
12	Impacts on the heritage and cultural environment	The proposed development falls within an area associated with San and Khoikhoi history that is a significant trademark of the Upper Karoo cultural landscape. The proposed photovoltaic power plant and associated infrastructure could have an impact on archaeological and heritage resources on site and in the surrounding area. These issues have been addressed in the Heritage Impact Assessment.

2.2.2 EIA PHASE

2.2.2.1 Specialist studies

Eight specialist studies were undertaken to address the potential impacts associated with the key issues raised during the Scoping Study. A list of the specialist studies undertaken is provided in Table 2.5.

Specialist studies involved the gathering of data relevant to identifying and assessing environmental impacts that may occur as a result of the proposed project. These impacts were then assessed according to pre-defined rating scales (see Appendix 3). Specialists also recommended appropriate mitigation / control or optimisation measures to minimise potential negative impacts or enhance potential benefits, respectively.

Table 2.5: List of specialist studies and specialists.

No.	Specialist study	Specialist/s	Qualifications	Organisation	Appendix
1.	Vegetation	Dr Dave McDonald	PhD (Vegetation Ecology), University of Cape Town	Bergwind Botanical Surveys & Tours	Appendix 4.1
2.	Fauna	Eloise Costandius	MSc (Ecological Assessment), University of Stellenbosch	CCA Environmental	Appendix 4.2
		Prof. Le Fras Mouton	PhD (Zoology), University of Stellenbosch	University of Stellenbosch	

No.	Specialist study	Specialist/s	Qualifications	Organisation	Appendix
4.	Freshwater	Toni Belcher	MSc (Environmental Management), Potchefstroom University	Independent Aquatic Scientist	Appendix 4.3
5.	Groundwater	Roger Parsons	MSc (Geohydrology), Rhodes University	Parsons and Associates Specialist Groundwater Consultants	Appendix 4.4
3.	Soil and Agricultural Potential	Garry Paterson	MSc (Soil Science), University of Pretoria	ARC-Institute for Soil, Climate and Water	Appendix 4.5
8.	Social	Tony Barbour	MSc (Environmental Science), University of Cape Town	Tony Barbour Environmental Consultant And Researcher	Appendix 4.6
		Daniel Rogatschnig	MSc (Environmental and Geographical Science), University of Cape Town	Independent Environmental Consultant	
7.	Visual	Bernard Oberholzer	Master of Landscape Architecture, University of Pennsylvania	Bernard Oberholzer Landscape Architect and Environmental Planner	Appendix 4.7
		Quinton Lawson	Bachelor of Architecture, University of Natal	MLB Architects and Urban Designers	
6.	Heritage	Elize Becker	BSocSci Hons (Anthropology) & BA Hons (Archaeology), University of Pretoria	Hatch	Appendix 4.8

2.2.2.2 Integration and Assessment

Compilation of Draft EIR

The specialist assessments, which address the key issues identified during the Scoping and EIA process, and other relevant information, were integrated into a Draft EIR. In addition, certain key stakeholders (including the South African Civil Aviation Authority and Birdlife Africa) were contacted in order to address certain issues / impacts related to the proposed project.

Public and authority consultation on the Draft EIR

The Draft EIR was distributed for a 40-day review and comment period from 21 June 2012 to 31 July 2012 in order to provide I&APs and authorities with an opportunity to comment on any aspect of the proposed project and the findings and recommendations of the Draft EIR. The following tasks were undertaken as part of the consultation on the Draft EIR:

- Copies of the full Draft EIR were made available at the following locations for the duration of the review and comment period:
  1. De Aar Public Library, 27 Station Street, De Aar; and
  2. On the CCA Environmental website (www.ccaenvironmental.co.za).
- Copies of the Draft EIR were sent directly to the following authorities and stakeholders (covering letters are presented in Appendix 2.2):
  - > DEA (Ms Thulisile Portia Nyaluinga);
  - > Department of Agriculture, Fisheries & Forestry: Land Use & Soil Management (Ms Mashudu Marubini);
  - > South African Heritage Resources Agency (Ms Mariagrazia Galimberti);
  - > Department of Environmental Affairs & Nature Conservation, Northern Cape (Mr Julius Mutyorauta);

- South African Heritage Resources Agency, Northern Cape (Mr Ratha Timothy);
- Department of Mineral Resources, Northern Cape (Mr Ntsundeni Ravhugoni);
- DWA, Northern Cape (Mr Ernest Kubayi);
- Department of Agriculture, Land Reform and Rural Development, Northern Cape (Mr J. Roux);
- Department of Tourism, Environment and Conservation, Northern Cape (Mr L. Festus);
- Eskom Transmission (Mr John Geeringh); and
- South African Civil Aviation Authority (Ms Lizelle Stroh).

- Notification letters and copies of the Draft EIR Executive Summary were sent to the mayor, municipal manager and councillors in the Emthanjeni Municipality, as well as the Municipal Manager of the Pixley Ka Seme District Municipality. Covering letters are presented in Appendix 2.2.
- A general notification letter (English and Afrikaans) was sent to all I&APs registered on the project database informing them of the release of the Draft EIR and where the report could be reviewed (see Appendix 2.1 & 2.2 for the I&AP database and a copy of the notification letter, respectively). A copy of the Draft EIR Executive Summary was enclosed with each letter.

Five written comments were received on the Draft EIR during the review and comment period (see Appendix 2.3). These comments have been collated, and responded to, in a Comments and Responses Report (see Appendix 2.4).

Compilation of Final EIR

After closure of the comment period, the Draft EIR was updated into this final report (including Comments and Responses Report). This report has been prepared in compliance with Section 31(2) of the EIA Regulations 2010, which lists the necessary content of an EIR. Table 2.6 lists these content requirements, indicates if the information has been included and where such information can be found within this report. This report aims to present all information in a clear and understandable format, suitable for easy interpretation by I&APs and authorities, and to provide an opportunity for I&APs and authorities to comment on the proposed project and findings of the Scoping and EIA process.

2.2.2.3 Completion of EIA Phase

The Final EIR will be submitted to DEA for consideration and decision-making at the same time it is released for I&AP review and comment (see Section 1.6). Any comments received on the Final EIR will be forwarded directly to DEA for consideration. After DEA has reached a decision, all I&APs registered on the project database will be notified of the outcome of the application and the reasons for the decision. A statutory Appeal Period in terms of Chapter 7 of the EIA Regulations 2010 will follow the issuing of the decision.

Table 2.6: Requirements of an Environmental Impact Report in terms of the EIA Regulations 2010.

Section 31	Content of Environmental Impact Report	Completed (Y/N or N/A)	Location in Final EIR
2 (a)	(i & ii) Details and expertise of EAP who prepared the report.	Y	Page ii
(b)	Detailed description of the proposed activity.	Y	Section 3.1
(c)	A description of the property on which the activity is to be undertaken and the location of the activity on the property, or if it is:	Y	Section 3.1
	(i) a linear activity, a description of the route of the activity; or	Y	
	(ii) An ocean-based activity, the co-ordinates where the activity is to be undertaken.	N/A	
(d)	A description of the environment that may be affected by the activity and the manner in which the physical, biological, social, economic and cultural aspects of the environment may be affected by the proposed activity.	Y	Chapter 4
(e)	Details of the public participation process conducted in terms of sub-regulation 1, including:		
	(i) Steps undertaken in accordance with the plan of study;	Y	Sections 1.6, 2.2.2.2 & 2.2.2.3
	(ii) A list of all persons or organisations and organs of state that were registered as interested and affected parties;	Y	Appendix 2.1
	(iii) A summary of comments received from and a summary of issues raised by registered I&APs, the date of receipt of these comments and the response of the EAP to those comments; and	Y	Appendix 2.4
	(iv) Copies of any representations and comments received from registered I&APs.	Y	Appendix 2.3
(f)	A description of the need and desirability of the proposed activity.	Y	Section 1.5
(g)	A description of identified potential alternatives to the proposed activity, including advantages and disadvantages that the proposed activity or alternatives may have on the environment and the community that may be affected by the activity.	Y	Section 3.2
(h)	An indication of the methodology used in determining the significance of potential environmental impacts.	Y	Appendix 3
(i)	A description and comparative assessment of all alternatives identified during the EIA process.	Y	Chapter 5
(j)	A summary of the findings and recommendations of any specialist report or report on a specialised process.	Y	Chapter 5 & 6
(k)	A description of all environmental issues that were identified during the EIA process, an assessment of the significance of each issue and an indication of the extent to which the issues could be addressed by the adoption of mitigation measures.	Y	Table 2.4 & Chapter 5

(l)	An assessment of each identified potentially significant impact, including: (i) Cumulative impacts; (ii) The nature of the impact; (iii) The extent and duration of the impact; (iv) The probability of the impact occurring; (v) The degree to which the impact can be reversed; (vi) The degree to which the impact may cause irreplaceable loss of resources; and (vii) The degree to which the impact can be mitigated.	Y	Chapter 5
(m)	A description of any assumptions, uncertainties and gaps in knowledge.	Y	Section 1.4
(n)	A reasoned opinion as to whether the activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation.	Y	Section 6.1.5
(o)	An environmental impact statement which contains: (i) A summary of the key findings of the EIA; and (ii) A comparative assessment of the positive and negative implications of the proposed activity and identified alternatives.	Y	Chapter 6
(p)	A draft environmental management programme containing the aspects contemplated in Regulation 33.	Y	Appendix 6
(q)	Copies of specialist reports and reports on specialised processes complying with regulation 32.	Y	Appendix 5.1 to 5.8
(r)	Any specific information that may be required by the competent authority. DEA listed information requirements in their Letter of Acceptance of the Application From. Information included:		
	• General site information;	Y	Chapter 3 & 4
	• Solar plant design specifications;	Y	Chapter 3
	• Site maps;	Y	Chapter 3 & 4
	• Regional maps;	Y	Chapter 1 & 4
	• Key stakeholders;	Y	Appendix 2.1
	• Agriculture study.	Y	Appendix 4.5
(s)	Any other matters required in terms of Sections 24(4)(a) and (b) of the Act. (This refers to Environmental Authorisations and procedures for the investigation, assessment and communication of the potential consequences or impacts of activities on the environment that the authority needs to consider when reviewing an Application).	Y	

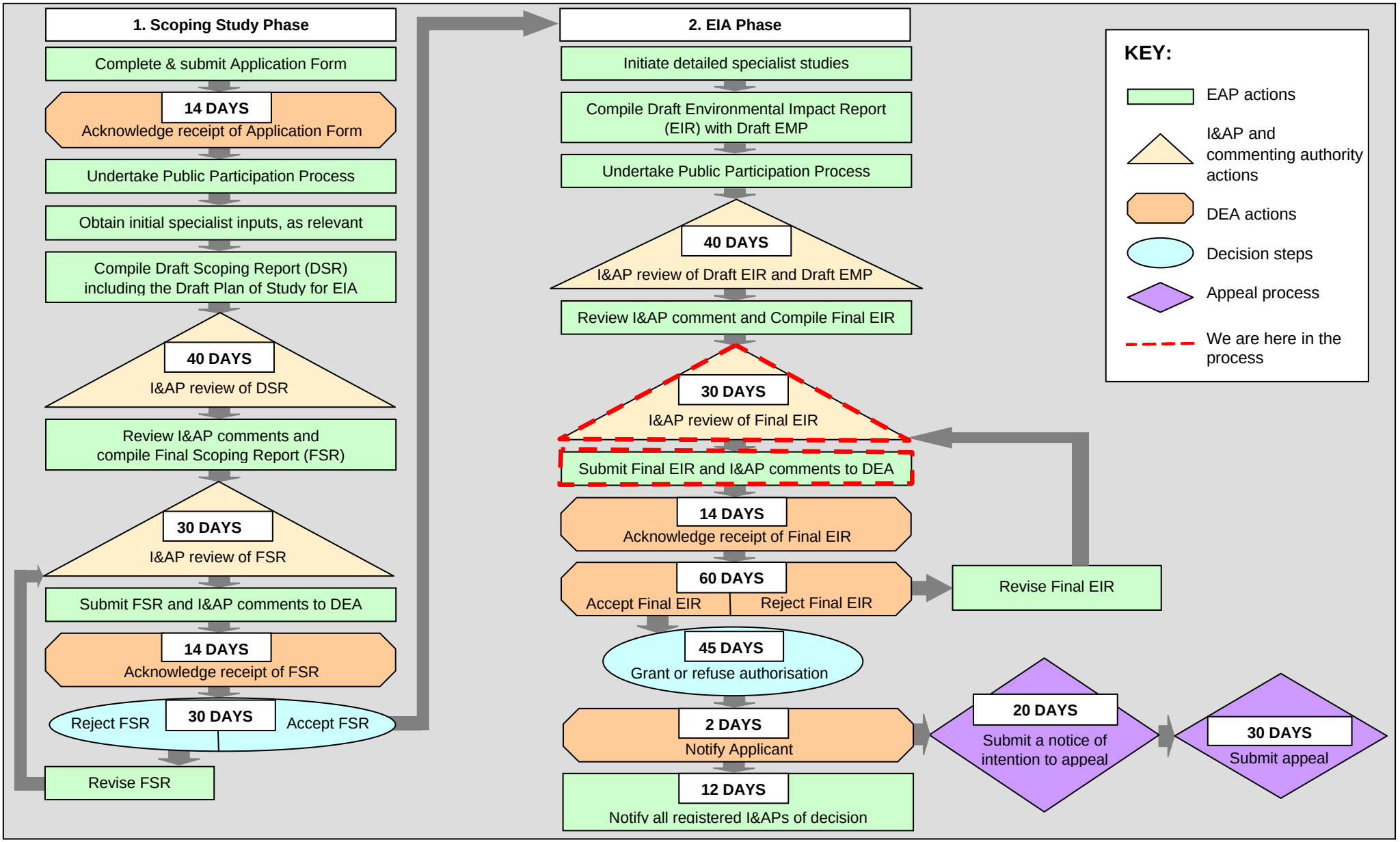


Figure 2.1: Scoping and EIA process.

3. PROPOSED PROJECT DESCRIPTION

This chapter provides a description of the proposed project, including the proposed power plant and related infrastructure, and alternatives.

3.1 PROJECT DESCRIPTION AND DETAILS

3.1.1 INTRODUCTION

The proposed De Aar Solar One Power Project would consist of a photovoltaic power plant with 25 to 30 MWp AC capacity, covering an area of 75 to 80 ha, depending on the choice of technology. The proposed power plant would be connected to the existing Hydra substation via a 132 kV power line.

3.1.2 SITE

The proposed photovoltaic power plant would be situated on Portion 3 of Farm Hartebeestplaats 135 (locally referred to as Kampfontein), which is located approximately 6 km south-east of De Aar in the Northern Cape (see Figure 1.1). The surveyor-general 21 digit site reference number is C012 0000 00000135 00003. The total size of the property is 117 ha. A copy of the title deed is presented in Appendix 5.

The site's biophysical and socio-economic characteristics are described in Chapter 4.

3.1.3 TECHNOLOGY

3.1.3.1 Introduction

Photovoltaics is a method of generating electrical power by converting solar radiation into direct current electricity using semiconductors that exhibit the photovoltaic effect, which is the process of converting light (photons) to electricity (voltage). Photovoltaic power generation employs solar panels or modules composed of a number of solar cells connected in series containing a photovoltaic material (see Figure 3.1).

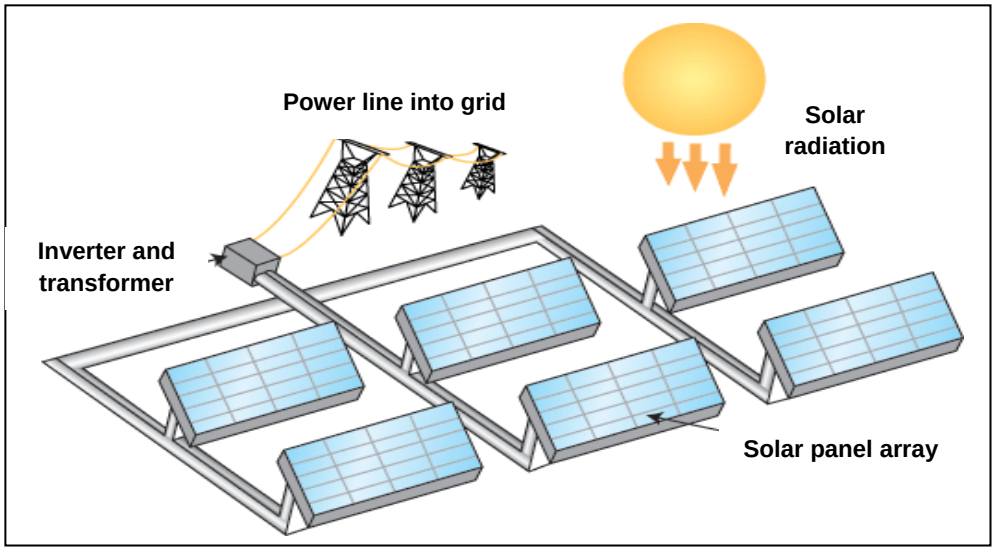


Figure 3.1: Photovoltaic Power Plant diagram (adapted from http://www.tva.gov/greenpowerswitch/solar.htm).

Due to the growing demand for renewable energy sources, the manufacturing of solar cells and photovoltaic modules has advanced considerably in recent years. There are a number of photovoltaic panel technologies, including (https://energypedia.info/index.php/Solar_Cells_and_Modules):

- Crystalline

  The most common material for solar cells is crystalline silicon, which is separated into multiple categories according to crystallinity and crystal size in the resulting ingot, ribbon or wafer.

  > Monocrystalline silicon cells are made from silicon wafers that are cut from cylindrical single-crystal silicon ingots. Monocrystalline silicon shows predictable and uniform behaviour, but is also the most expensive type of silicon. Modules consisting of monocrystalline silicon cells reach commercial efficiencies between 15 and 18%.

  > Polycrystalline or multicrystalline silicon cells are made from cast square ingots, which are large blocks of molten silicon, carefully cooled and solidified. They are less expensive to produce than monocrystalline silicon cells, but are marginally less efficient, with module conversion efficiencies between 13 and 16%.

- Thin film

  Thin-film technologies reduce the amount of light absorbing material required in creating a solar cell. Thin film cells are constructed by depositing extremely thin layers of photovoltaic semi-conductor materials onto a backing material such as glass, stainless steel or plastic. Thin film materials commercially used are amorphous silicon, cadmium telluride and copper-indium-(gallium)-diselenide. Although thin film cells are potentially cheaper to manufacture than crystalline cells, the majority have lower energy conversion efficiencies (an average 6 to 12% module efficiency).

3.1.3.2 Modules

The proposed project would use either crystalline or thin-film technology.

Module specifications would ultimately depend on the technology used, but it is anticipated that the modules would have dimensions in the order of 1 m x 2 m (i.e. 2 m^2). Modules would be mounted on racks to form solar arrays. Solar arrays would be orientated in a northerly direction, offset at a maximum of 15 degrees either to the east or west and would have a maximum height of approximately 2.5 to 3 m (technology dependent) above ground level and placed approximately 7.4 m apart (see Figures 3.2 & 3.3). The racks would have either a ballasted or piled foundation, which will be determined once a detailed geotechnical survey has been completed. The use of a tracker system is also being considered. A tracker system could increase the performance of modules during early morning and late afternoon periods (see Section 3.2.3).

Modules would be arranged in 1.25 MW blocks of approximately 3.5 ha each and would be tilted at a 30 degree angle. The project would cover an area of between 75 and 80 ha (including rack frame). Solar arrays would be placed over the vegetation, where possible. However, vegetation over 60 cm in height would need to be removed beneath the modules. In addition, vegetation within the proposed footprint of rack foundations, access roads, pylons and the internal underground cables (some of which are in the road verges) would also have to be removed.

3.1.4 LAYOUT

Although the final layout would primarily be determined by the technology choice and detailed design considerations, an indicative layout of the proposed photovoltaic power plant is presented in Figure 3.4. This layout has been informed by the recommendations made in the specialist baseline studies that were undertaken during the Scoping Study Phase.

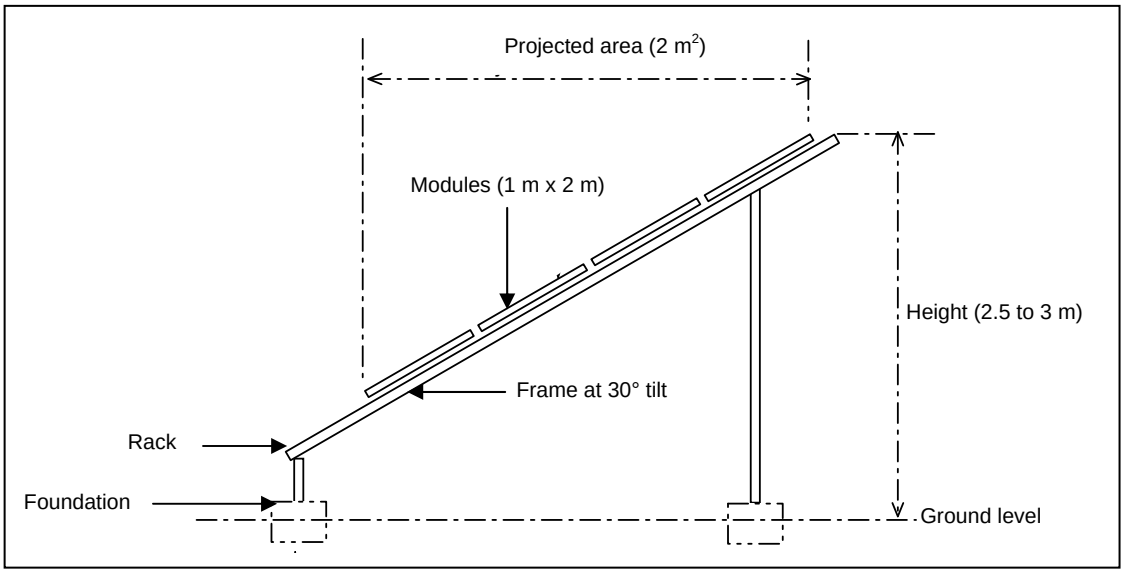


Figure 3.2: Illustration of the modules and rack mounting.

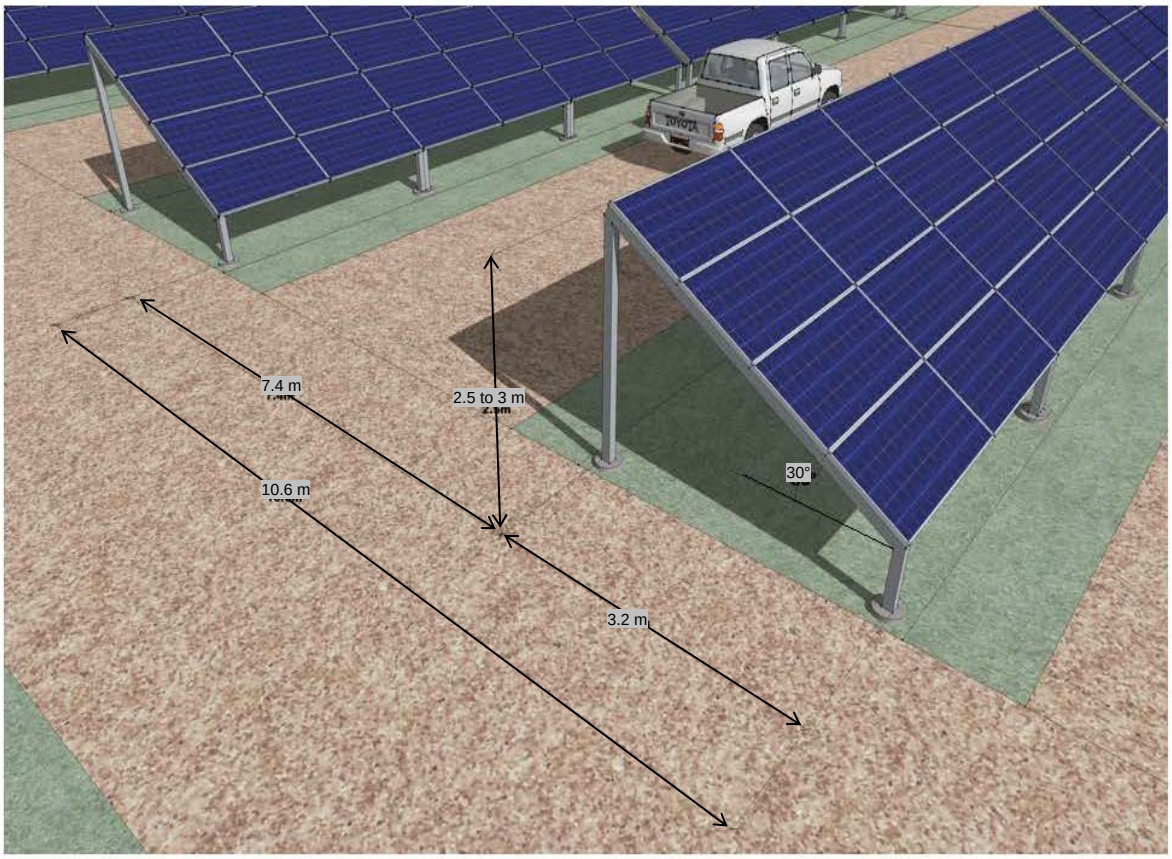


Figure 3.3: Illustration of the array layout and spacing.

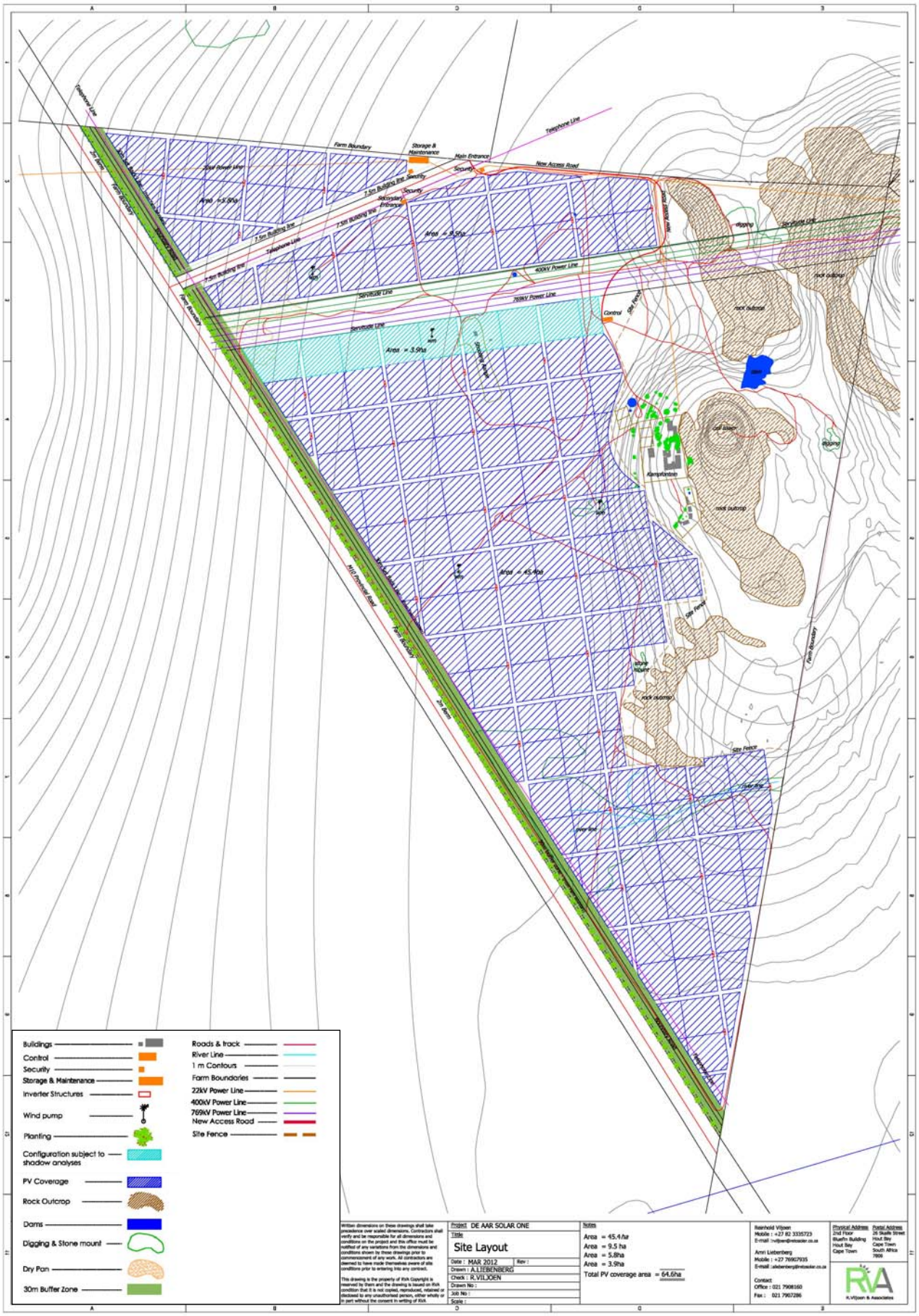


Figure 3.4: Proposed layout for the photovoltaic power plant on Farm Hartebeestplaats 135/3.

3.1.5 ASSOCIATED INFRASTRUCTURE

3.1.5.1 Power line

The proposed photovoltaic power plant would be connected to the adjacent Hydra substation, approximately 1.5 km east of the site, via a 132 kV power line, approximately 2 to 2.5 km in length. Three alternative connection options to the Hydra substation are being considered for the proposed project (see Section 3.2.4). The proposed power line would require a servitude (38 m wide over a distance of ±225 m) over private land, Remainder of Farm Hartebees Hoek 3 (surveyor-general 21 digit site reference: C030 0000 00000031 00000), and negotiations have commenced with the landowner (Mr Ian Horn) in this regard. The remainder of the power line would be routed over land owned by Eskom (surveyor-general 21 digit site reference: C030 0000 00000005 00003).

Monopole steel towers with a height of approximately 17.5 m to 21 m would be used for the proposed power line (see Plate 3.1).

Plate 3.1: Photograph of a monopole steel tower similar to that which would be utilised for the proposed project (Photo: Reinhold Viljoen).

3.1.5.2 Transformer and inverter

Transformers (22/132 kV 75 MVA substation) and photovoltaic inverters (250 kW) would be required for each 1.25 MW block of modules (see Figure 3.5). The inverters convert the variable DC output of the modules into a utility frequency AC current that can be fed into the commercial electrical grid or used by a local, off-grid electrical network. These may be housed in two separate structures as shown in Figure 3.5 or together in one structure.

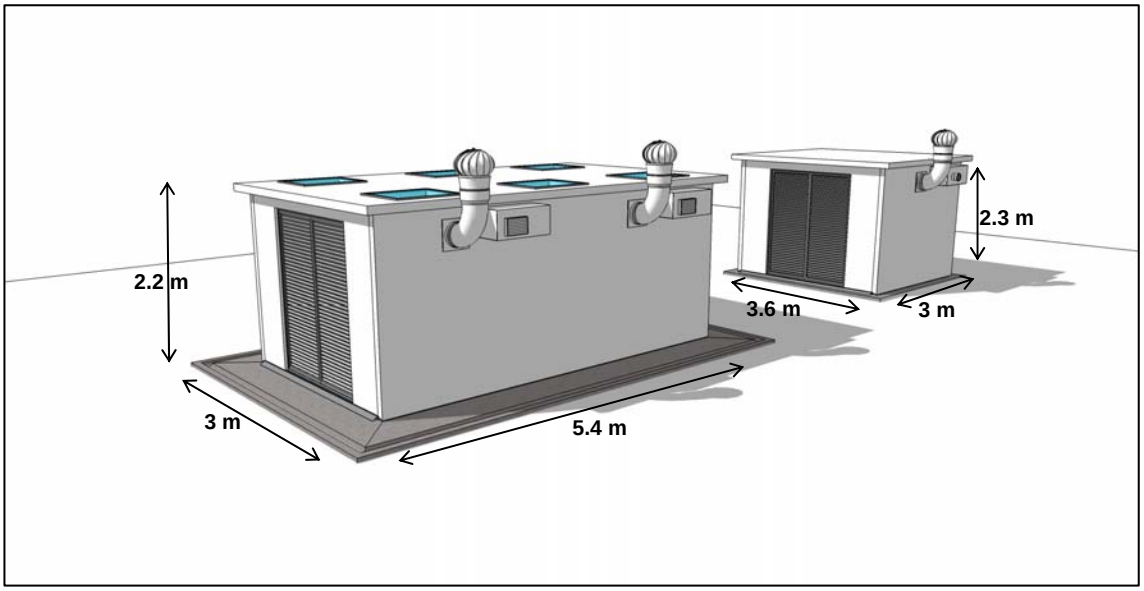


Figure 3.5: Illustration of the proposed inverter structure and separate smaller transformer structure (from RV & Associates).

3.1.5.3 Access roads

Access to the site would be via the existing Hydra substation access road off the N10 and the existing farm access road, which enters the site from the north.

Access roads totalling an estimated 14.5 km would be required between the individual solar arrays during the construction phase. It is anticipated that a third of these roads would remain as permanent during the operation phase (± 5 km). The permanent roads would be in the order of 4 to 7 m wide and surfaced with permeable pavers, which would facilitate the infiltration of stormwater into the soil (see Figure 3.6). Any fill material required would be obtained from local approved sources.

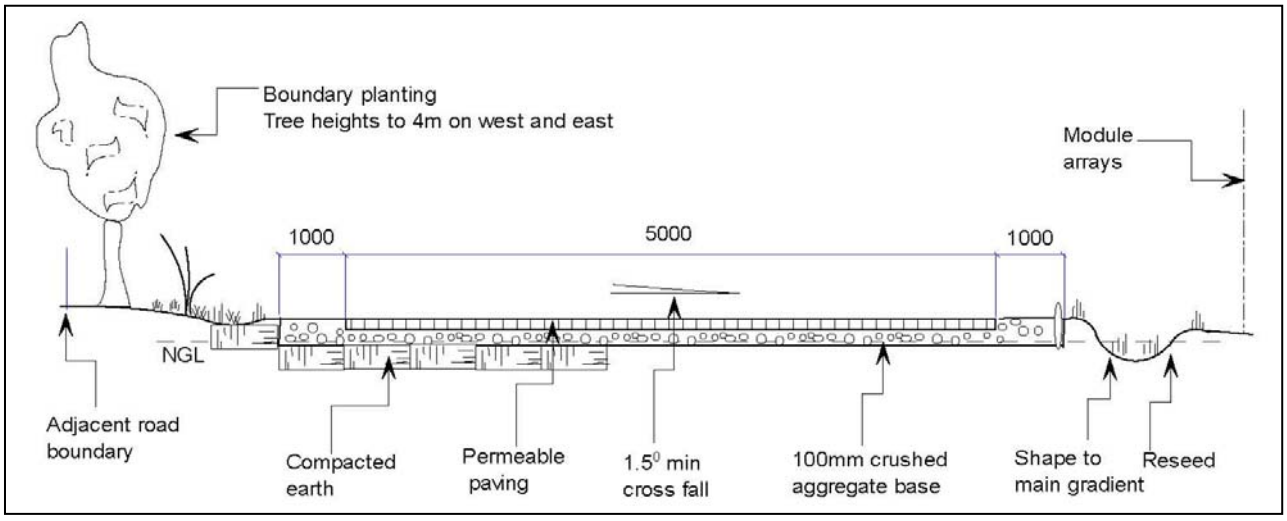


Figure 3.6: Schematic of proposed internal roads structure between sub-arrays and planting of trees along main road boundaries.

3.1.5.4 Buildings

Various operations and maintenance buildings would be constructed, including:

- Main building (± 150 m^2), which would be shared by control and security staff;
- Store (± 500 m^2);
- Main electrical substation and transformers (max 500 m^2 fenced area);
- Inverter structures in between arrays (each ± 15 m^2) – prefabricated concrete or steel structures (see Figure 3.5); and
- Transformer structures – small concrete or steel structures (see Figure 3.5).

The store and main buildings would be located to the north of the Hydra substation access road (see Figure 3.4). The buildings would be single storey and would be constructed from brick or stone with metal sheet roofing. The store would, however, be a simple clad portal frame type structure.

3.1.5.5 Fencing

The proposed power plant would be fenced off with a 2.5 m high wire mesh security fence, with access gained via a security gate. Trees and shrubs would be planted along the fence line (see Section 3.1.6).

3.1.5.6 Services

Water supply

Groundwater would be used for construction and operational purposes. There are five existing boreholes on site, which would be used to abstract groundwater. Water would be stored in 5 or 10 kL storage tanks, which would be located near the main office building. The water would pass through a simple filtration process.

It is anticipated that approximately 20 to 30 kL of water would be required per day during the operational phase. This water would be used to clean the modules / solar array and general office use (e.g. toilets, drinking water, etc.). In order to reduce the volume of water required, the cleaning of the modules using high pressure air will be investigated. Construction phase water requirements would depend on where the fabrication of certain components of the project would take place. It is currently envisaged that concrete elements would be cast on site in order to increase the community labour opportunities. This would require approximately 50 to 75 kl of water per day during the construction phase.

Electricity supply

Electricity would be obtained from Eskom via the existing supply to the site.

Sewerage treatment

A septic tank and French drain system would be used to treat sewage and wastewater from the office buildings. It is envisaged that a maximum of 2 kL of sewage and wastewater would be generated per day.

Waste disposal

All non-recyclable waste would be disposed of at the De Aar licensed landfill site.

3.1.6 VISUAL SCREENING

A visual buffer of 30 m has been included between the external farm boundary along the N10 and the proposed layout design (see Figure 3.4). In addition, a berm 2 m in height would be constructed along the N10 within the visual buffer, which would create a view shadow along a portion of the N10 adjacent to the site. The proposal is to construct the berm closer to the N10 as this would provide better visual screening (see Figure 3.7). Shrubs and trees would also be planted along the Hydra substation access road and along the N10 boundary fence to provide further visual screening (see Figure 3.6).

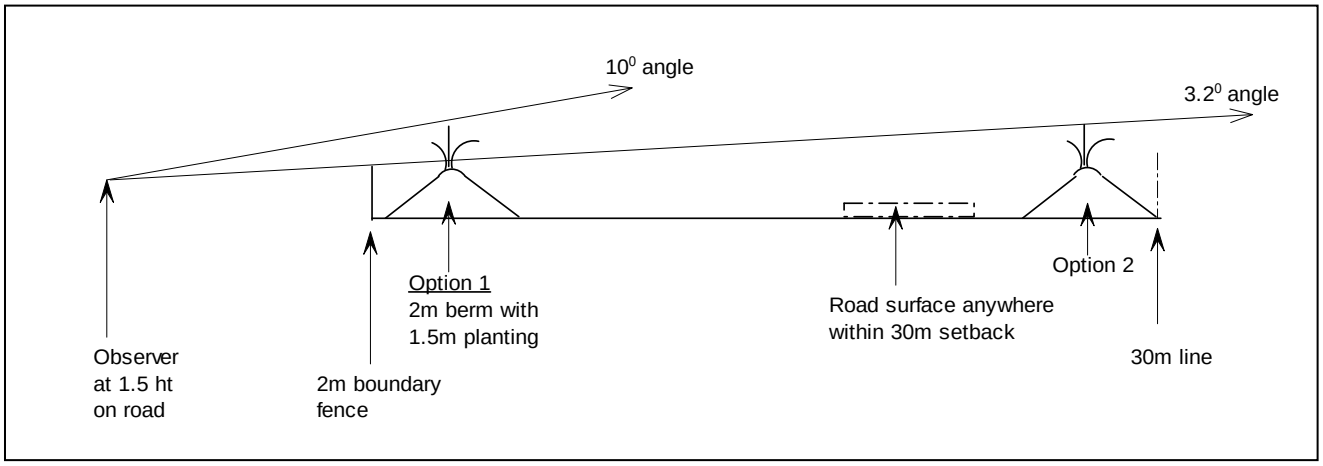


Figure 3.7: Visual screening alternatives related to the proposed berm along the N10.

3.1.7 REZONING AND LAND USE

The site is currently zoned *Agricultural* and would be rezoned to *Special*, or other appropriate zoning in consultation with the provincial authority in terms of the Northern Cape Planning and Development Act, 1998. A rezoning application will only be prepared and submitted to the Provincial Administration and the local municipality if the proposed project attains preferred bidder status.

3.1.8 PROJECT PHASES

3.1.7.1 Construction Phase

It is anticipated that the plant, if approved, would be constructed during 2013. During construction approximately 200 to 300 people would work on site over a period of six to nine months. A large number of the workforce would be sourced from the local labour force in and around De Aar.

The appointed contractor would be required to establish a construction camp and laydown area. It is anticipated that an area of approximately 1.5 ha would be required for these purposes.

3.1.7.2 Operational Phase

It is envisaged that approximately 30 to 40 people would be employed during the operational phase of the project. It is proposed that local labour from the De Aar area would be employed as far as possible.

Limited accommodation for four to six persons would be provided within the main office building complex.

3.1.7.3 Decommissioning Phase

The Power Purchase Agreement is only valid for a period of 20 years after which the Agreement would be renewed or the power plant decommissioned and the site rehabilitated. Extensions of the life of the plant of up to 10 to 20 years would depend on the choice of technology and the development of the technology over the first operational period. If the power plant is decommissioned the site would revert back to current land use activities (namely the grazing of small game and livestock).

During decommissioning approximately 50 to 100 people would be working on site over a period of six to 12 months. A large number of the workforce, if not all, would be sourced from the De Aar area.

3.2 CONSIDERATION OF ALTERNATIVES

3.2.1 INTRODUCTION

NEMA prescribes that every application for Environmental Authorisation must include, *inter alia*, include an investigation of the potential consequences or impacts of the alternatives to the activity on the environment and assessment of the significance of those potential consequences or impacts, including the option of not implementing the activity (i.e. No-Go Alternative).

"Alternatives", in relation to a proposed activity, are different ways of meeting the general purposes and requirements of the proposed activity, which may include alternatives to:

- the property on which, or location where, it is proposed to undertake the activity;
- the type of activity to be undertaken;
- the design or layout of the activity;
- the technology to be used in the activity;
- the operational aspects of the activity; and
- the option of not implementing the activity.

3.2.2 SITE AND LAYOUT ALTERNATIVES

Only one site alternative (namely Portion 3 of Farm Hartebeestplaats 135) is being considered. The site was selected on the basis of high radiation levels, buy-in from the landowner and proximity to the Hydra substation. As can be seen in Figure 1.2, the area of the Northern Cape around De Aar is one of the areas with the highest solar radiation intensity in South Africa.

Due to the relatively small size of the site, it is not possible to consider any significantly different layout options on the site. The placement of the solar arrays was initially based on the following technical criteria:

- Horizons;
- Gradient;
- Slope orientation;
- Accessibility; and
- Existing infrastructure (e.g. roads, power lines, substations, etc.).

The proposed layout, as presented in the FSR, was amended slightly based on the recommendations made in the specialist baseline studies undertaken during the Scoping Study Phase. The rock outcrops, existing buildings and area beneath and to the south of the existing power lines have purposely been excluded from the proposed plant layout. Figures 3.9 and 3.10 present earlier layout options considered during the Scoping and EIA process. The layout currently proposed is presented in Figure 3.4.

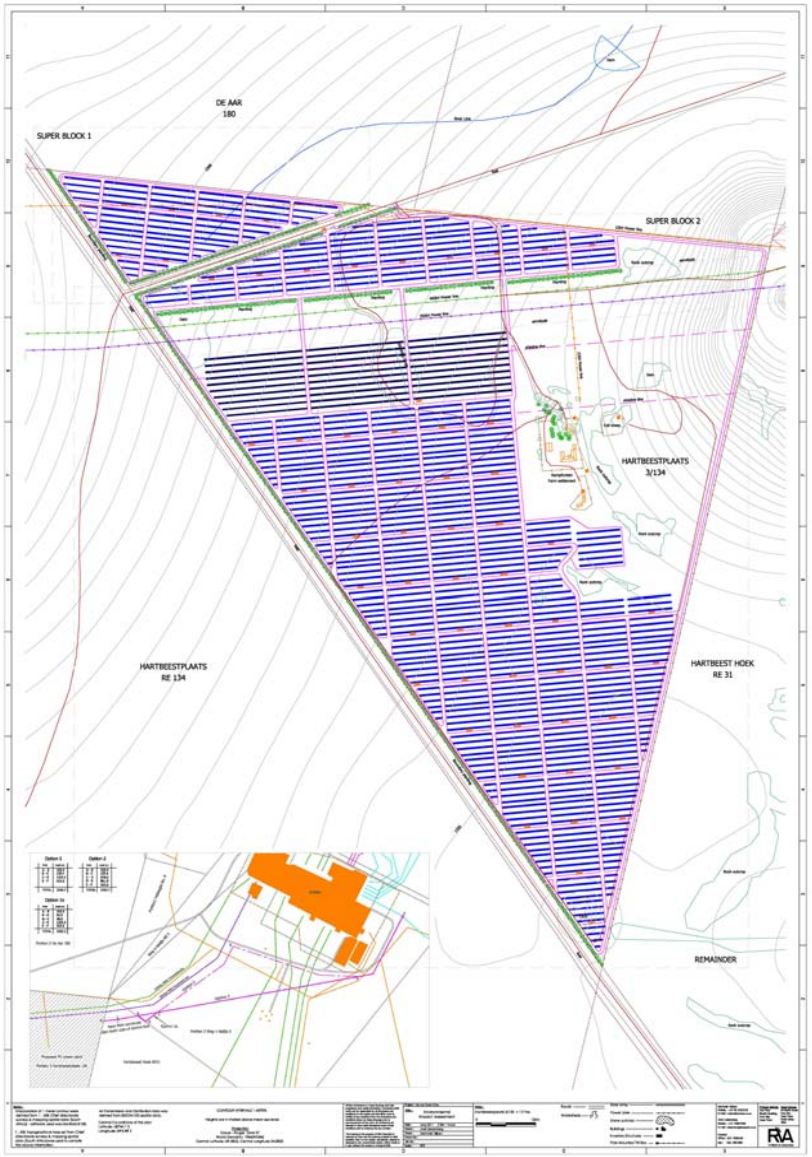


Figure 3.8: Original layout proposed for the photovoltaic power plant on Farm Hartebeestplaats 135/3.

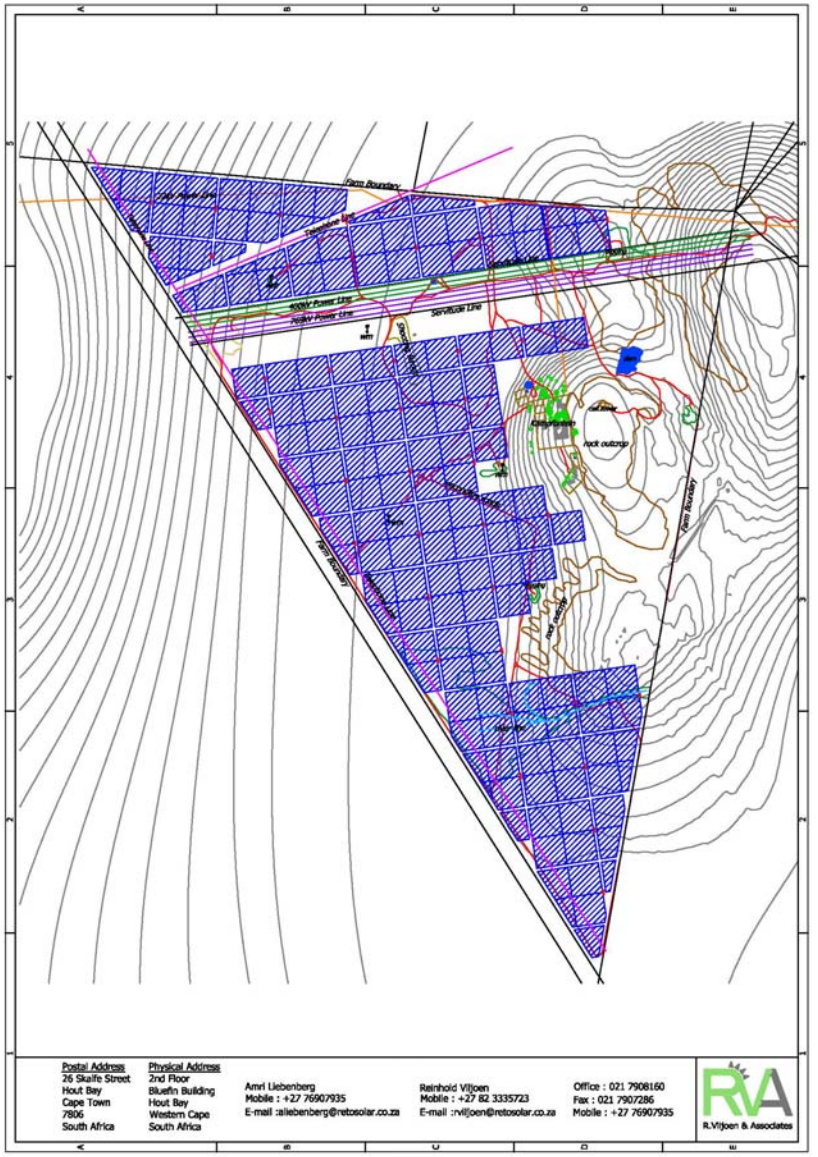


Figure 3.9: Proposed layout as presented in the Final Scoping Report.

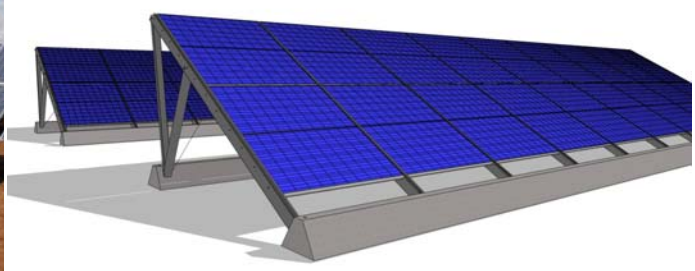
3.2.3 TECHNOLOGY

The proposed project would use either silicone crystalline or thin-film modules, configured on fixed frames or on trackers (see Section 3.1.3).

Alternative mounting systems are also being investigated. There are many ground mounted structures available based on either piled or ballast systems (see Figure 3.8). Piled systems utilise a metal pile that is driven into the soil on which the main structural beam is mounted. This system is utilised extensively in Europe where soils are generally deep. An advantage of this system is the mechanisation of the process, lowering the construction costs in Europe where labour is expensive. Ballast foundations utilise a concrete or other material foundation with sufficient mass to offset wind loads. This system requires no penetration of the soil and is suitable for hard rocky soils.

Polar trackers are also being considered (see Figure 3.9). This system is suitable for use with standard crystalline and thin-film modules. The tracker is oriented on a north-south axis and tracks in two dimensions only (also called a 'single-axis' tracker). This system increases the performance of modules by approximately 20% over a fixed configuration. This improvement is mainly experienced early and late in the day and covers more of the morning and evening electricity usage peaks.

Piled system (Shletter)



Ballast system (Greennexus)

Figure 3.10: The different ground mounted systems being considered (from RV & Associates).

Figure 3.11: A Polar Tracker mounted system (from RV & Associates).

3.2.4 POWER LINE

The closest substation to the site is the Hydra substation, approximately 1.5 km east of the site. Three alternative power line route options are being considered from the north-eastern corner of the site to the Hydra substation.

The parameters of each of the options are summarised in Table 3.1 below and illustrated in Figure 3.10. Note that Option 1a is just a slight deviation of the Option 1 alignment. The proponent's preferred alternative at this stage is Option 1a.

Table 3.1 Power line options considered from the north-eastern corner of the proposed plant.

Power Line Option	Route Description	Total Length
Option 1	• Runs parallel to an existing 765 kV line for 358.7 m. • Carries on straight for 1 353 m to the south-eastern corner of Hydra. • Bends in a north-north-easterly direction, following an internal substation access road and connecting to the substation along the eastern boundary.	2 236.7 m
Option 1a	• Similar alignment to Option 1 for the first 225.3 m. • A slight deviation from Option 1 route over a distance of 160 m. • Joins Option 1 route for the last 1 878 m.	2 263.3 m
Option 2	• Runs parallel to an existing 765 kV line for 1 036.7 m. • Bends in an east-south-easterly direction, following an internal substation access road for 861 m. • Joins the Option 1 route for the last 525 m.	2 422.7 m

3.2.5 NO-GO ALTERNATIVE

The No-Go alternative relates to the option of not developing the proposed power plant and associated infrastructure. If the proposed project is not developed, the current land use activities would continue. The landowner would continue to operate a guesthouse and graze small game and livestock on the property.

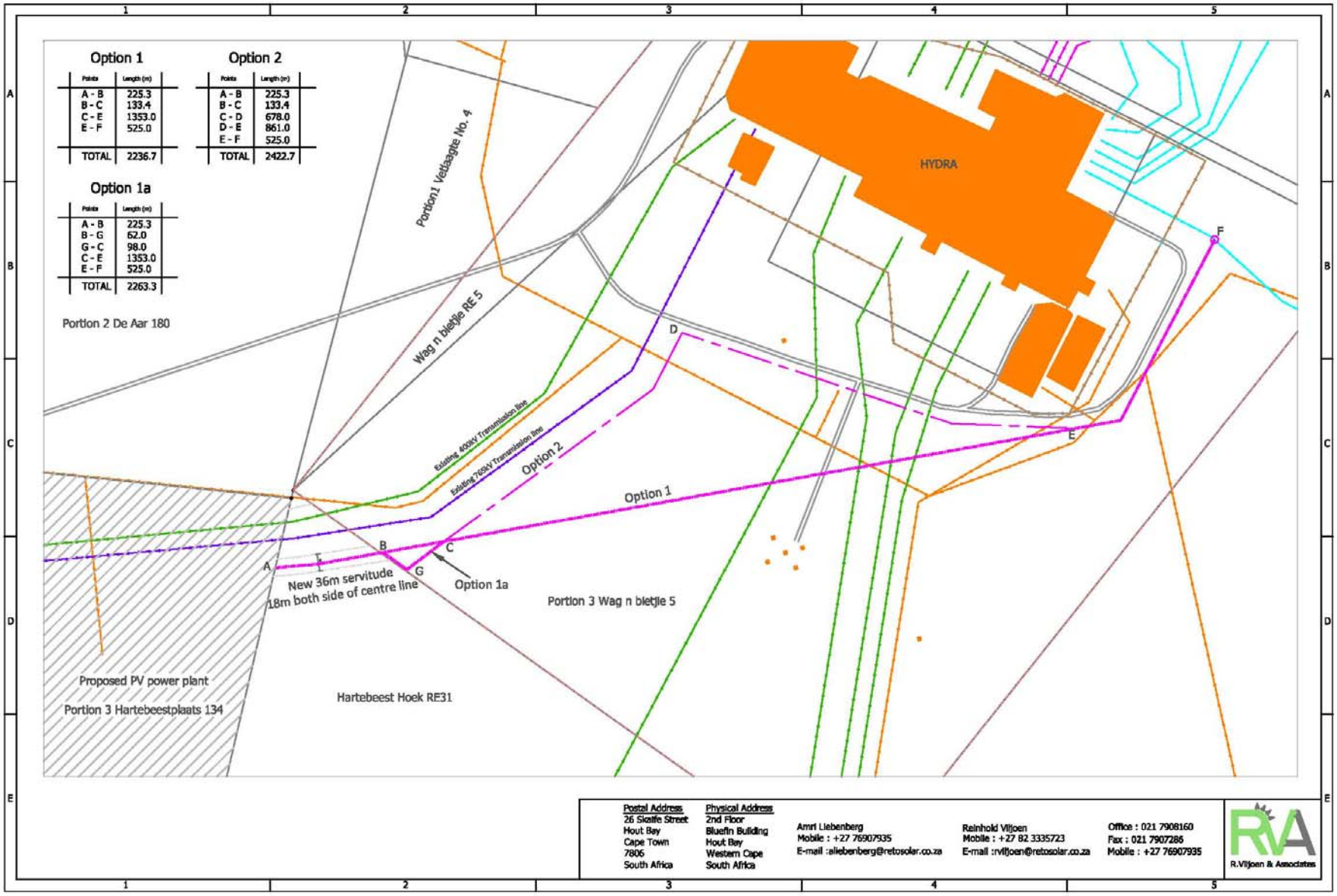


Figure 3.12: Three alternative power line route options and connection points to the Hydra substation. Existing power line connections are also indicated.

4. THE AFFECTED ENVIRONMENT

This chapter provides a summary description of the biophysical and socio-economic environment likely to be affected by the proposed project.

4.1 THE BIOPHYSICAL ENVIRONMENT

4.1.1 CLIMATE

The climate of the study area (Koch & Kotze, 1986) can be regarded as warm to hot with a summer rainfall and dry, cold winters. The long-term average annual rainfall in this region of the Northern Cape is only 289 mm, of which 201 mm (70%) falls from November to April.

Temperatures vary from an average monthly maximum and minimum of 32.6ºC and 15.4ºC for January to 16.8ºC and 0.3ºC for July, respectively. Temperature ranges are large with lows of -10°C in winter to mid-40°C in summer. Frost occurs most years, 30 days on average, between late May and early September.

4.1.2 TOPOGRAPHY

The area is characterised by wide open plains with relatively flat topography typical of the Central Karoo. The site is relatively flat (average slope gradient is less than 10% from the east to the west) with some low rocky ridges in the east and north-east of the site. There are a few shallow drainage lines present on site (see Section 4.1.7). The site is located at an altitude of approximately 1 300 m to 1 340 m above sea level. The contours (20 m) on site are presented in Figure 3.4.

4.1.3 GEOLOGY

The geology of the area comprises shales, mudstones and sandstones of the Adelaide Formation (Beaufort Group, Karoo Supergroup), which have been intruded in places by dolerite of the Jurassic age (see Figure 4.1). The sedimentary shales and sandstones are more readily weathered than the dolerite that forms resistant rocky outcrops (Barichievy, 2010; Outeniqua Geotechnical Services, 2011).

4.1.4 LAND TYPE, SOIL AND AGRICULTURAL POTENTIAL

The site is characterised by one land type, namely Ae137 (i.e. deep, red, freely-drained soils with a high base status). The soils on site are shallow red and red-brown soils, mainly loamy and structureless. More structured, clayey soils are found on the dolerite parent material in the east.

The area has a low prevailing agricultural potential. The climatic restrictions (namely very low rainfall) means that this part of the Northern Cape is best suited for grazing, although the grazing capacity is low (approximately 20-25 ha/large stock unit) (ARC-ISCW, 2004). The only means of cultivation would be by irrigation.

A summary of the dominant soil characteristics and agricultural potential of the Ae137 land type is given in Table 4.1.

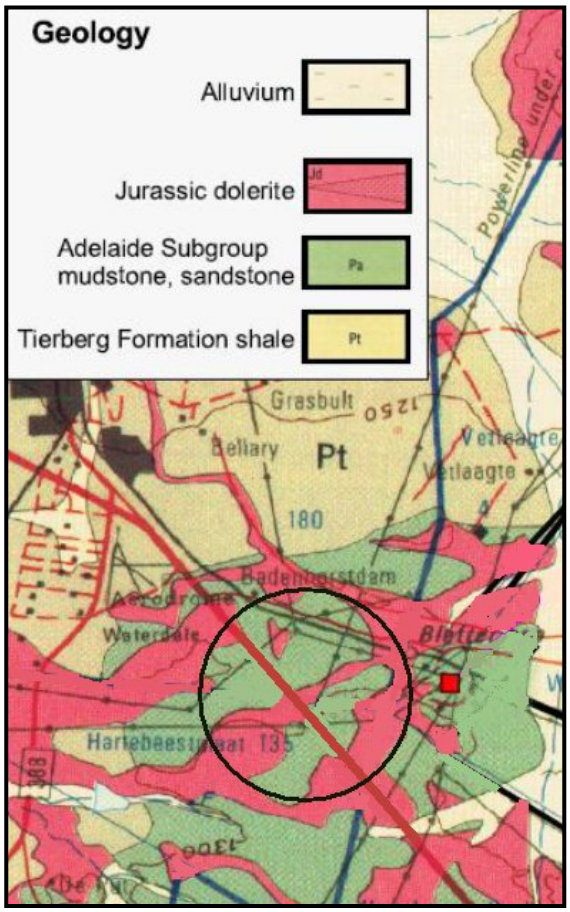


Figure 4.1: Geological map of the study area showing the approximately location of Hartbeestplaat 135/3 (adapted from the geological map in Outeniqua Geotechnical Services, 2011).

Table 4.1: Dominant soil characteristics of the land type Ae137.

Land type	Depth (mm)	Dominant soils	% of land type	Characteristics	Agricultural Potential (%)
Ae137	200-400	Hutton 33/36	69%	Red, sandy to sandy loam topsoils on hard rock	High: 3.2 Mod: 0.0 **Low: 96.8**
	50-300	Mispah 10/20	13%	Red-brown, occasionally calcareous topsoils on rock/calcrete	
	100-200	Swartland 20/21	10%	Red-brown, structured clay loam soils on weathering rock	

4.1.5 VEGETATION

4.1.5.1 General vegetation description and conservation status

De Aar and its immediate surroundings are located within the Nama Karoo Biome and Upper Karoo Bioregion (Rutherford & Westfall, 1994; Mucina & Rutherford, 2006). Mucina and Rutherford (2006) identify four vegetation types in the vicinity of De Aar, including Upper Karoo Hardeveld, Besemkaree Koppies Shrubland, Eastern Upper Karoo Vegetation and Northern Upper Karoo Vegetation. The vegetation type on the site consists entirely of Northern Upper Karoo (see Figure 4.2).

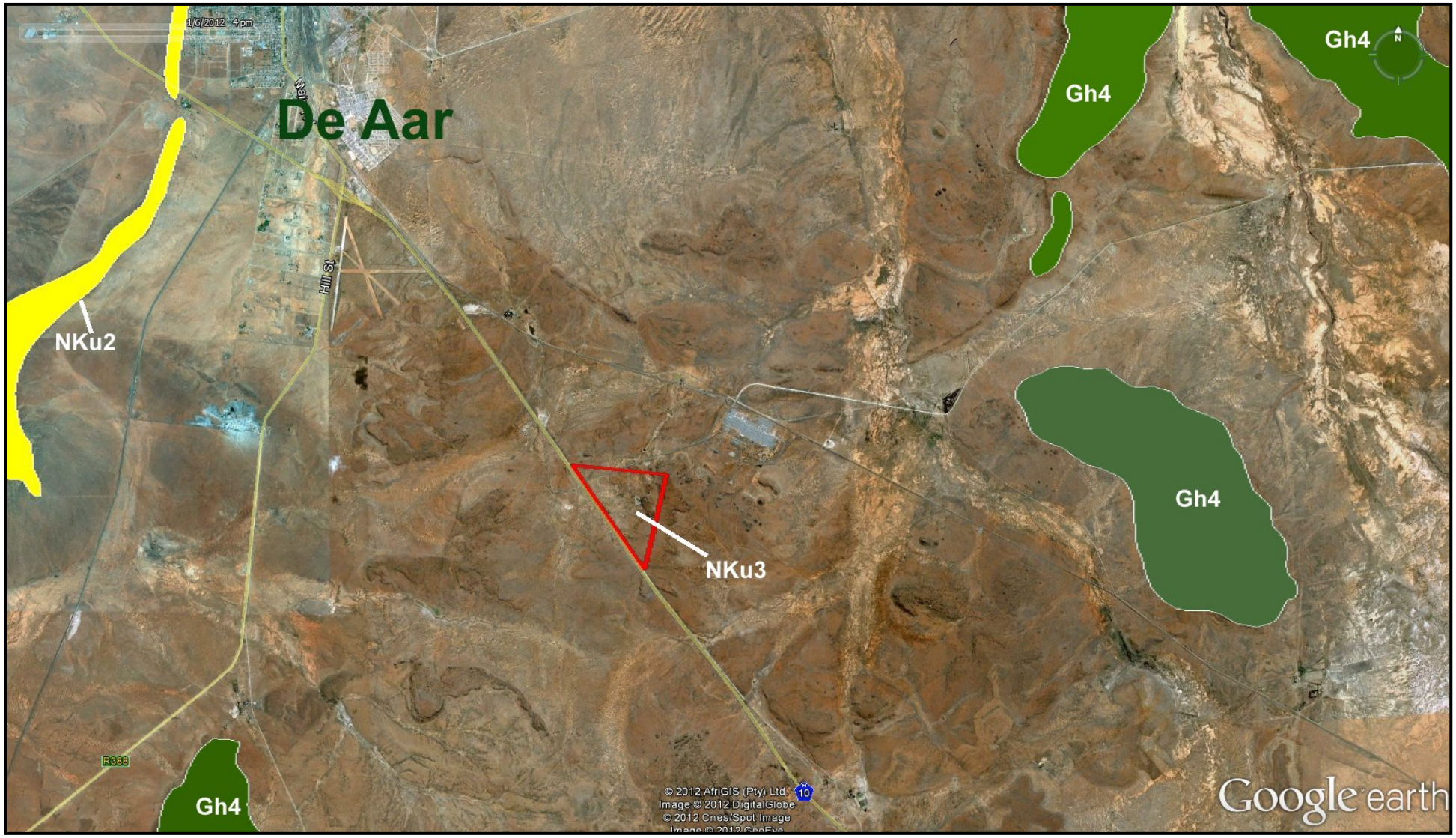


Figure 4.2: Vegetation Map of the De Aar area with the site indicated (after Mucina, Rutherford and Powrie, 2005). Gh4 (green) = Besemkaree Koppies Shrubland; NKu2 (yellow) = Upper Karoo Hardeveld; NKu3 (all uncoloured area on map) = Northern Upper Karoo vegetation.

Northern Upper Karoo is a grassy shrubland vegetation type with low shrubs, forbs and herbs in a grassy matrix. This vegetation type has a wide distribution and is classified as Least Threatened. There has been low transformation of this vegetation type by agriculture and infrastructure. However, grazing has had the main impact and in many places the high densities of livestock over extended periods have resulted in extensive degradation of the veld. The study area does not fall within a proclaimed threatened ecosystem (Government Gazette No. 34809) and the area (namely the Nama-Karoo) has not been mapped to designate Critical Biodiversity Areas (CBAs) or Ecological Support Areas (ESAs).

4.1.5.1 Description of the vegetation on site

The vegetation of the study area is typical Upper Northern Karoo vegetation.

The low-lying parts of the site are dominated by a low grassy shrubland (see Plate 4.1), which has a good mix of grass species, with *Aristida* spp. and *Eragrostis* spp. Being prominent. The majority of shrubs are in the family Asteraceae (daisy family) with *Pentzia incana* (ankerkaroo) being abundant and dominant. *Chrysocoma ciliata* (bitterbos), *Phymaspermum aciculare* (heuningkaroo), *Rosenia glandulosa* (klierbos) and *Pentzia sphaerocephala* (grootberggansiekaroo) are scattered throughout the site, but not abundant. *Ruschia* cf. *intricata* (doringvygie) (Aizoaceae), a low succulent-leaved shrub with spiny branches, occurs in concentrated patches most often where the soil is shallow (see Plate 4.2).

The rocky outcrops to the east of the existing farmstead are characterised by low to mid-high shrubs of *Searsia ciliata* and the occurrence of co-dominant shrubs, *Ruschia* cf. *intricata* and *Eriocephalus ericoides* (see Plate 4.3). A notable population of *Aloe broomii* (Bergaalwyn) is also found on the higher dolerite outcrops (see Plates 4.4).

Although there are endemic species in Northern Upper Karoo vegetation (e.g. *Lithops hookeri, Stomatium pluridens*, *Atriplex spongiosa, Galenia exigua* and *Manulea deserticola*), no endemic or threatened plant species were found on site.

The vegetation on site has been historically disturbed by ploughing and establishment of the Kampfontein farmstead (an area of approximately 54 ha or half the area of the farm), mainly in the flat 'low-lying' northern and western part. The area was last ploughed 27 years ago and has since been allowed to revert to natural grassy shrubland. The rocky areas in the east and the grassy shrubland in the southern corner are relatively undisturbed apart from grazing.

Plate 4.1: Low grassy shrubland typical of the greater part of the study area (Photo: D. McDonald).

Plate 4.2: Low, spiny *Ruschia* cf. *intricata* shrubs forming open stands on shallow soils (Photo: D. McDonald).

Plate 4.3: **A typical dolerite rocky outcrop found in the eastern part of the study area (Photo: D. McDonald).**

Plate 4.4: ***Aloe broomii*** **favours the higher rocky dolerite habitats (Photo: J. Blood).**

4.1.6 TERRESTRIAL FAUNA (INLCUDING AVIFAUNA)

4.1.6.1 Invertebrates

There are no Red Data butterfly species occurring in the study area (Henning *et al*., 2009).

4.1.6.2 Amphibians

Four frog species have been recorded in the vicinity of De Aar (Minter *et al.*, 2004) (see Table 4.2). In addition, the Giant Bullfrog (*Pyxicephalus adspersus*), a species protected in terms of NEMBA has been recorded just to the north of De Aar. There is no other formal record of this species occurring in the quarter degree grid cell around De Aar and as there are no substantial water bodies on the site, it is not expected to occur within the proposed project footprint. No other species of conservation concern are known to occur in the Northern Cape (Measy, 2011).

Table 4.2: Frog species expected to occur in the De Aar study area.

No.	Scientific name	Common name
1	*Kassina senegalensis*	Bubbling Kassina
2	*Xenopus laevis*	Common Platanna
3	*Cacosternum boettgeri*	Boettger's Caco
4	*Breviceps adspersus*	Common Rain Frog
5	*Pyxicephalus adspersus*	Giant Bullfrog

4.1.6.3 Reptiles

From the latest Reptile Atlas Data (Bates *et al.*, In prep.) 19 reptile species have been recorded within the quarter degree grid cell around De Aar (and according to Branch (1998), it is expected that a further 10 reptile species may occur in the present study area (see Table 4.3). These include 15 lizard species, 11 snake species and three tortoise species. None of these are currently classified as species of conservation concern.

During the baseline survey, only Bibron's Gecko (*Chondrodactylus bibronii*) and the Variegated Skink (*Trachylepis variegata*) were recorded in the rocky areas of the site.

Table 4.3: Reptile species expected to occur in the study area.

No.	Species	Common name
Lizards		
1	*Trachylepis capensis*	Cape Skink
2	*Trachylepis occidentalis*	Western Three-striped Skink
3	*Trachylepis sulcata sulcata*	Western Rock Skink
4	*Trachylepis variegata*	Variegated Skink
5	*Meroles suborbitalis*	Spotted Desert Lizard
6	*Pedioplanis namaquensis*	Namaqua Sand Lizard
7	*Pedioplanis lineocellata pulchella*	Spotted Sand Lizard
8	*Pedioplanis laticeps*	Karoo Sand Lizard
9	*Karusasaurus polyzonus*	Karoo Girdled Lizard
10	*Agama atra*	Southern Rock Agama
11	*Agama aculeata aculeata*	Common Ground Agama
12	*Pachydactylus mariquensis*	Marico Gecko
13	*Chondrodactylus bibronii*	Bibron's Gecko
14	*Pachydactylus capensis*	Cape Gecko
15	*Varanus albigularis albigularis*	Rock Monitor
Tortoises		
1	*Stigmochelys pardalis*	Leopard Tortoise
2	*Psammobates tentorius* subsp.	Tent Tortoise
3	*Psammobates tentorius verroxii*	Verrox's Tent Tortoise
Snakes		
1	*Boaedon capensis*	Brown House Snake
2	*Prosymna sundevalii*	Sundevall's Shovel-snout
3	*Dipsina multimaculata*	Dwarf Beaked Snake
4	*Psammophis notostictus*	Karoo Sand Snake
5	*Dasypeltis scabra*	Rhombic Egg Eater
6	*Bitis arietans*	Puff Adder
7	*Bitis caudalis*	Horned Adder
8	*Pseudaspis cana*	Mole Snake
9	*Naja nivea*	Cape Cobra
10	*Aspidelaps lubricus lubricus*	Coral Shield Cobra
11	*Rhinotyphlops lalandei*	Delalande's Beaked Blind Snake

4.1.6.4 Birds

One hundred and thirty five (135) bird species have been recorded in the area (South African Bird Atlas 1 (SABAP1) data (Harrison, 1997) and SABAP2). These species are presented in full in the Terrestrial Faunal Assessment (see Appendix 4.2).

The area around De Aar has been classified as an Important Bird Area - Platberg Karoo Conservancy: SA037 (Barnes, 1998). Barnes (2000) lists ten of the species recorded in the study area as Red Data species (see below). Some of these classifications have, however, been amended by Birdlife International for the International Union for Conservation of Nature (IUCN).

- Black Stork (*Ciconia nigra*) is listed as *Near Threatened* (Barnes, 2000) and *Least Concern* (IUCN, 2011). It feeds in and around water bodies and breeds in mountainous regions. It tends to roost in trees, on cliffs and power line pylons. Given the fairly flat topography of the site and absence of natural water bodies, it is not deemed as suitable stork habitat.

- Greater Flamingo (*Phoenicopterus ruber*) is listed as *Near Threatened* (Barnes, 2000) and *Least Concern* (IUCN, 2011). It frequents large, shallow water bodies. Since no such water bodies occur on site, it is not expected to occur in the study area.
- Secretary Bird (*Sagittarius serpentarius*) is listed as *Near Threatened* (Barnes, 2000) and *Vulnerable* (IUCN, 2011). It is widespread across South Africa in savannah and open grassland habitats. It is sensitive to disturbance and populated areas and is not commonly found around De Aar.
- Martial Eagle (*Polemaetus bellicosus*) is listed as *Vulnerable* (Barnes, 2000) and *Near Threatened* (IUCN, 2011). It is a widespread species, but uncommon in South Africa. It nests in large trees or on power pylons. The species is expected to occur in the surrounding area, but the site does not constitute suitable breeding habitat.
- Black Harrier (*Circus maurus*) is listed as *Near Threatened* (Barnes, 2000 and IUCN, 2011). It hunts over dry and damp grassland, fynbos and Karoo vegetation with a breeding stronghold in the south-western regions of South Africa. It is not expected to occur in the study area.
- Lesser Kestrel (*Falco naumannii*) is listed as *Vulnerable* (Barnes, 2000) and *Least Concern* (IUCN, 2011). It is a non-breeding migrant, favouring open grassland for foraging and is known to roost in large aggregations in trees and on utility structures. De Aar has some of the largest roosting populations of Lesser Kestrels in South Africa, arriving in late-October / early-November and migrating north during late-March and early-April (Anderson & Taljaard, 2002). The Lesser Kestrel has been seen foraging on site.
- Blue Crane (*Anthropoides paradisea*) is listed as *Vulnerable* (Barnes, 2000 and IUCN, 2011). It favours open grassland and cultivated fields, nesting on bare ground, often in moist places. Due to the disturbed nature of the site and proximity to human settlements it is not expected to constitute suitable breeding or foraging habitat for this species.
- Kori Bustard (*Ardeotis kori*) is listed as *Vulnerable* (Barnes, 2000) and *Least Concern* (IUCN, 2011). It occurs within semi-arid regions of South Africa, particularly in the Nama-Karoo, favouring tree-lined watercourses. It has not been recorded in high numbers around De Aar and is thus not expected to frequent the site.
- Ludwig's Bustard (*Neotis ludwigii*) is listed as *Vulnerable* (Barnes, 2000) and *Endangered* (IUCN, 2011). Its range is centred around the Nama-Karoo and Succulent Karoo biomes. It favours the open plains of the semi-arid Karoo and is a common resident of the De Aar area and is thus expected to occur on site. Collision with overhead power lines has been identified as an important threat to this species.
- Blue Korhaan (*Eupodotis caerulescens*) is listed as *Near Threatened* (Barnes, 2000 and IUCN, 2011). It is a common resident in the De Aar area, favouring open grassveld, Karoo scrub and cultivated lands. It is expected to occur on site.

4.1.6.5 Mammals

Forty-eight mammal species may occur within the larger study area around De Aar (Friedmann & Daly, 2004). These species are presented in full in the Terrestrial Faunal Assessment (see Appendix 4.2). Only one mammal species (suricate) was observed on site, apart from the landowner's herd of Blesbuck and Springbuck. The site provided limited shelter for mammal species, but some signs of small mammal activity were, however, observed in the rocky areas on the site.

Only one of the species potentially occurring in the greater study area is classified as a Red Data species, namely Geoffroy's Horseshoe Bat (*Rhinolophus clivosus*), which is listed as Near Threatened (Friedmann & Daly 2004). It is predominantly a cave-dwelling species and as there are no major cave systems in the area, it is not expected to occur on the site.

4.1.6.6 Faunal habitats

The site is fairly flat with low-growing shrubs in a grassy matrix (see Section 4.1.5.1). The area is largely disturbed and is currently used for grazing of small game. There are a number of low rocky dolerite outcrops along the eastern edge of the site (see Plate 4.3). The rocky outcrops, however, do not provide abundant shelter for rock-dwelling mammals and reptiles. There is a shooting range on site, which is surrounded by a berm of rocks and boulders, currently providing some shelter for reptiles and small mammals.

The study area contains no unique or important faunal habitats relative to the surrounding area. Furthermore, the study area appears to have a low faunal species diversity and population densities are expected to be low.

4.1.7 FRESHWATER SYSTEMS

4.1.7.1 General description and conservation status

The site is located in the Lower Orange Water Management Area, which forms part of the DWA's greater water supply system, and in quaternary catchment D62D. The main aquatic feature within the larger study area is the Brak River, which is a seasonal tributary within the Orange River System. Most of the smaller tributaries are ephemeral and are discernible only as slightly shallow depressions with slightly clayey soils and no clear associated vegetation.

Due to the unreliable nature of surface water flows, much of the water use in the area is from groundwater (see Section 4.1.8). In addition, small, shallow instream dams have generally been constructed within the small drainage channels, which is the situation on site. This water is available for a relatively short period after rainfall events and is used mainly for stock watering.

The Brak River has been identified as having conservation importance. The site lies within the upstream Freshwater Ecosystem Protected Area (FEPA) catchment of the Brak River, which implies that the water resource and its catchment should be maintained in its current state and should not be allowed to degrade the downstream FEPA catchment.

4.1.7.2 Description of the water resources on site

Two small ephemeral streams / drainage channels with predominately a sandy / silty substrate cross the site. The upper portions of these ephemeral streams are largely natural to moderately modified (see Plate 4.5). However, in their lower sections these streams have been significantly modified into stormwater drainage channels to allow for stormwater management along the N10 and in the lower lying areas on the site (see Plate 4.6). There are also two small instream dams within these drainage channels (see Plate 4.7). The water features on the site are indicated in Figure 4.3.

The ephemeral streams on site are all considered to be of low ecological importance and sensitivity.

Plate 4.5: An ephemeral tributary of the Brak River (Photo: T. Belcher).

Plate 4.6: More formalized drainage channel along the N10 that is connected to the natural ephemeral streams (Photo: T. Belcher).

Plate 4.7: Farm dam in the north-eastern corner of the site (Photo: T. Belcher).

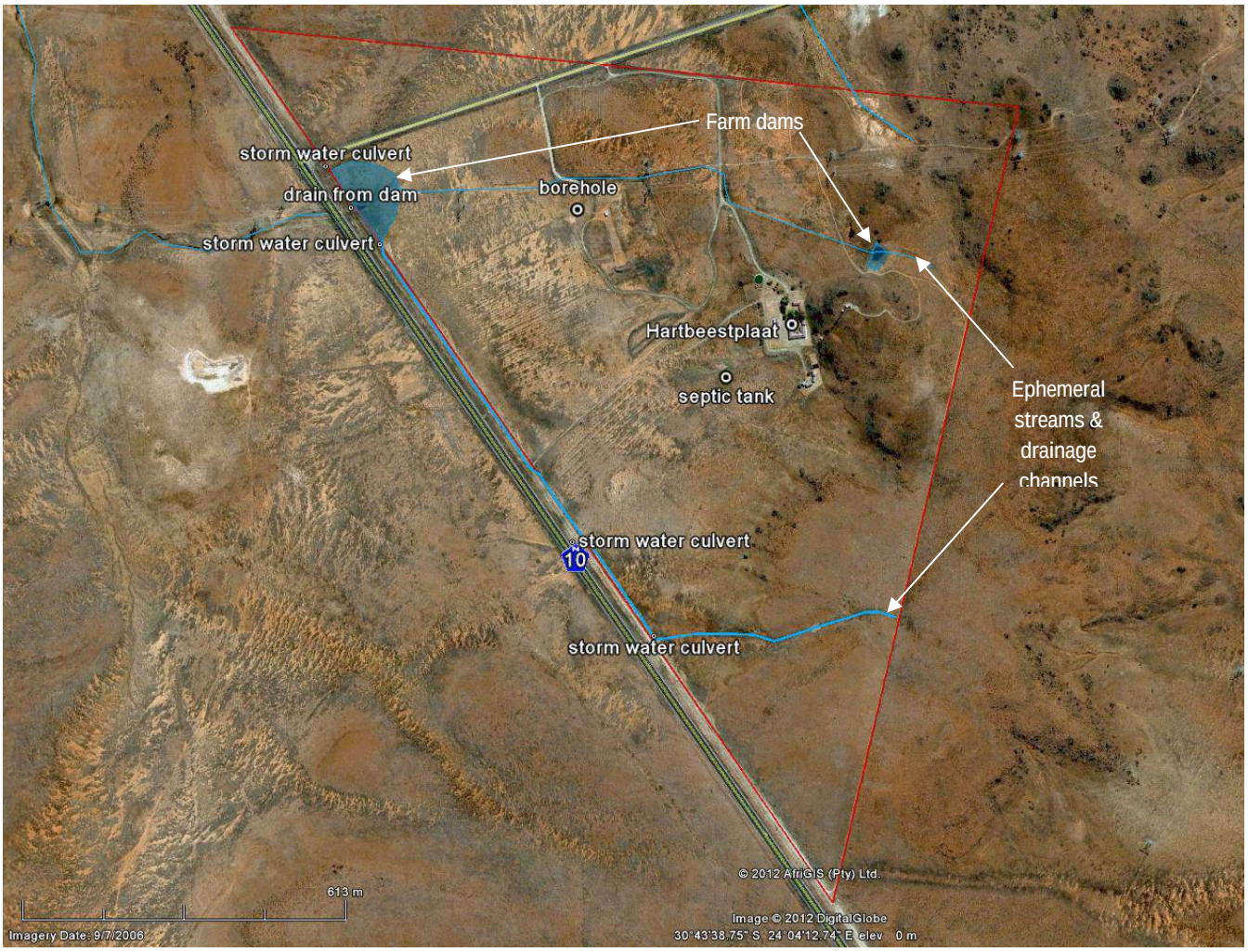


Figure 4.3: Google Earth image showing the water features located on site.

4.1.8 GROUNDWATER

4.1.8.1 Aquifer type, classification and vulnerability

Aquifers in the Karoo are secondary in character and owe their water-bearing properties to both fracturing and weathering. The intrusion of Jurassic-aged dolerite dykes, sheets and ring structures play an important role in the geohydrology of the region. The aquifers are fractured and intergranular in character. It is conceptualised that the prevailing Karoo aquifer system comprises four layers, namely:

- The thin upper alluvial cover (0 – 2m thick);
- The upper weathered zone (0 - 10m thick);
- The weathered and fractured zone (10 – 50m thick); and
- The deeper unweathered bedrock.

Karoo aquifers are heterogeneous with hydraulic properties varying significantly over short distances. The harvest potential of these aquifers in the vicinity of the site has been set at 11 000 m^3/km^2/annum (Baron et al., 1998).

Aquifers in and around De Aar are classified as sole source aquifers as they are used to supply more than 50% of the water demand of the area (Parsons, 1995). These aquifers merit a high degree of protection because of their high strategic importance.

Parsons and Conrad (1998) showed Karoo aquifers are typically moderately vulnerable to anthropogenic impacts.

4.1.8.2 Recharge

Recharge of Karoo aquifers is a complex process dependent on antecedent soil moisture conditions, rainfall (duration and intensity) and geology. It is well recognised that a minimum volume of rainfall is required before recharge takes place, with Vegter (1992) indicating that recharge in the vicinity of De Aar only occurrs when daily rainfall exceeds 15 mm. It is also recognised recharge only takes place after significant rainfall events and does not necessarily occur each year.

A general acceptance that recharge in the Karoo equates to 2% to 3% Mean Annual Precipitation (MAP). Woodford (2007) estimated recharge in the De Aar groundwater management areas is 3% MAP. Recharge is probably ubiquitous in character.

4.1.8.3 Borehole yields

In Karoo geohydrological settings, typical borehole yields range between 0.5 and 2 litres per second (L/s). However, higher yields are obtained in dolerite-sediment contacts zones and areas of increased fracturing and jointing. Woodford (2007) reported the yield of municipal production boreholes range between 3 L/s and 15 L/s.

Boreholes at the site are relatively low yielding. Some of the stronger boreholes on the farm were reported to have been tested at about 1.2 L/s (PJ Erasmus, *pers. comm*.).

4.1.8.4 Depth to groundwater and direction of flow

Depth to groundwater on site was measured to be between 8 and 12 metres below ground level (mbgl). Similar depths were measured directly north and north east of the site. Slightly shallower depths were reflected in the National Groundwater Archive data set (i.e. 4 mbc to 6 mbc some 5 km east of the site). Monitoring by DWA indicates groundwater levels typically fluctuate seasonally by 1 m to 2 m.

Using data measured during the hydrocensus and that sourced from the National Groundwater Archive, it was calculated that groundwater flows in a northerly direction. At a regional scale, the direction of groundwater flow probably mimics topography (and hence surface water flow directions).

4.1.8.5 Surface-groundwater interaction

Based on groundwater depth (8 to 12 mbgl) and given the ephemeral nature of the streams on site, limited (if any) groundwater discharge to surface takes place in the vicinity of the study site. No springs were identified in the vicinity of the site.

4.1.8.6 Groundwater quality

Groundwater quality in the general vicinity of the study area is moderate, with Woodford (1989) reporting an "average" electrical conductivity (EC) of 160 milliSemens per metre (mS/m) in the areas south east of De Aar. Good to moderate quality groundwater (75 mS/m – 130 mS/m) has been observed at Riet Fountain some 9km east of the proposed photovoltaic power plant. Groundwater typically has a NaCl character. A bulk groundwater sample taken from the reservoir on Kampfontein yielded an EC of 58 mS/m, indicating a surprisingly good groundwater quality fit for domestic consumption.

4.1.8.7 Groundwater use

De Aar is entirely dependent on groundwater for its water supply (Woodford, 2007). Well fields comprising some 68 boreholes and two springs are distributed around the town (see Figure 4.4), the closest to the study site being boreholes in De Aar (approximately 6.5 km to the north) and those on the Farm Riet Fountain (approximately 9 km to the east). Total municipal groundwater abstraction amounts to about 2 x 106 m^3/annum or 5 500 kilolitres per day (KL/d) (DWA, 2011).

Groundwater is also the predominant source of water for agricultural activities. Boreholes located in the vicinity of the site are presented in Figure 4.5. Groundwater is principally used for stock watering and domestic supply. There is no evidence of significant irrigation within 3 km of the study area.

At least 12 boreholes have been drilled on site (see Figure 4.6). Two of the boreholes are equipped with mono pumps driven by diesel-powered engines (BH5 and BH6), while three boreholes are equipped with wind pumps (BH1, BH2, BH4). BH3 is also periodically used, but at present is not equipped. It is estimated that groundwater use on site is currently in the order of 15 KL/d.

The Hydra substation, located east of the site, is also supplied with water from boreholes (see Figure 4.5). ESK2 is used for domestic and industrial purposes, while ESK3 is used solely for gardening purposes. ESK1 was used for supply purposes, but is now seldom used. Five boreholes were located within 1 km of the proposed development. These include two operational wind pumps used for stock watering (BM9 and WP15), one operational submersible pump (ESK3) used for gardening and two dysfunctional boreholes (PP1 and WP2).

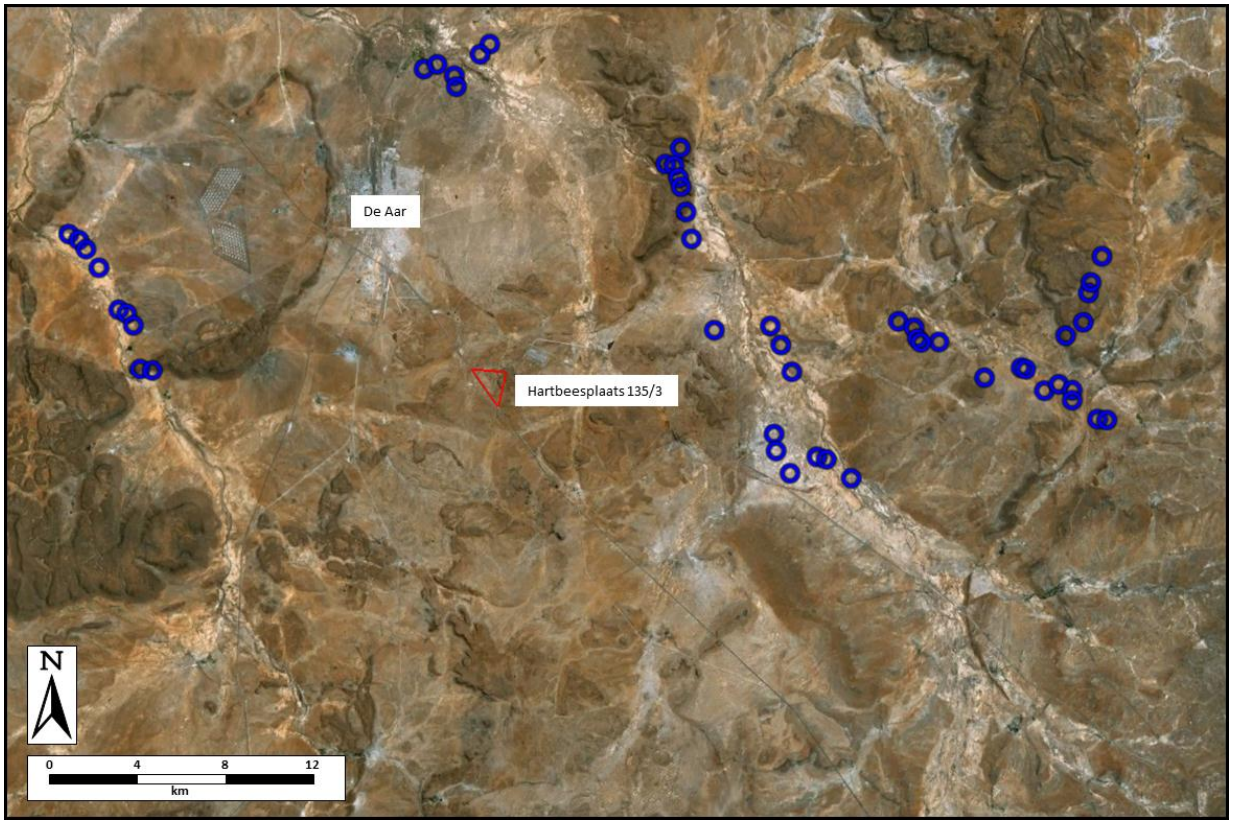


Figure 4.4: **Position of the production boreholes used to supply De Aar with water in relation to the proposed site (after groundwater assessment).**

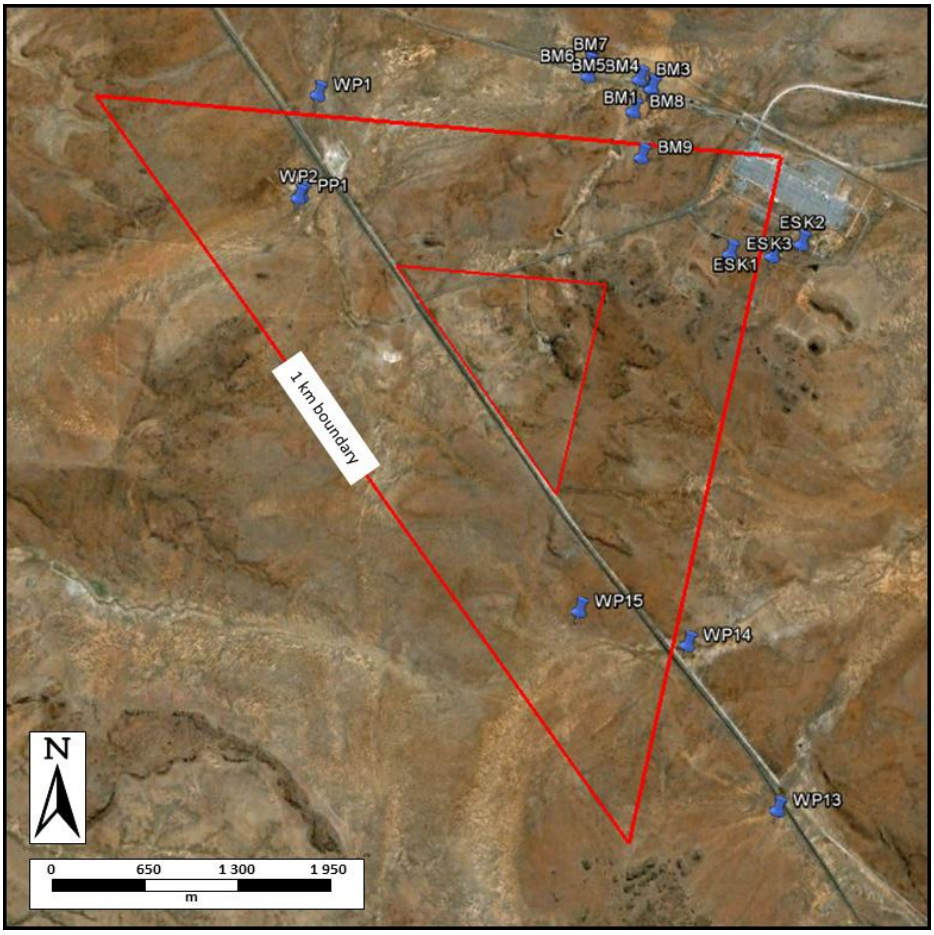


Figure 4.5: **Position of boreholes within 1 km of the site.**

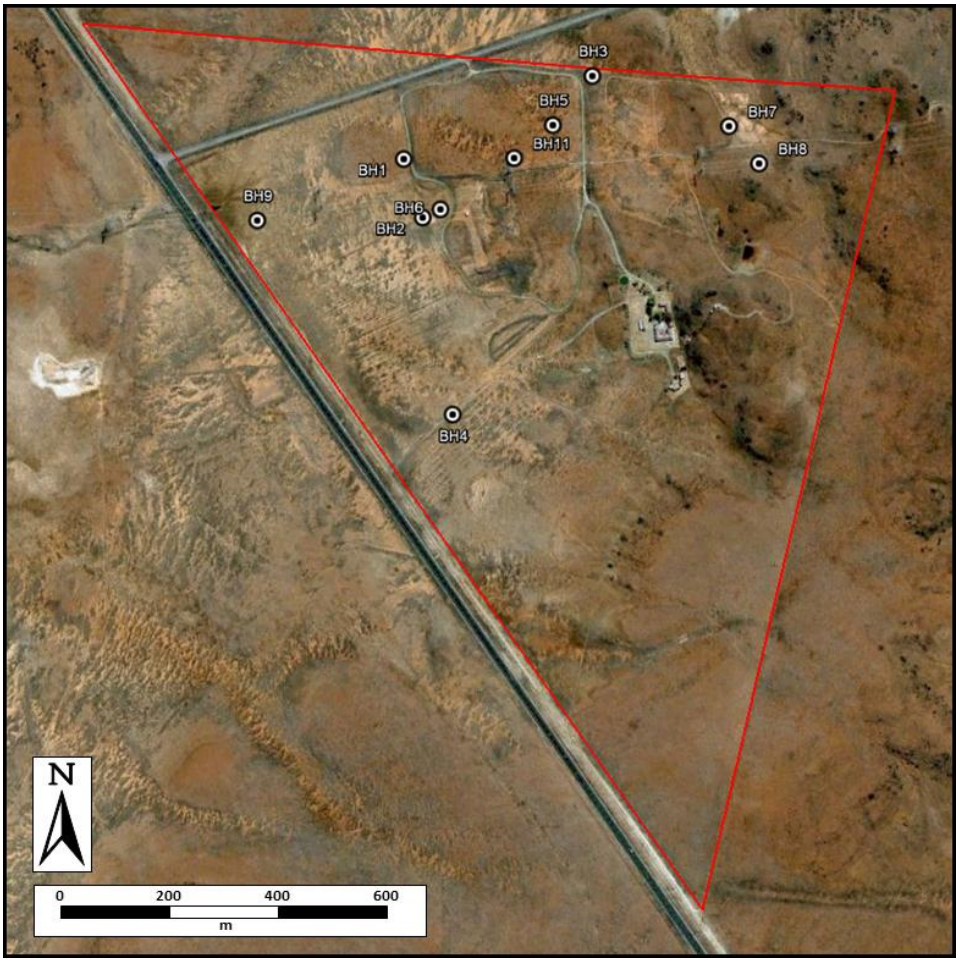


Figure 4.6: Position of boreholes on the Farm Hartbeesplaats 135/3.

4.2 SOCIO-ECONOMIC ENVIRONMENT

4.2.1 SOCIO-ECONOMIC DATA

4.2.1.1 Administrative context

The proposed project is located in the Emthanjeni Local Municipality (ELM) (NC073), which is divided into seven administrative wards, is one of eight B-Municipalities that constitute the Pixley ka Seme District Municipality (NC7). The District Municipality also includes a District Management Area (NCDMA07). The ELM is approximately 11 390 km² in size (approximately 11% of the greater Pixley ka Seme District Municipality). The largest towns within the ELM are De Aar, Britstown and Hanover. The administrative centre of the Municipality is De Aar, which lies approximately 300 km south east of the provincial capital of Kimberley.

4.2.1.2 Dominant economic sectors

Economically, the ELM contributed approximately 25% of the greater district's local economy in the year 2000. According to the ELM IDP (2010), the largest sectors within the municipality are the following: Community Services (36%); Transport (24%); Finance (13%); Trade (11%); Agriculture (7%); Electricity (4%); Manufacturing (3%); and Construction (2%).

De Aar is at the centre of the economy of the ELM. The dominant land use activity in the area is farming, specifically livestock farming (sheep) and small game farming (springbok). De Aar is a major railway junction that links Gauteng, Cape Town, Port Elizabeth, the Port at Coega, and Namibia. De Aar also has the largest abattoir in the Southern Hemisphere and the surrounding sheep farms are also major suppliers of wool for the local and international market.

4.2.1.3 Population and population groups

The Pixley ka Seme District Municipality's total population was estimated at 166 849 people, with the ELM accounting for approximately 23% (38 228) (Community Survey, 2007). The average population growth between 2001 and 2010 was estimated at 0.60% (ELM IDP, 2010). Given the size of the Municipality and the relatively small total population size, the population density within the Municipality generally is low at 3.4 people per km^2. According to the ELM IDP (2010), the municipal population is largely Coloured (57.5%), followed by Black African (35.3%), White (7.1%) and Asian (<1%).

4.2.1.4 Age profile

The age profile of the population reveals that approximately 65.2% of the population falls within the economically active age bracket of between 15 to 64 years of age. Approximately 30% of the population is 15 years old or less while the remaining 5% of the population are 64 years old or older. According to the ELM IDP, 31% of the population falls within the school going age group of 7 to 19 years.

4.2.1.5 Education

Broadly, the level of education within the ELM is low. In 2001 just under 20% of the population had no schooling, while approximately 1/10 of those who completed some form of Secondary education (~36%) progress to obtain education at University/Technikon level (~3.5%). Between 2001 and 2007, the education levels improved marginally with the number of people who had no form of education decreasing to 15% and those who completed some form of tertiary education increasing to just over 5%.

4.2.1.6 Employment

Unemployment within the ELM is estimated at approximately 23% of the total labour force, which is below the Northern Cape average of approximately 27%, while 43.5% of the population is not economically active[1]. The latter are made up of made up of scholars/students, homemakers/housewives, pensioners, the medically unfit, seasonal workers not currently employed and those who choose not to work.

4.2.2 PRESENT LAND USES

The site, Portion 3 of Farm Hartebeestplaats 135, is currently used primarily to graze small game and livestock (including Springbok, Hartebeest and Bontebok) and as a small guest lodge, 'Kampfontein' (see Plate 4.6). The site has five boreholes (diesel-powered and wind pumps), which used on a rotational basis for water supply (see Section 4.1.8.7). Other infrastructure on site includes: farm access roads (Plate 4.7); shooting range (Plate 4.8); brickworks (Plate 4.9); radio tower; and 400 kV and 769 kV power lines (Plate 4.10).

[1] The term "not economically active" refers to people of working age not actively participating in the economy, such as early retirees, students, the disabled and home-makers.

Other notable land uses in the area include livestock farming on adjacent properties in all directions from the site, the Hydra substation approximately 1.5 km east of the site (see Plate 4.11), and the De Aar airfield approximately 5 km north-west of the site. The Bletterman railway station, which is located adjacent to the Hyrda substation approximately 2 km to the north-east of the site, is no longer operational (see Plate 4.12). The visual character of the area and its sense of place have been altered by these existing infrastructure and adjacent land uses (see Section 4.3.4).

There are no formal or informal nature conservation areas in close proximity to the study area. A number of other solar power projects are also being proposed in the area, the closest being the proposed Hartebeesthoek project along the southern boundary of the site.

4.3 HERITAGE AND CULTURAL ENVIRONMENT

4.3.1 History of De Aar

The history of De Aar is closely linked to the history of South Africa's railway system. Due to its central location, the government bought a portion of the Farm De Aar and construct a junction on the first railway line from Cape Town to Kimberley in 1881. The junction was originally called Brounger Junction after the Colonial railway engineer at the time, William Brounger. However, the name reverted to the name of the farm, namely De Aar. The junction played a key strategic role for the English during the Second Boer War. In 1889 two brothers, Issac and Wolf Friedlander, who ran the local trading store and hotel at the junction bought the Farm De Aar. After the Anglo Boer War a small town was established on the farm and a municipality was created in 1903. The town’s first mayor, Dr Harry Baker, was elected in 1907.

De Aar is the second-most important railway junction in the country. The lines from the Eastern and Western Cape, as well as the northern provinces, Zimbabwe and Namibia all meet in De Aar. As a railway and bridge-building depot the local South African Railways workshops played an important role in South Africa's rail network and were a major source of employment for the town.

However, over the last 10 to 15 years the move away from rail transport to road transport has had a significant effect on the town’s economy. Despite this De Aar remains the main commercial and distribution centre for a large area of the central Great Karoo. Major production activities of the area include wool production and livestock farming.

4.3.2 Anglo-Boer War

De Aar played a significant role during the Anglo-Boer War and the two battles of significance occurred in the area, namely the Battle of Stormberg and the Battle of Colenso.

Fortifications were developed on hilltop locations and the railway station is guarded by strategically placed blockhouses (Marais, 1977). De Aar was used as a central storage place for ammunition and horses. However, the shortage in water resulted in the death of horses and cattle. Wounded soldiers were transported from Magersfontein, Modderfontein and Graspan to the De Aar hospitals to receive medical treatment (Marais, 1977). The high number in deaths resulted in a significant number of grave yards being established in the area.

4.3.3 Archaeology

The De Aar area is evident of the occurrence of rock art engravings and the associated Stone Age period. The two main cultural and industrial units that have been traditionally recognised during the Holocene in South Africa include the Wilton and Smithfield industries (Deacon, 1974). The Smithfield industry was originally defined as an indigenous element that occurred in the Orange Free State, Northern Cape and the previously named Transvaal areas. However, Smithfield variants were also discovered in Natal and along the Southern Cape areas. The Smithfield industries were categorised into:

- Smithfield A was characterised by large circular and concavo-convex scrapers;
- Smithfield B was characterised by long-end scrapers; and
- Smithfield C was used to describe the small convex or “thumbnail” scrapers (Deacon, 1974).

Smithfield A and B industries preferred the use of lydianite or shale raw material. The smaller scrapers produced during the Smithfield C industries preferred using chalcedonies and agates (Deacon, 1974).

The Wilton industry is regarded as essentially similar to the Smithfield C with smaller scrapers and backed microliths, but with the addition of significantly larger number of segments. Raw materials were usually silcrete, quartz and chalcedony

No significant archaeological sites or artefacts were identified on site. A scattered stone tool was identified on the dolerite outcrop to the east of the existing farmstead (see Plate 4.13).

Rock paintings in South Africa are mainly distributed along the mountainous areas in the south-western Cape and the northern areas of the Drakensberg. A rock art site is, however, located in the vicinity of De Aar that shows weathered, lightly pecked outlines of a buck (Beaumont and Vogel, 1989).

4.3.4 Sense of place

The study area has a rural character consisting of open grassland and low scrub vegetation. It is an arid landscape with scattered farmsteads surrounding the site. The area is already visually disturbed by existing visual clutter of the power lines, pylons and the large Hydra substation to the north-east of the site (see Section 4.2.2; Figure 4.7).

Plate 4.8: View of the Kampfontein Guesthouse (and the base of the radio tower) from the proposed site looking north-east (Photo: T. Barbour).

Plate 4.9: Photograph of an existing access roads on site (Photo: J. Blood).

Plate 4.10: Photograph of the shooting range (Photo: J. Blood).

Plate 4.11: Brickworks located in the north-eastern portion on the site (Photo: J. Blood).

Plate 4.12: Photograph of the two power lines (400 kV and 769 kV) along the northern boundary of the site (Photo: T. Barbour).

Plate 4.13: Hydra substation seen from the Hydra access road (Photo: B. Oberholzer / Q. Lawson).

Plate 4.14: Bletterman Station (Photo: T. Barbour).

Plate 4.15: Scattered stone tool identified on the dolerite outcrop to the east of the existing farmstead, outside the development footprint (Photo: E. Costandius).

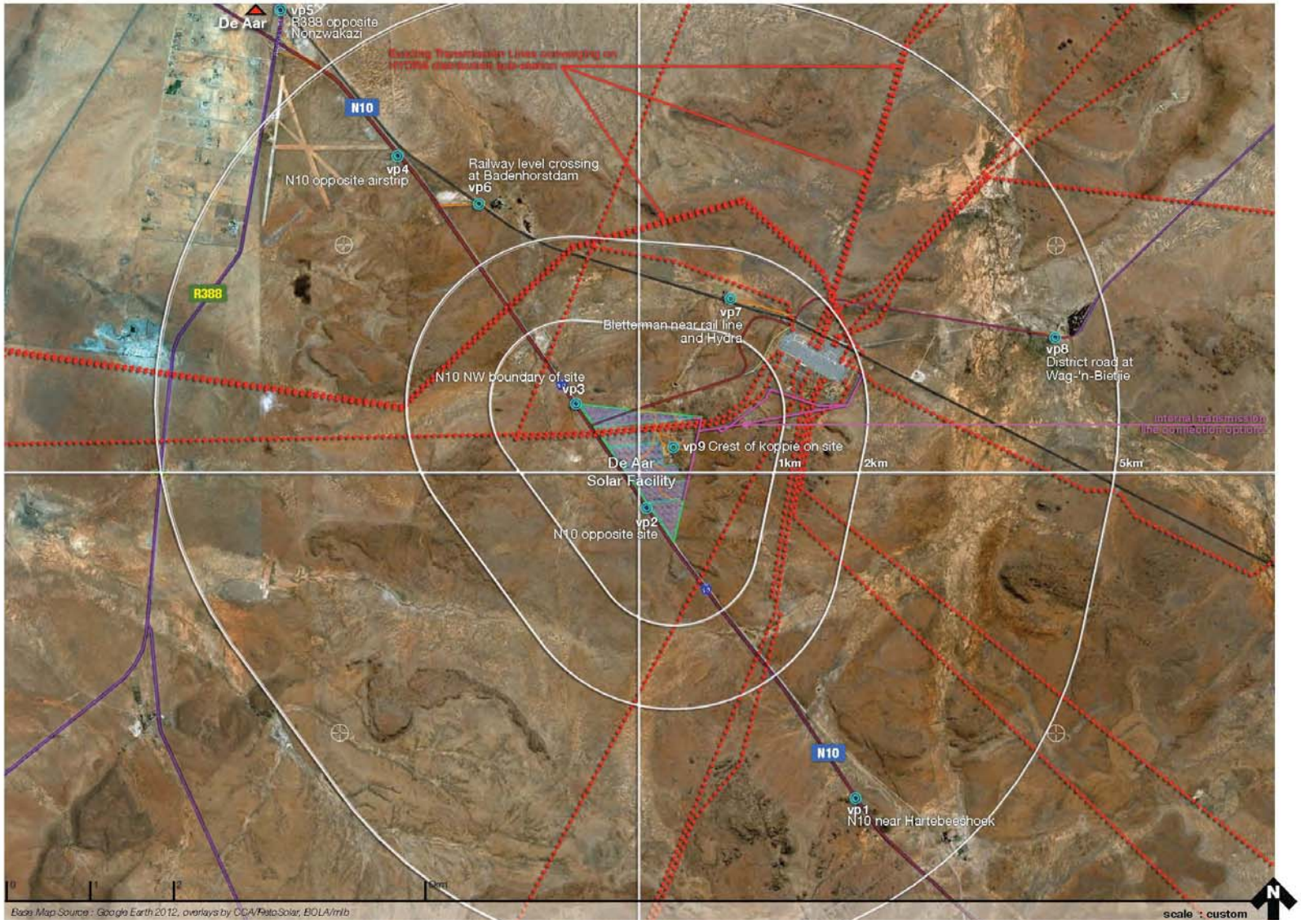


Figure 4.7: Figure showing, *inter alia*, the site and the existing infrastructure (power lines and Hydra substation) in the area.

5. IMPACT DESCRIPTION AND ASSESSMENT

This chapter describes and assesses the significance of potential impacts related to the proposed De Aar Solar One Photovoltaic Power Project, as well as the Cumulative Impact and the No-Go Alternative. All impacts are systematically assessed and presented according to predefined rating scales (see Appendix 3). Mitigation or optimisation measures are proposed which could ameliorate negative impacts or enhance potential benefits, respectively. The status of all impacts should be considered to be negative unless otherwise indicated. The significance of impacts before and after mitigation or optimisation is also assessed.

Eight specialist studies were undertaken to address the potential impacts associated with the key issues raised during the Scoping Study (see Table 2.5).

Potential issues / impacts identified have been addressed / assessed in the following sections:

- Section 5.1: Fit with legislation, policy and planning;
- Section 5.2: Impacts on the biophysical environment;
- Section 5.3: Impacts on the socio-economic environment;
- Section 5.4: Impacts on heritage and cultural environment;
- Section 5.5: Impacts related to the construction and decommissioning phases;
- Section 5.6: Cumulative impact; and
- Section 5.7: No-Go alternative.

No importance is to be assigned to the order in which these have been presented.

5.1 FIT WITH LEGISLATION, POLICY AND PLANNING

The legislative, policy and planning context plays a critical role in identifying if the proposed development fits with key legal, policy and planning documents. In addition, it also plays a critical role in assessing the potential social impacts associated with the proposed development (see Section 5.3). If a proposed development does not conform to the spatial principles and guidelines contained in the relevant legislation, policy and planning documents, and there are no significant or unique opportunities created by the development, the development cannot be supported from a social perspective.

A review of the relevant legislation, policies and documents pertaining to the energy sector indicate that solar energy is presented in the “Need and Desirability” section of this report (see Section 1.5). A brief summary is provided below.

- The National Energy Act (2008)
  One of the objectives of the National Energy Act, 2008 is to promote diversity of supply of energy and its sources, including solar.
- The White Paper on the Energy Policy of the Republic of South Africa (1998)
  Investment in renewable energy initiatives is supported by this policy. Renewable resources generally operate from an unlimited resource base and, as such, can increasingly contribute towards a long-term sustainable energy future. The support for renewable energy policy is guided by a rationale that South Africa has a very attractive range of renewable resources, particularly solar and wind, and that renewable applications are in fact in most cases the most cost effective; more so when social and environmental costs are taken into account.
- The White Paper on Renewable Energy (2003)
  The South African Government’s long-term goal is the establishment of a renewable energy industry producing modern energy carriers that will offer in future years a sustainable, fully non-subsidised alternative to fossil fuels. Government has recognised the country’s high level of renewable energy potential and has set a medium-term (10-year) target of 10 000 GW hrs of renewable energy by 2013.

- IRP 2010
  The IRP 2010 allocates 43% of energy generation in South Africa to renewables and allows for an additional 14 749 MW of renewable energy in the electricity blend in South Africa by 2030. One of the key conclusions is that an accelerated roll-out of renewable energy options should be allowed in order to derive the benefits of localisation in these technologies. The proposed project, which is an IPP project, would contribute towards meeting the national energy target as set by the DoE, of a 30% share of all new power generation being derived from IPPs.
- Northern Cape Provincial Growth and Development Strategy (2004-2014)
  At a provincial level the NCPGDS notes that availability of inexpensive energy is a key requirement in order to promote economic growth in the Northern Cape and that the development of energy sources such as solar energy could be a means by which new economic opportunity and activity is generated in the Northern Cape.
- Northern Cape Provincial Spatial Development Framework (2011)
  The development of large-scale renewable energy supply schemes is strategically important for increasing the diversity of domestic energy supplies for the Northern Cape and avoiding energy imports. Renewable energy is identified as a mechanism to diversify the economy and thereby promoting a green economy in the province.
- Pixley ka Seme District Municipality IDP (2009-2012)
  At a local level the Pixley ka Seme District Municipality IDP identifies the promotion and utilisation of renewable energy as a core initiative that influences its policies, objectives, strategies and projects. As such, the proposed project could play an important role in the District realising some of its key IDP objectives.
- Emthanjeni Local Municipality Integrated Development Plan 2010
  The ELM IDP identifies alternative energy projects as a key driver for local economic development. One of these projects includes the establishment of De Aar as a Renewable Energy Hub. The establishment of the proposed project has the potential to support a number of key strategies in the ELM IDP.

The findings of the review of the relevant legislation, policies and planning documents indicate that solar energy and the establishment of solar energy plants are supported at a national, provincial and local level. Thus the establishment of the proposed project is supported by the relevant policy and planning documentation and has the potential to support a number of key strategies in the district and local IDPs. However, the NCPGDS also states that the sustainable utilisation of the natural resource base on which agriculture depends is critical in the Northern Cape with its fragile ecosystems and vulnerability to climatic variation. The document also indicates that the Province has the potential to become the preferred adventure and ecotourism destination in South Africa. Therefore, care needs to be taken to ensure that the development of large renewable energy projects, such as the proposed development, do not have a significant impact on the tourism potential of the province (see Section 5.3.5 for potential impact on tourism).

5.2 IMPACTS ON THE BIOPHYSICAL ENVIRONMENT

5.2.1 VEGETATION

5.2.1.1 Loss of vegetation

Description of impact:
The proposed project would result in the clearing of vegetation within the proposed development footprint (including module frame foundations, access roads, substation, buildings and parking, power line, etc.). In addition, vegetation would need to be temporarily cleared or disturbed for the construction camp and laydown area/s.

Assessment:
Although the proposed project covers an area of between 75 and 80 ha, the solar arrays would be placed over the vegetation reducing the area that needs to be cleared. Only vegetation over 60 cm in height beneath the modules and that within the proposed footprint of rack foundations, access roads, pylons and the internal underground cables would be removed. This is estimated to be in the order of approximately 12.5 ha. In addition, a further approximately 1.5 ha would need to be temporary cleared or disturbed for the establishment of the construction camp and laydown areas.

The Northern Upper Karoo vegetation found in the study area has an extensive distribution (widespread) and is classified as Least Threatened. In addition, the more sensitive rocky outcrop habitats on site have been avoided. The proposed layout is thus limited to the lowland area, which is less sensitive on a local scale and has been historically disturbed (ploughed). No threatened species were found to occur on site.

The loss of an estimated 14 ha of Least Threatened Northern Upper Karoo vegetation for all alternatives would result in a long-term impact of medium intensity at a local level. The significance of the impact is thus considered to be of **MEDIUM** significance before and after mitigation (see Table 5.1).

Mitigation:
The main recommendation of avoiding the more sensitive rocky outcrop areas has been accommodated in the proposed layout. No further mitigation is considered necessary.

Table 5.1: Assessment of the potential impact related to the loss of vegetation.

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Local	Local
Duration	Long-term	Long-term
Intensity	Medium	Medium
Probability	Highly probable	Highly probable
Confidence	High	High
Significance	**Medium**	**MEDIUM**
Cumulative impact	Low	Low
Nature of Cumulative impact	Impact associated with the development of numerous renewable energy projects in the De Aar area on Northern Upper Karoo vegetation at a regional scale.	
Degree to which impact can be reversed	Fully Reversible	
Degree to which impact may cause irreplaceable loss of resources	Low	
Degree to which impact can be mitigated / optimised	None	

5.2.1.2 Change of species composition

Description of impact:
Increased shading of the vegetation and reduced rainfall underneath the modules / solar arrays could alter local ecological processes, which in turn could result in a change in the plant species composition of the remaining vegetation.

Assessment:
As mentioned above, the Northern Upper Karoo vegetation is classified as Least Threatened and no threatened species were found on site. Shading within this vegetation type is naturally limited, as there are very few trees or shrubs of any great stature. The potential composition change and magnitude to the estimated 50 ha of vegetation shaded by the modules / solar arrays cannot be quantified *a priori* since there is no documentation of such effects. However, the potential change to species composition is considered to be no more significant than the changes that could result from poor land management (e.g. overgrazing).

The potential impact related to a change in plant species composition is considered to be a localised, long-term impact of medium intensity. The significance of this impact is, therefore, assessed to be **MEDIUM** before and after mitigation (see Table 5.2).

Mitigation:
The main recommendation of avoiding the more sensitive rocky outcrop areas has been accommodated in the proposed layout. No further mitigation is considered necessary.

Table 5.2: Assessment of the potential impact related to a change in plant species composition.

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Local	Local
Duration	Long-term	Long-term
Intensity	Medium	Medium
Probability	Highly probable	Highly probable
Confidence	Low	Low
Significance	**Medium**	**MEDIUM**
Cumulative impact	Low	Low
Nature of Cumulative impact	Impact associated with the development of numerous renewable energy projects in the De Aar area on Northern Upper Karoo vegetation at a regional scale.	
Degree to which impact can be reversed	Fully Reversible	
Degree to which impact may cause irreplaceable loss of resources	Low	
Degree to which impact can be mitigated / optimised	None	

5.2.2 TERRESTRIAL FAUNA

5.2.2.1 Loss and alteration of faunal habitats

Description of impact:
Faunal habitats may be lost through the clearing of vegetation, as well as alteration of habitat due to increased shading and reduced rainfall underneath the modules / solar arrays.

Assessment:
There are no unique or important faunal habitats found on site relative to the surrounding area. The faunal habitats on site are also largely in a disturbed state from past (e.g. ploughing and cultivation) and current (e.g. grazing and shooting range) land uses. In addition, the rock outcrops on the east of the site, which provide shelter for small mammals and rock-dwelling reptiles, have been excluded from the proposed layout.

The vegetation within the proposed solar array footprint would also largely be left intact and habitat options would thus remain for faunal species. However, it is possible that the increased shading and reduced rainfall underneath the modules / solar arrays could have an impact on the local ecological processes, which could alter the vegetation (see Section 5.2.1.2) and associated faunal habitat. This could have an impact on species that depend on sunlight for thermoregulation (i.e. reptiles and some insects). It is, however, not expected that any species of conservation concern utilise habitats on the site on a regular basis and there would be no permanent impact on any population or species as a whole.

The potential impact of loss and alteration of faunal habitats is considered to be a localised, long-term impact of low intensity. The significance of this impact is, therefore, assessed to be **LOW** before and after mitigation (see Table 5.3).

Mitigation:

- The rocky outcrop areas to the east of the site are to be demarcated as no-go areas during the construction phase.

Table 5.3: Assessment of the potential impact of the loss and alteration of faunal habitats.

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Local	Local
Duration	Long-term	Long-term
Intensity	Low	Low
Probability	Probable	Probable
Confidence	Medium	Medium
Significance	**Low**	**LOW**
Cumulative impact	Low	Low
Nature of Cumulative impact	The numerous other proposed renewable energy projects around De Aar would result in a fairly large area of natural habitat that would be lost or transformed over the long-term.	
Degree to which impact can be reversed	Partially Reversible	
Degree to which impact may cause irreplaceable loss of resources	Low	
Degree to which impact can be mitigated / optimised	None	

5.2.2.2 Bird strikes and interactions

Description of impact:

The proposed power line linking the photovoltaic power plant to the Hydra substation could lead to bird strikes and electrocution. In addition, reflective surfaces act as attractants for approaching birds. These surfaces may be confused for large water bodies and cause disorientation of flying birds, resulting in injury and / or death. The proposed project may also attract bird species that may attempt to utilise the new infrastructure for nesting or roosting purposes.

Assessment:

In terms of species of conservation concern, the Ludwig's Bustard (listed as *Vulnerable* and *Endangered*) has proved to be vulnerable to overhead power lines (Jenkins *et al*., 2011). However, taking into account the type of structure proposed and the current obstacles on the site, the risk to birds due to the proposed power line is not considered a "new" impact. The use of monopole steel structures is generally known to minimise bird strikes and it is also unlikely that electrocution of birds landing on the lines would occur with this type of

structure. In addition, the proposed power line alternatives would run parallel to existing high voltage power lines for a certain extent, which may even increase the visibility of the current obstacle and reduce the likelihood of bird collisions. Option 2 would run parallel to the existing power lines for a greater distance compared to Option 1 and 1a (see Table 3.1).

With regards to the modules / solar arrays, not much research has been undertaken on bird collisions and interactions. The proposed modules / solar arrays would, however, not be highly reflective and it is unlikely that birds would become disorientated, resulting in injury and / or death (Birdlife Africa, in prep.).

The new infrastructure could also provide nesting opportunities for birds which may be perceived as a benefit. However, it could cause a skewed concentration of certain bird species (e.g. crows) and nesting on infrastructure should thus be discouraged.

The potential impact of bird strikes and interactions is considered to be a localised, long-term impact of low to medium intensity. The significance of this impact is, therefore, assessed to be **LOW to MEDIUM** before and after mitigation (see Table 5.4). Although all power line alternatives are assess to be of similar significance, Option 2 is the preferred alternative from an avifaunal perspective as it run parallel to the existing power lines for a greater distance.

Mitigation:

- The solar arrays and mounting systems should, if possible, be designed to not create opportunities for birds to construct nests;
- Nests or signs of nesting are to be removed during regular maintenance activities; and
- An avifaunal monitoring programme is to be established for the first 12 months of operation in order to contribute to the research database. The monitoring programme should ideally be undertaken during routine maintenance activities and should record the following:
  - > Number of bird carcasses encountered around the modules / solar arrays;
  - > Incidence of nests and nesting attempts; and
  - > Increase in bird activity and unusual bird aggregations.

  Data should be sent to Dr Hanneline Smit of Birdlife Africa (conservation@birdlife.org.za).

Table 5.4: Assessment of the potential impact of bird strikes and interactions.

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Local	Local
Duration	Long-term	Long-term
Intensity	Low to Medium	Low to Medium
Probability	Probable	Probable
Confidence	Medium	Medium
Significance	**Low to Medium**	**LOW to MEDIUM**
Cumulative impact	Medium	Medium
Nature of Cumulative impact	The numerous other proposed renewable energy projects around De Aar would result in a number of new power lines that would need to link into the Hydra substation. This impact is mitigated to a certain extent due to the vast network of power lines already connected to the Hydra substation from all directions.	
Degree to which impact can be reversed	Fully Reversible	
Degree to which impact may cause irreplaceable loss of resources	Low to Medium	
Degree to which impact can be mitigated / optimised	None	

5.2.2.3 Barrier effect

Description of impact:
The proposed photovoltaic power plant could present a barrier to movement of faunal species, which could have an impact on gene flow of smaller species.

Assessment:
While most faunal species would be able to freely move in between the solar arrays, it is likely that the newly created shaded areas and potential changes in habitat underneath the solar arrays could present a barrier to the long-term movement/dispersal of small, less mobile faunal species (e.g. small geckos). It is, however, not expected that movement and gene flow of any species of conservation concern would be impacted in this way. In addition, the surrounding environment is fairly homogenous and as no small concentrated populations of species are expected to occur on site, the proposed infrastructure should not act as a significant barrier to long-term dispersal.

This unlikely impact is considered to be localised, long-term and of zero intensity. The significance of this impact is, therefore, assessed to be **INSIGNIFICANT** before and after mitigation (see Table 5.5).

Mitigation:
No mitigation measures are deemed necessary.

Table 5.5: Assessment of the potential impact related to the barrier effect.

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Local	Local
Duration	Long-term	Long-term
Intensity	Zero	Zero
Probability	Improbable	Improbable
Confidence	Medium	Medium
Significance	**Insignificant**	**INSIGNIFICANT**
Cumulative impact	Low	Low
Nature of Cumulative impact	When considered together with other proposed renewable energy projects in the De Aar area, there would be a fairly large area of natural habitat that could be altered, which could present a barrier to the long-term movement of species.	
Degree to which impact can be reversed	Fully Reversible	
Degree to which impact may cause irreplaceable loss of resources	Low	
Degree to which impact can be mitigated / optimised	None	

5.2.3 FRESHWATER SYSTEMS

5.2.3.1 Disturbance and loss of freshwater habitat

Description of impact:
The proposed project would result in the clearing of vegetation within the proposed development footprint (including module frame foundations, access roads, etc.), which could result in the localised disturbance of the two small ephemeral streams / drainage channels on site. In addition, habitat disturbance provides an opportunity for invasive alien plants to proliferate on site. During operation, regular access for maintenance and cleaning purposes may have a further impact on these drainage channels.

Assessment:

The proposed development layout (see Figure 3.4), although only indicative at this stage, shows the footprint of the modules / solar arrays to include the two drainage channels on site. Access roads, which would be constructed between the solar arrays, would also need to cross these drainage channels. The original drainage channels have been significantly modified into stormwater channels and instream dams to allow for stormwater management along the N10 and in the lower lying areas on the site. These drainage channels are both considered to be of low ecological importance and sensitivity. The proposed power line alternatives are not expected to have an impact on any freshwater systems.

The potential impact during operation is considered to be a localised, long-term impact of low intensity. The significance of this impact is, therefore, assessed to be **low** before mitigation and **VERY LOW** with mitigation (see Table 5.6).

Mitigation:

- The proposed footprint of the modules / solar array, and associated operation activities, should remain, as far as possible, outside of the delineated freshwater buffers indicated in Figure 5.1;
- Disturbed areas are to be rehabilitated after construction with suitable indigenous plant species;
- The establishment of invasive alien vegetation on site, particularly within the drainage channels, is to be monitored and removed on an ongoing basis.

Altering the bed and banks of a watercourse (Water Use Activity 21i) due to the construction of access roads could possibly be Generally Authorised. However, an application for authorisation would need to be submitted to DWA in order to confirm whether there is a need for a Water Use Licence.

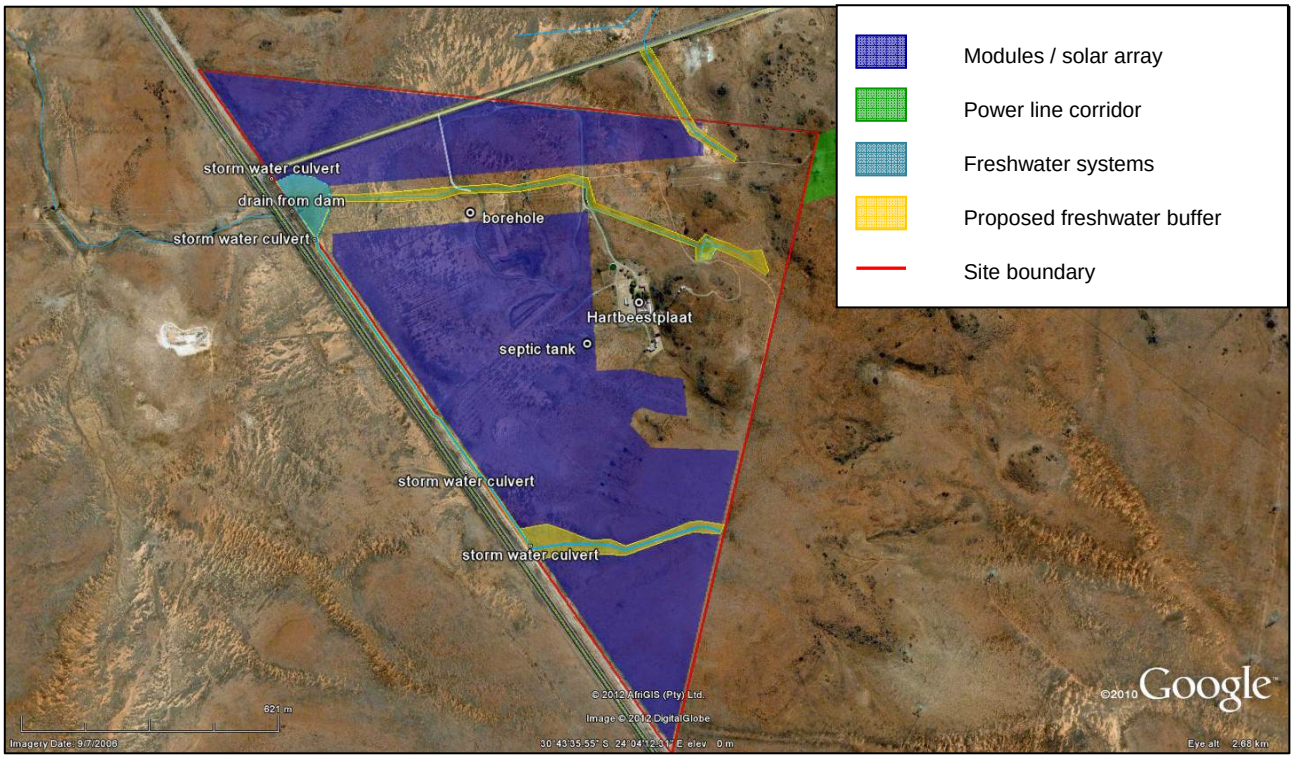


Figure 5.1: Proposed freshwater buffers.

Table 5.6: Assessment of the potential impact of freshwater habitat disturbance / habitat loss.

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Local	Local
Duration	Long-term	Long-term
Intensity	Low	Very Low
Probability	Probable	Probable
Confidence	High	High
Significance	**Low**	**VERY LOW**
Cumulative impact	Low	Very Low
Nature of Cumulative impact	A number of photovoltaic power projects are proposed in the area surrounding De Aar. Although these projects would potentially add to the area disturbed, the impact is considered to be similar to that of the proposed project, due to the existing disturbances within these streams.	
Degree to which impact can be reversed	Fully Reversible	
Degree to which impact may cause irreplaceable loss of resources	Low to Medium	
Degree to which impact can be mitigated / optimised	Low	

5.2.3.2 Flow modification

Description of impact:
Access roads constructed between the solar arrays would be required to cross the two drainage channels at various locations, which could alter or impede the flow of water in the drainage channels.

Assessment:
As indicated in the previous section, the freshwater systems on site have been significantly modified and are considered to be of low ecological importance and sensitivity.

The potential impact of flow modification is considered to be a localised, long-term impact of low to medium intensity. The significance of this impact is, therefore, assessed to be **low** before mitigation and **VERY LOW** with mitigation (see Table 5.7).

Mitigation:
- All drainage channel crossings should be designed to ensure that stormwater flow is not impeded by the proposed access roads and pipe or culvert design. Culvert or pipes are to be sufficiently wide to accommodate and distribute the flow; and
- Stormwater infrastructure (e.g. culverts and drains) is to be maintained to ensure it does not become blocked with alien vegetation, sediment and debris.

Impeding the flow of water in a watercourse (Water Use Activity 21c) due to the construction of access roads could possibly be Generally Authorised. However, an application for authorisation would need to be submitted to DWA in order to confirm the need for a Water Use Licence.

Table 5.7: Assessment of the potential impact of flow modification.

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Local	Local
Duration	Long-term	Long-term
Intensity	Low to Medium	Low
Probability	Probable	Probable
Confidence	High	High
Significance	**Low**	**VERY LOW**
Cumulative impact	Low to Medium	Low
Nature of Cumulative impact	A number of photovoltaic power projects are proposed in the area surrounding De Aar. These projects could potentially add to the area disturbed and further alter or impede watercourses.	
Degree to which impact can be reversed	Partially Reversible	
Degree to which impact may cause irreplaceable loss of resources	Low to Medium	
Degree to which impact can be mitigated / optimised	Low	

5.2.3.3 Runoff modification

Description of impact:
Increased stormwater runoff from modules / solar array surfaces and roads, as well as the compaction of soils during both the construction and operation phases, could result in the concentration of stormwater flows, reduced infiltration (assessed in Section 5.2.4.1) and increased risk of erosion.

Assessment:
The proposed access roads between the modules / solar arrays would be in the order of 14.5 km, of which it is estimated that a third would be surfaced with permeable pavers. This would facilitate the infiltration of stormwater into the soil to a certain extent. The soils in the study area are not considered to have a high erosion potential. However, most soils will erode to some degree after vegetation clearing, so care should be taken in the construction phase to minimise the extent of excavations and avoid, where possible, the concentration of flows.

This potential impact is considered to be a localised, long-term impact of medium intensity. The significance of this impact is, therefore, assessed to be **low to medium** before mitigation and **LOW** with mitigation (see Table 5.8).

Mitigation:
- The proposed footprint of the modules / solar array, and associated construction activities, should remain, as far as possible outside of the delineated freshwater buffers indicated in Figure 5.1;
- Runoff over exposed areas should be mitigated to reduce the rate and volume of runoff in order to prevent erosion occurring on the site. The stormwater management plan must incorporate the following in order to manage stormwater before it leaves the site:
  - > The existing drainage channels are to be incorporated into the stormwater drainage system;
  - > The stormwater drainage channel along the N10 and a portion of the existing dam (size to be determined by estimated stormwater volume for the developed site) in the north-western corner

of the site are to be retained in the proposed buffer along the N10. The formalised drainage channel may need to be moved slightly to accommodate the proposed berm; and

> Overflow from the dam is to continue down the existing drainage channel and under the N10.

- Stormwater infrastructure (e.g. culverts and drains) is to be maintained to ensure it does not become blocked with alien vegetation, sediment and debris.

Table 5.8: Assessment of the potential impact of stormwater runoff modification.

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Local	Local
Duration	Long-term	Long-term
Intensity	Medium	Low
Probability	Probable	Probable
Confidence	High	High
Significance	**Low to Medium**	**LOW**
Cumulative impact	Low to Medium	Low
Nature of Cumulative impact	A number of photovoltaic power projects are proposed in the area surrounding De Aar. These projects could potentially add to the modification of stormwater runoff, resulting in the further concentration of flows and increased erosion.	
Degree to which impact can be reversed	Fully Reversible	
Degree to which impact may cause irreplaceable loss of resources	Low to Medium	
Degree to which impact can be mitigated / optimised	Low	

5.2.4 GROUNDWATER

5.2.4.1 Groundwater recharge

Description of impact:

The proposed modules / solar array would modify the nature and properties of the ground surface. The area under the modules / solar array would largely remain unaltered, but rain falling onto the panels would be concentrated before falling to ground, effectively creating a higher intensity rainfall at a very local scale. Similarly, the creation of roads and access paths would result in very local hardening of surfaces with a concomitant reduction in permeability, which would promote runoff and reduce infiltration (and recharge) into the groundwater.

Assessment:

Due to the variation of permeability across the site, increased runoff at a very local scale may not necessarily translate to increased runoff across the site. Water would move from hardened areas to unaltered area where infiltration can take place. In addition, a third of the proposed access roads on site would be paved with permeable paver, which would facilitate the infiltration of stormwater into the soil to a certain extent.

The potential impact of reduced recharge is considered to be a localised, long-term impact of medium intensity. The significance of this impact is, therefore, assessed to be **medium** before mitigation and **INSIGNIFICANT to VERY LOW** with mitigation (see Table 5.9).

Mitigation

- Existing local stormwater retention structures across the site are to be included in the design (also see mitigation in Section 5.2.3.3) and stormwater, where possible, is to be directed into natural vegetated areas.

Table 5.9: Assessment of the potential impact on groundwater recharge.

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Local	Local
Duration	Long-term	Long-term
Intensity	Medium	Low
Probability	Highly probable	Probable
Confidence	High	High
Significance	**Medium**	**INSIGNIFICANT to VERY LOW**
Cumulative impact	Medium	Insignificant to Very Low
Nature of Cumulative impact	Increased hard surfaces related to other potential photovoltaic power projects in the surrounding area would increase stormwater runoff and reduce recharge even further.	
Degree to which impact can be reversed	Fully Reversible / Partially reversible	
Degree to which impact may cause irreplaceable loss of resources	N/A – there is no expected loss of resource.	
Degree to which impact can be mitigated / optimised	Medium to High	

5.2.4.2 Groundwater abstraction

Description of impact:

The proposed abstraction and use of groundwater during operation could result in pumping-induced drawdown, which could impact adjacent groundwater users.

Assessment:

There are five operating boreholes on site, which each have relatively low yields in the order of 1.2 L/s. During the operation phase an estimated 20 to 30 KL of groundwater would be required per day. This would entail pumping one borehole for 10.5 hrs per day or three boreholes for 3.5 hrs per day to satisfy the demand. No impacts are expected beyond the borders of the farm.

The potential impact during operation is considered to be a localised, short-term impact of very low intensity. The significance of this impact is, therefore, assessed to be **insignificant to very low** before mitigation and **INSIGNIFICANT** with mitigation (see Table 5.10). It should be noted that although the activity would be long-term during the operation phase, the impact would be of short-term duration as groundwater is a renewable resource.

Mitigation

Good groundwater management and reducing water demand is considered good practise. In this regard the following is proposed:

- Water-saving devices (e.g. dual flush toilets, waterless urinals, etc.) should be installed in the offices;
- Opportunities for the reuse and recycling of water during operation should be investigated;

- Multiple boreholes should be used for shorter durations, as this would reduce the extent of the radius of influence; and
- The groundwater level, quality and abstraction volume should be monitored.

Since there is no municipal water supply to site and the proposed project is dependent on the use of groundwater it is recommended that groundwater tests (including drawdown tests and 48 hr constant discharge pumping tests) are undertaken on at least four existing boreholes to determine the exact yields and determine the most appropriate pumping regime.

A Water Use Licence authorisation application would need to be submitted to DWA (Northern Cape Regional Office) for approval for the abstraction and use of groundwater during operation.

Table 5.10: Assessment of the potential impact of groundwater abstraction during operation.

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Local	Local
Duration	Short-term	Short-term
Intensity	Very Low	Zero
Probability	Highly probable	Probable
Confidence	Medium	Medium
Significance	**Insignificant to Very Low**	**INSIGNIFICANT**
Cumulative impact	Very Low	Very Low
Nature of Cumulative impact	Existing water use of 15 KL per day (which is expected to continue) and other potential renewable energy projects could increase the drawdown of groundwater, which could have an impact on farmers and the town of De Aar.	
Degree to which impact can be reversed	Fully Reversible	
Degree to which impact may cause irreplaceable loss of resources	N/A – there is no expected loss of resource.	
Degree to which impact can be mitigated / optimised	Low	

5.2.4.3 Groundwater contamination

Description of impact:
Operation activities could result in the contamination of the groundwater. Potential sources of contamination include the leakage of chemicals, oils and fuels, accidental spills, the disposal of waste and wastewater, and septic tank / soak-away system.

Assessment:
The contamination of groundwater by any activity is a concern as it could have a long-lasting impact and may be difficult and expensive to remediate. The volumes of hazardous materials used in the operation phase are expected to be small and the volumes of waste (solid and liquid) to be minor. The extent of contamination, should it occur, would be localised.

The septic tank and soak-away system would be required to treat an estimated 2 KL of sewage and wastewater per day. Given the low density of the proposed systems and the small volumes generated, this component poses a very low risk to the underlying groundwater resources and is an accepted and efficient means of managing this waste.

The cleaning of the solar panels during the operation phase is expected to be a regular activity. Cleaning with soap or detergent could also have an impact on the groundwater.

The potential impact during operation is considered to be a localised, permanent impact of medium to high intensity. The significance of this impact is, therefore, assessed to be **medium to high** before mitigation and **LOW** with mitigation (see Table 5.11). The impact is considered to be unlikely (improbable) with mitigation.

Mitigation:

- All components (e.g. inverters and transformer, chemical and fuel storage facilities etc.) that have a potential to contaminate groundwater are to be established on low permeability, bunded surfaces;
- The septic tank and soak-away system must be sited at least 50 m from the nearest production borehole;
- Any maintenance or refuelling activities are to be undertaken on a low permeability, bunded surfaces;
- Routine inspections are to be carried out to check for leaks and spills;
- Any leaks and spills are to be promptly dealt with, including the cleaning, treatment or removal of the contaminated area or soil; and
- Water (only) should ideally be used for the cleaning the modules / solar arrays. However, if a soap or detergent is required, then a biodegradable and environmentally-friendly product must be used.

Table 5.11: Assessment of the potential impact of groundwater contamination during operation.

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Local	Local
Duration	Permanent	Long-term
Intensity	Medium to High	Low
Probability	Probable	Improbable
Confidence	Medium	High
Significance	**Medium to High**	**LOW**
Cumulative impact	High	Low
Nature of Cumulative impact	Other potential renewable energy projects and current farming practices could increase the risk of groundwater contamination.	
Degree to which impact can be reversed	Partially Reversible	
Degree to which impact may cause irreplaceable loss of resources	Medium	
Degree to which impact can be mitigated / optimised	Medium	

5.3 IMPACTS ON THE SOCIO-ECONOMIC ENVIRONMENT

5.3.1 DEVELOPMENT OF A CLEAN, RENEWABLE ENERGY FACILITY

Description of impact:

The establishment of a clean, renewable energy facility would reduce, albeit minimally, South Africa's reliance on coal-generated energy and the generation of carbon emissions into the atmosphere.

Assessment:
South Africa currently relies on coal-powered energy to meet more than 90% of its energy needs. As a result South Africa is one of the highest per capita producers of carbon emissions in the world and Eskom, as an energy utility, has been identified as the world's second largest producer carbon emissions.

The overall contribution to South Africa's total energy requirements of the proposed project is relatively small. However, the 25 to 30 MW produced would help to offset the total carbon emissions associated with energy generation in South Africa. Given South Africa's reliance on Eskom as a power utility, the benefits associated with an IPP based on renewable energy are regarded as an important contribution.

The development of a clean, renewable energy project is considered to be a national, long-term impact of low intensity. The significance of this potential impact is, therefore, assessed to be **MEDIUM (POSITIVE)** before and after mitigation (see Table 5.12).

Optimisation:
No optimisation measures considered necessary.

Table 5.12: Assessment of the potential social impact related to the development of a clean, renewable energy facility.

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	National	National
Duration	Long-term	Long-term
Intensity	Low	Low
Probability	Highly probable	Highly probable
Confidence	High	High
Significance	**Medium (positive)**	**MEDIUM (POSITIVE)**
Cumulative impact	High (positive)	High (positive)
Nature of Cumulative impact	Reduced carbon emissions from numerous renewable energy projects could have added benefits in terms of global warming and climate change.	
Degree to which impact can be reversed	N/A	
Degree to which impact may cause irreplaceable loss of resources	Low	
Degree to which impact can be mitigated / optimised	None	

5.3.2 CREATION OF EMPLOYMENT AND BUSINESS OPPORTUNITIES

Description of impact:
The proposed development would create a number of local employment and business opportunities during operation. In addition, there would be an opportunity for skills development and on-site training.

Assessment:
The local economy in De Aar has been negatively impacted by the decline in the role of the railways, the downscaling of the army base and relocation of Eskom stores to Colesberg. The proposed establishment of De Aar as a Renewable Energy Hub would create additional employment and skills development opportunities, which in turn would benefit local businesses.

The proposed project would create a limited number of employment opportunities during the operational phase. It is anticipated that approximately 30 to 40 employment opportunities would be created, of which approximately 80% (24-32) would be low and medium-skilled and 20% (6-8) would be high-skilled positions. The majority of the low and medium skilled employment opportunities are likely to benefit historically disadvantaged members of the community. The implementation of a skills development and training programme would increase the number of skilled local employment opportunities.

The benefits to the local economy would extend over the operational lifespan of the proposed project. A percentage of the monthly wage bill earned by permanent staff would be spent in the regional and local economy, which would benefit local businesses in De Aar (and possibility Britstown and Hanover). A percentage of the non-local permanent employees may purchase houses or rent in De Aar (and possibly Britstown and Hanover), which would represent a positive economic benefit for the region. The local hospitality industry in De Aar is also likely to benefit due to site visits by staff members and other professionals (engineers, technicians, etc.) not linked to the day-to-day operations.

The creation of employment and business opportunities during the operation phase is likely to result in a long-term, local impact of low intensity. The significance of this potential impact is, therefore, assessed to be **LOW (positive)** before and after mitigation (see Table 5.13).

Optimisation:

- The proponent should, where reasonable and practical, implement a 'locals first' employment policy, especially for semi- and low-skilled job categories, and appoint local contractors/sub-contractors that are compliant with Black Economic Empowerment (BEE) criteria;
- A training and skills development programme for locals should be implemented during the first five years of operation; and
- Opportunities for establishing a Community Trust should be investigated, in consultation with the ELM (see Section 5.3.7).

Table 5.13: Assessment of the potential social impact related to employment and the creation of business opportunities during operation.

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Local	Local
Duration	Long-term	Long-term
Intensity	Low	Low
Probability	Probable	Probable
Confidence	High	High
Significance	**Low (positive)**	**LOW (POSITIVE)**
Cumulative impact	Low (positive)	Low (positive)
Nature of Cumulative impact	The establishment of photovoltaic facilities in the area is strongly supported by the ELM. In this regard the municipality had identified the establishment of a Renewable Energy Hub as one of the key economic opportunities for the area. This would create significant economic opportunities for the area and go a long way to offsetting the negative socio-economic impacts, such as job losses, associated with the scaling down of the railway linked activities in De Aar over the last 10-15 years.	
Degree to which impact can be reversed	Fully reversible	
Degree to which impact may cause irreplaceable loss of resources	N/A	
Degree to which impact can be mitigated / optimised	None	

5.3.3 INFLUX OF JOB SEEKERS TO THE AREA

Description of impact:
The establishment of the proposed project is likely to attract job seekers to the area during the operation phase, which could pose a number of risks to the local community in De Aar.

Assessment:
While the presence of operation workers and their families does not in itself constitute a social impact, the manner in which they conduct themselves can affect the local community. In the case of local communities the most significant risks include:

- Impact on existing social networks and community structures;
- Competition for housing, specifically low cost housing;
- Pressure on local services, such as schools, clinics, etc.;
- Competition for scarce jobs;
- Increase in incidences of crime; and
- Increase in transmission of sexually transmitted diseases (STDs).

The implementation of a local employment strategy would reduce these risks to a large extent. The potential risk posed by operation workers is considered to have a localised, long-term to permanent of low intensity for the community as a whole. The significance of this potential impact is, therefore, assessed to be **medium** before mitigation. However, with the effective implementation of the proposed mitigation measures the potential social impact is considered to be of **LOW** significance (see Table 5.14).

Mitigation:

- A 'locals first' employment policy should be implemented (see Section 5.3.2); and
- The establishment of an Environmental Monitoring Committee (or Monitoring Forum) for the operation phase should be investigated, in consultation with the ELM, in order to monitor the implementation of the recommended mitigation measures. The forum should include representatives from the local community, local councillors, farmers and the proponent.

Table 5.14: Assessment of the potential social impact related to the influx of operation workers.

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Local	Local
Duration	Long-term to Permanent	Long-term to Permanent
Intensity	Low	Low
Probability	Probable	Probable
Confidence	High	High
Significance	**Medium**	**LOW**
Cumulative impact	Medium	Medium
Nature of Cumulative impact	The presence of operation workers involved with other renewable energy projects in the area may exacerbate the risks.	
Degree to which impact can be reversed	Irreversible (in case of HIV/AIDs, unwanted pregnancies, etc.)	
Degree to which impact may cause irreplaceable loss of resources	Low	
Degree to which impact can be mitigated / optimised	Low	

5.3.4 IMPACT ON SENSE OF PLACE AND RURAL CHARACTER OF THE LANDSCAPE (VISUAL IMPACT)

Description of impact:
The proposed development would potentially alter the visual landscape / rural character of the site, which would have a visual impact in the immediate surrounding area and along the N10 national road.

Assessment:
A series of quantitative and qualitative criteria are used to determine the potential visual impact, including:

- *Viewpoints:* The proposed facilities would be potentially visible from a number of surrounding farmsteads and the N10, although the farmsteads would be 1.6 km or more from the proposed project. Reflections from solar panels are not expected to be an issue at ground level. Visibility at night would relate to amount of safety and security lighting, but would be confined to the substation and maintenance buildings;
- *Visibility:* Given the height and footprint of the proposed solar arrays and related infrastructure, and the hilly terrain, visibility tends to be significant up to distances of about 2 km. Most important viewpoints in the area, excluding the N10, are beyond 2 km in distance;
- *Visual exposure:* The zone of visual influence of the solar arrays tends to fall mainly within a 2 km radius. The proposed berm would also create a view shadow along a portion of the N10 adjacent to the site;
- *Visual sensitivity:* There are few landscape features of importance, except for the dolerite outcrops (koppies) on site. The proposed development has been largely excluded from these outcrops;
- *Landscape integrity:* The area has a number of existing visual intrusions in the rural landscape, particularly the numerous power lines and the Hydra substation; and
- *Visual absorption capacity:* Given the modest height of the solar arrays (2.5 to 3 m), some screening by the topography and trees would occur. The existing visual clutter of power lines and the Hydra substation would tend to increase the visual absorption capacity of the area.

The potential visual impact is considered to be a localised and long-term. The intensity of the impact is considered to range from low-medium (substation and buildings) to medium (power lines) to medium-high (solar arrays). The significance of this impact is, therefore, assessed to range from **Low-Medium** (substation and buildings) to **Medium** (power lines) to **Medium-High** (solar arrays) before mitigation. After mitigation the impact is considered to be **LOW-MEDIUM** (substation and buildings) to **MEDIUM** (power lines and solar arrays (see Table 5.15).

Mitigation:
A number of mitigation measures have been included in the proposed design (including avoidance of the higher lying rocky outcrop areas, 30 m buffer and berm along the N10, and planting along N10 and Hydra substation access road), which has reduce the visual impact to some extent. The further exclusion of solar arrays from the northern and eastern ridges of the site would further reduce the visibility of the proposed project.

The following additional mitigation measures are recommended:

- A set back (buffer) of at least 10 m (or as required by the municipal by-law) from all farm boundaries must be included in the proposed layout design;
- The proposed berm along the N10 must have a sinuous, undulating shape with variable heights to look as natural as possible. In addition, rocks from the construction areas could be placed on the berm to simulate the characteristic outcrops of the area and help to create faunal habitats;
- Detailed specifications for the berm and all screen planting must be prepared by a qualified landscape architect. Planting on the proposed berm should only use locally occurring species to blend with the surrounding landscape;
- Drainage channels must be incorporated into the delineated freshwater buffers (see Figure 5.1);

- Cables should be located underground as far as possible;
- The substation, maintenance and storage buildings should be clustered and located in low-lying areas, as proposed;
- The design of the buildings should be compatible in scale and form with rural buildings, such as farm barns in the surrounding area;
- All yards and storage areas should be enclosed by masonry walls;
- The colour of the solar array structures, such as the supports and the rear of the panels, should be in the dark grey or green range in order to minimise visibility and avoid reflectivity;
- Signage related to the development should be discrete and confined to the entrance gate/s. No other corporate or advertising signage and billboards is to be permitted, particularly along the N10;
- External lighting should be confined to the maintenance and storage areas. Lights should be low-level and fitted with reflectors to avoid light spillage;
- The construction camp, material stockpiles and lay-down area/s should be screened from farmsteads and settlements, and preferably located in the vicinity of the proposed maintenance buildings or existing shooting range in order to minimise disturbance;
- The extent of the construction camp and stores should be limited in area to only that which is essential;
- Measures to control wastes and litter should be included in the Environmental Management Programme (EMP);
- Provision should be made for rehabilitation / re-vegetation of areas damaged by construction activities. A suitably experience rehabilitation / landscaping contractor should be appointed to compile a rehabilitation plan for the site;
- The footprint of the maintenance facilities, as well as parking and vehicular circulation, should be clearly defined, and not be allowed to spill over into other areas; and
- The maintenance and storage areas should be screened by buildings, walls, hedges and/or tree planting, and should be kept in a tidy state.

Table 5.15: Assessment of the potential visual impact.

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Local	Local
Duration	Long-term	Long-term
Intensity	Solar arrays: Medium to High	Solar arrays: Medium
	Power lines: Medium	Power lines: Medium
	Buildings: Low to Medium	Buildings: Low to Medium
Probability	Probable	Probable
Confidence	High	High
Significance	Solar arrays: **Medium to High**	Solar arrays: **MEDIUM**
	Power lines: **Medium**	Power lines: **MEDIUM**
	Buildings: **Low to Medium**	Buildings: **LOW TO MEDIUM**
Cumulative impact	Medium to High	Medium to High
Nature of Cumulative impact	A number of photovoltaic power projects are proposed in the area surrounding De Aar, which if not planned properly could visually impact a large area around De Aar.	
Degree to which impact can be reversed	Partially Reversible	
Degree to which impact may cause irreplaceable loss of resources	Low	
Degree to which impact can be mitigated / optimised	Low to Medium	

5.3.5 IMPACT ON TOURISM

Description of impact:
The potential visual impact associated with the proposed project could in turn result have an impact on tourism.

Assessment:
The Northern Cape Provincial Growth and Development Strategy indicates that due to the provinces exceptional natural and cultural attributes, it has the potential to become the preferred adventure and ecotourism destination in South Africa. Therefore, caution must be taken to ensure that the development of renewable energy projects do not impact negatively on the tourism potential of the province.

The proposed project is, however, not located in an area of high aesthetic landscape value and there are no national parks, nature reserves or other conservation sites in the immediate vicinity. The character of the area has already been visually altered by the existing Hydra Substation and a number of power lines in the vicinity of the site.

The establishment of the proposed project and De Aar as a Renewable Energy Hub also has the potential to attract visitors to the area, which could have a positive impact.

The potential impact on tourism is considered to be a local, long-term impact of low intensity. The significance of this potential impact is, therefore, assessed to be **LOW (both negative and positive)** before and after mitigation (see Table 5.16).

Mitigation / Optimisation:
Mitigation measures to reduce the visual impact are presented in Section 5.3.4. Optimisation measures include:

- The option of establishing a renewable energy interpretation centre at the entrance to the site should be investigated. The centre should include a viewing area where passing visitors can stop and view the site.

Table 5.16: Assessment of the potential tourism impact.

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Local	Local
Duration	Long-term	Long-term
Intensity	Low	Low
Probability	Probable	Probable
Confidence	High	High
Significance	Low (negative & positive)	Low (negative & positive)
Cumulative impact	Low (negative & positive)	Low (negative & positive)
Nature of Cumulative impact	A number of photovoltaic power projects are proposed in the area surrounding De Aar, which if not planned properly could impact a large area visually around De Aar, which in turn could impact tourism. In addition, the establishment of De Aar as a Renewable Energy Hub could attract visitors.	
Degree to which impact can be reversed	Fully Reversible	
Degree to which impact may cause irreplaceable loss of resources	Low	
Degree to which impact can be mitigated / optimised	None	

5.3.6 IMPACT ON CIVIL AVIATION

Description of impact:

The potential impacts on civil aviation are related to the reflection of sunlight during the day from the module / solar array surface, which can present a hazard during critical phases of flight, especially approach and landing, and the physical obstruction (collision hazard) presented by the proposed power line.

Assessment:

Modules are manufactured to maximise the absorption of light (energy) and reduce reflection. Since glare from modules reflects only approximately 2% of light, the intensity of the glare is much less that the glare from direct sunlight, as would be experienced when flying directly towards a low sun. Photovoltaic modules have a lower reflectivity that water, grass/crops and the rural environment (Spaven Consulting, 2011) (see Figure 5.2). There are many examples in the United States, and around the world, where photovoltaic power plants have been constructed on operational airfields and on airport buildings, e.g. San Francisco (roof), Denver (ground) and Munich (roof).

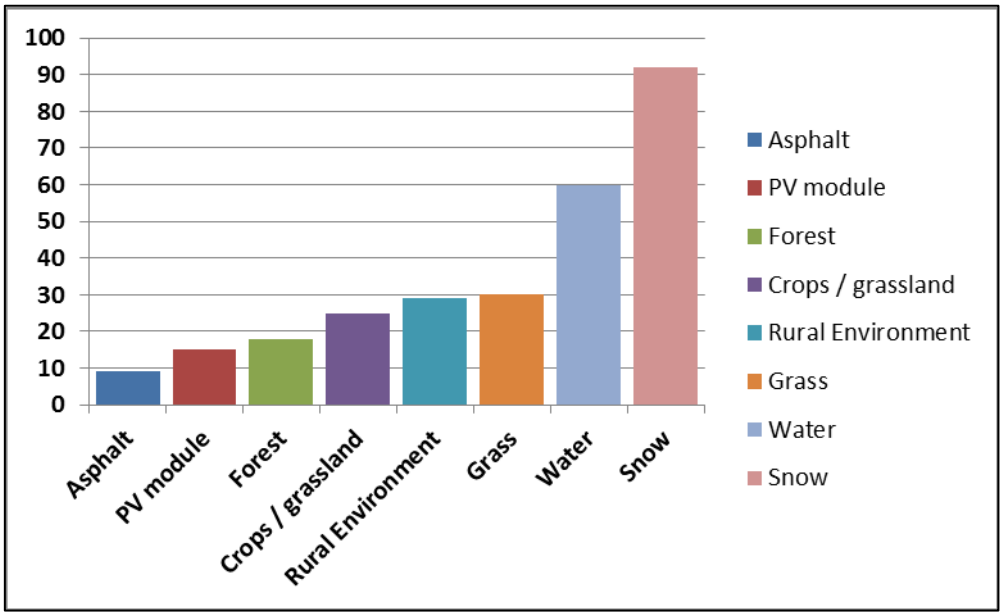


Figure 5.2: Reflectivity of different surfaces (Spaven Consulting, 2011).

There are two airfields in the De Aar area. There is a civil and a military airfield approximately 5 km and 17 km from the site, respectively. The proposed site is considered to be “en route” to these airfields. It has been found that photovoltaic power plants are unlikely to present glare / dazzle problems for pilots for the following reasons (Spaven Consulting, 2011):

- Dazzle / glare is likely to present a hazard only during critical phases of light, especially approach and landing. The “en route” phase is not normally a critical phase;
- Dazzle / glare occurs almost exclusively at low angles of elevation. An aircraft in the “en route” phase of flight would be at higher angles of elevation;
- Pilots in the “en route” phase are already subjected to glare from a number of existing sources, e.g. parked cars, large bodies of water, etc.;
- The pilot view from most cockpits, particularly in the forward direction, is severely limited in the downward direction by the aircraft structure, thus blocking the line of sight to any source of glare on the ground.

In the light of the above, solar energy facilities located "en route" or away from airfields are unlikely to present problems of glare to pilots. The proposed power line is also unlikely to present a physical obstruction (collision hazard) to civil aviation, as the proposed power line would be lower than and parallel to the existing high voltage power lines on site. The South African Civil Aviation Authority has indicated that they have no objection to the proposed project and that it would not pose a hazard to aviation (see Appendix 2.3).

The potential impact on civil aviation is considered to be a local, long-term impact of very low to low intensity. The significance of this potential impact is, therefore, assessed to be **VERY LOW** before and after mitigation (see Table 5.17).

Mitigation:
No mitigation is considered necessary.

Table 5.17: Assessment of the potential on civil aviation.

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Local	Local
Duration	Long-term	Long-term
Intensity	Very Low to Low	Very Low to Low
Probability	Probable	Probable
Confidence	Medium	Medium
Significance	Very Low	Very Low
Cumulative impact	Low	Low
Nature of Cumulative impact	A number of photovoltaic power projects are proposed in the area surrounding De Aar, which if not planned properly could have a more significant impact on civil aviation.	
Degree to which impact can be reversed	Fully Reversible	
Degree to which impact may cause irreplaceable loss of resources	Low	
Degree to which impact can be mitigated / optimised	None	

5.3.7 ESTABLISHMENT OF A COMMUNITY TRUST

Description of impact:
The establishment of a Community Trust funded by the proposed project could fund development initiatives in the area and support local and community development.

Assessment:
In terms of the Request for Proposal document prepared by the DoE all bidders for operating licences for renewable energy projects must demonstrate how the proposed development would benefit the local community. This could be achieved by the establishment a Community Trust, to which the proponent has indicated they are committed, funded by revenue generated from the sale of energy.

Community trusts provide an opportunity to generate a reliable and steady revenue stream over a 20-year period. This revenue could be used to fund development initiatives in the area and support the local economic and community development. The 20-year timeframe also allows local municipalities and

communities to undertake long-term planning for the area. The revenue from the proposed project could be used to support a number of social and economic initiatives in the area, including:

- Education (adult and child);
- Health care;
- Training and skills development; and
- Support for SMME's.

The potential impact of the establishment of a Community Trust is considered to be a local, long-term impact of low intensity. The significance of this potential impact is, therefore, assessed to be **low (positive)** before mitigation and **MEDIUM to HIGH (positive)** after mitigation (see Table 5.18).

Optimisation:

The following should be investigated and implemented in consultation with the ELM:

- The criteria for identifying and funding community projects and initiatives in the area should be investigated. The criteria should be aimed at maximising the benefits for the community as a whole and not individuals within the community; and
- Strict financial management controls, including annual audits, should be implemented to ensure that the funds generated for the Community Trust from the proposed project are managed for benefit of the community as a whole.

It is also recommended that the ELM should investigate the option of establishing a forum to assist the renewable energy sector with the establishment of Community Trusts.

Table 5.18: Assessment of the potential social impact related to the establishment of a Community Trust.

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Local	Local
Duration	Long-term	Long-term
Intensity	Low	Medium
Probability	Probable	Highly probable
Confidence	High	High
Significance	**Low (Positive)**	**MEDIUM to HIGH (POSITIVE)**
Cumulative impact	High (positive)	High (Positive)
Nature of Cumulative impact	The promotion of social and economic development and improvement in the overall well-being of the community would be enhanced by the establishment of other solar energy facilities in the area.	
Degree to which impact can be reversed	Fully Reversible	
Degree to which impact may cause irreplaceable loss of resources	N/A	
Degree to which impact can be mitigated / optimised	Low to Medium	

5.3.8 LOSS OF GRAZING AND INCREASED RISK OF EROSION

Description of impact:
The proposed project could result in the loss of grazing and potentially arable land. In addition, construction activities (e.g. excavations) may also increase the erosion potential of soils, which could result in the permanent loss of topsoil.

Assessment:
The landowner currently grazes a small number of game and livestock on site (including Springbok, Hartebeest and Bontebok). Numbers are low due to the low grazing capacity in the area (i.e. approximately 20 to 25 ha per large stock unit), which is related to the dry, hot climate with very low rainfall and associated vegetation type. The landowner has entered into a 20-year lease agreement with the proponent and as such the loss of productive farmland would be offset by the income the farmer would receive from the lease agreement. The effect on the landowner would be further offset as it is the intention to allow small game and / or livestock to graze between the modules / solar arrays, thereby reducing the area lost to this form of agriculture.

The soils in the study area are not considered to have a high erosion potential. However, most soils will erode to some degree after vegetation clearing, so care should be taken in the construction phase to minimise the extent of excavations.

The potential impact is considered to be a localised, long-term impact of low intensity. The significance of this impact is, therefore, assessed to be **LOW** before and after mitigation (see Table 5.19).

Mitigation:
- The footprint associated with the construction related activities (construction camps, lay down areas, workshop, etc.) should, wherever possible, be minimised;
- An Environmental Control Officer (ECO) should be appointed to monitor the implementation of and adherence to the EMP; and
- Disturbed areas are to be rehabilitated after construction with suitable indigenous plant species to reduce the risk of erosion.

Table 5.19: Assessment of the potential impact on soils and agricultural potential.

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Local	Local
Duration	Long-term	Long-term
Intensity	Low	Low
Probability	Probable	Probable
Confidence	High	High
Significance	**Low**	**LOW**
Cumulative impact	Low	Low
Nature of Cumulative impact	A number of photovoltaic power projects are proposed in the area surrounding De Aar, which would result in the loss of additional agriculturally productive soils.	
Degree to which impact can be reversed	Fully Reversible	
Degree to which impact may cause irreplaceable loss of resources	Low	
Degree to which impact can be mitigated / optimised	None	

5.4 IMPACTS ON THE HERITAGE AND CULTURAL ENVIRONMENT

5.4.1 HERITAGE RESOURCES

Description of impact:
The proposed project could have an impact on heritage resources (including artefacts, palaeontology and rock art) typical to the De Aar area during vegetation clearing and excavations for the proposed project.

Assessment:
The area is characterised by the Stone Age archaeology and Anglo-Boer War events. Although the site is highly disturbed from past and present farming activities, scattered Middle Stone Age artefacts were discovered close to the rocky outcrops on site, as well as on neighbouring properties. Thus earthmoving activities could expose in situ artefacts on site.

Previous Palaeontological Assessments have indicated that fossil bearing rocks are located in the De Aar area, which could be exposed during excavations. However, the majority of the excavations on site would be shallow and unlikely to impact any palaeontological resources.

No rock art was found to occur on site.

The potential impact on heritage resources is considered to be a localised, permanent impact of medium intensity. The significance of this impact is, therefore, assessed to be **medium** before mitigation and **LOW** with mitigation (see Table 5.20).

Table 5.20: Assessment of the potential impact on heritage resources.

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Local	Local
Duration	Permanent	Permanent
Intensity	Medium	Low
Probability	Probable	Probable
Confidence	Medium to High	Medium
Significance	**Medium**	**LOW**
Cumulative impact	Medium to High	Medium
Nature of Cumulative impact	The numerous other proposed renewable energy projects around De Aar could result in a significant loss of heritage resources.	
Degree to which impact can be reversed	Irreversible	
Degree to which impact may cause irreplaceable loss of resources	Medium to High	
Degree to which impact can be mitigated / optimised	Low	

Mitigation:
A basic heritage management plan should be included in the Environmental Management Programme (EMP) in order to provide some guidance as to the management of heritage resources that may be uncovered during earthmoving activities. The management plan should include the following:

- *Sampling:* A local archaeologist is to be appointed to sample and collect any scattered stone tools found on site before construction commences. It is recommended that the McGregor Museum in Kimberley be contacted to provide support in this regard;

- *Permit:* No heritage objects can be removed from site without a sampling permit issued by the South African Heritage Resources Agency (SAHRA). Therefore, it is recommended that the archaeologist apply for the permit; and
- *Heritage training:* The archaeologist is to provide a one day workshop for the Contractor and ECO to explain the type of heritage objects that may be uncovered and the methodology to follow in event any are uncovered during construction.

5.4.2 CULTURAL LANDSCAPE

Description of impact:
The proposed project could have an impact on the cultural landscape (including places of cultural / historic value, sense of place and indigenous groups) typical to the De Aar area.

Assessment:
Although the site is highly disturbed from past and present farming activities, as well as the existing visual clutter in the area, the cultural landscape and sense of place is characterised by the Stone Age period and Anglo-Boer War events. Old railway stations, blockhouses and foundations have been discovered in the surrounding landscapes closer to town. These two time periods have provided a unique sense of place in and around De Aar. The proposed project would add to the visual clutter in the area and further alter the cultural landscape.

No indigenous groups live on site and thus no cultural knowledge and traditional lifestyles would be affected or lost.

The potential impact on cultural heritage is considered to be a regional, long-term impact of low to medium intensity. The significance of this impact is, therefore, assessed to be **low to medium** before mitigation and **LOW** with mitigation (see Table 5.21).

Mitigation:
Mitigation proposed to reduce the visual impact is considered applicable here (see Section 5.3.4).

Table 5.21: Assessment of the potential impact on the cultural landscape.

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Regional	Regional
Duration	Long-term	Long-term
Intensity	Low	Low
Probability	Probable	Probable
Confidence	Medium to High	Medium
Significance	**Low to Medium**	**LOW**
Cumulative impact	Medium	Low
Nature of Cumulative impact	The numerous other proposed renewable energy projects around De Aar could result in a significant loss of the cultural landscape, including the sense of place associated with the area.	
Degree to which impact can be reversed	Irreversible	
Degree to which impact may cause irreplaceable loss of resources	Low	
Degree to which impact can be mitigated / optimised	Low	

5.5 IMPACTS RELATED TO THE CONSTRUCTION AND DECOMMISSIONING PHASES

5.5.1 VEGETATION

Description of impact:
Approximately 1.5 ha would need to be temporary cleared or disturbed for the establishment of the construction camp and laydown areas.

Assessment:
Due to the long-term nature of this impact, all impacts on the vegetation related to clearing and disturbance are assessed in Section 5.2.1.1.

5.5.2 TERRESTRIAL FAUNA

5.5.2.1 Direct mortality of faunal species

Description of impact:
Site clearing and excavations may result in the direct mortality of individuals during the construction phase.

Assessment:
The study area appears to have a low faunal species diversity and population densities are expected to be low. Birds, large snakes and medium-sized mammals would be able to flee at the start of site clearing. However, many reptiles and small mammals (rodents and insectivores) may hide underground and would be directly impacted by site clearing and excavations. Although construction activities may lead to the direct mortality of individuals that cannot safely flee the construction site, no species of conservation concern occur on site nor would there be a permanent impact on any population or species as a whole.

The potential impact of direct mortality on faunal species during construction is considered to be a localised, short-term impact of low intensity. The significance of this impact is, therefore, assessed to be **VERY LOW** before and after mitigation (see Table 5.22).

Table 5.22: Assessment of the potential impact of direct mortality of faunal species during the construction phase.

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Local	Local
Duration	Short-term	Short-term
Intensity	Low	Low
Probability	Probable	Probable
Confidence	High	High
Significance	**Very Low**	**VERY LOW**
Cumulative impact	Low	Low
Nature of Cumulative impact	The numerous other proposed renewable energy projects around De Aar would result in a higher incidence of direct mortality of faunal species.	
Degree to which impact can be reversed	Fully Reversible	
Degree to which impact may cause irreplaceable loss of resources	Low	
Degree to which impact can be mitigated / optimised	None	

Mitigation:

- Although no formal faunal search and rescue is considered necessary during site preparation, every effort is to be made to relocate faunal species that cannot flee on their own accord to a suitable area immediately adjacent to the proposed footprint.

5.5.3 FRESHWATER SYSTEMS

5.5.3.1 Disturbance and loss of freshwater habitat

Description of impact:
The construction of access roads and the installation of modules / solar arrays could result in the localised disturbance of the two small ephemeral streams / drainage channels on site.

Assessment:
The ephemeral streams have been significantly modified into stormwater drainage channels and instream dams to allow for stormwater management along the N10 and in the lower lying areas on the site. These channels are both considered to be of low ecological importance and sensitivity. The construction of the proposed power line (all alternatives) is not expected to have an impact on any freshwater systems.

The potential impact is considered to be a localised, short-term impact of low to high intensity (depending on the distance between construction activities and drainage lines). The significance of this impact is, therefore, assessed to be **low** before mitigation and **VERY LOW** with mitigation (see Table 5.23).

Mitigation:

- Where access routes need to be constructed through the drainage channels, disturbance should be limited;
- All construction materials are to be properly stored and contained;
- Ablution facilities are to be located at least 30 m from the drainage channels and regularly serviced;
- Solid waste is to be properly managed with no burying of waste on site;
- All invasive alien vegetation currently within the drainage channels is to be removed; and
- Disturbed areas are to be rehabilitated after construction with suitable indigenous plant species.

Table 5.23: Assessment of the potential impact of freshwater habitat disturbance / habitat loss during the construction phase.

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Local	Local
Duration	Short-term	Short-term
Intensity	Low to High	Low
Probability	Probable	Probable
Confidence	High	High
Significance	**Low**	**VERY LOW**
Cumulative impact	Low to Medium	Very Low
Nature of Cumulative impact	A number of photovoltaic power projects are proposed in the area surrounding De Aar. These projects would potentially add to the freshwater habitat disturbed or lost.	
Degree to which impact can be reversed	Fully Reversible	
Degree to which impact may cause irreplaceable loss of resources	Low to Medium	
Degree to which impact can be mitigated / optimised	Low	

5.5.4 GROUNDWATER

5.5.4.1 Groundwater abstraction

Description of impact:
The proposed abstraction and use of groundwater during construction could result in pumping-induced drawdown, which could impact adjacent groundwater users.

Assessment:
There are five operating boreholes on site, which each have relatively low yields in the order of 1.2 L/s. During the construction phase an estimated 75 KL of groundwater would be required per day. This would entail pumping one borehole almost continuously or pumping three boreholes for 8 hrs per day to satisfy the demand. It is calculated that the drawdown 1 km from a borehole being pumped continuously at 1.2 KL would be approximately 1 m, which would not impact the performance of nearby boreholes.

The potential impact during construction is considered to be localised, short-term and of very low intensity. The significance of this impact is, therefore, assessed to be **insignificant to very low** before mitigation and **INSIGNIFICANT** with mitigation (see Table 5.24).

Mitigation
- Multiple boreholes should be used for shorter durations, as this would reduce the extent of the radius of influence;

A Water Use Licence authorisation application would need to be submitted to DWA Northern Cape Regional Office for approval for the abstraction and use of groundwater.

Table 5.24: Assessment of the potential impact of groundwater abstraction during construction.

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Local	Local
Duration	Short-term	Short-term
Intensity	Very Low	Zero
Probability	Highly probable	Probable
Confidence	Medium	Medium
Significance	**Insignificant to Very Low**	**INSIGNIFICANT**
Cumulative impact	Very Low	Very Low
Nature of Cumulative impact	Existing water use of 15 KL per day (which is expected to continue) and other potential renewable energy projects could increase the drawdown of groundwater, which could have an impact on farmers and the town of De Aar.	
Degree to which impact can be reversed	Fully Reversible	
Degree to which impact may cause irreplaceable loss of resources	N/A – there is no expected loss of resource.	
Degree to which impact can be mitigated / optimised	Low	

5.5.4.2 Groundwater contamination

Description of impact:
Construction activities could result in the contamination of the groundwater. Potential sources of contamination include the leakage of chemicals, oils and fuels, accidental spills, and the disposal of waste and wastewater.

Assessment:
The volumes of hazardous materials used in the construction phase are expected to be small and the volumes of waste (solid and liquid) to be minor. The extent of contamination, should it occur, would remain localised. It is anticipated that the contractor would be required to provide portable chemical toilets during the construction phase.

The potential impact during construction is considered to be a localised, short-term impact of very low intensity. The significance of this impact is, therefore, assessed to be **very low** before mitigation and **INSIGNIFICANT** with mitigation (see Table 5.25).

Mitigation:
- Chemical and fuel storage areas that have a potential to contaminate groundwater are to be established on low permeability, bunded surfaces;
- Any maintenance or refuelling activities are to be undertaken on a low permeability, bunded surfaces;
- Routine inspections are to be carried out to check for leaks and spills; and
- Any leaks and spills are to be promptly dealt with, including the cleaning, treatment or removal of the contaminated area or soil.

Table 5.25: Assessment of the potential impact of groundwater contamination during construction.

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Local	Local
Duration	Short-term	Short-term
Intensity	Very Low	Zero
Probability	Probable	Improbable
Confidence	High	High
Significance	**Very Low**	**INSIGNIFICANT**
Cumulative impact	Very Low	Very Low
Nature of Cumulative impact	Other potential renewable energy projects and current farming practices could increase the risk of groundwater contamination.	
Degree to which impact can be reversed	Fully / Partially Reversible	
Degree to which impact may cause irreplaceable loss of resources	N/A – there is no expected loss of resource.	
Degree to which impact can be mitigated / optimised	Low	

5.5.5 SOCIO-ECONOMIC ENVIRONMENT

5.5.5.1 Creation of employment and business opportunities

Description of impact:
The proposed development would create a number of local employment and business opportunities during the construction and decommissioning phases. In addition, there would potentially be an opportunity for skills development and on-site training.

Assessment:

Construction Phase:
The construction-related work would be undertaken by a main contractor with various sub-contractors. It is estimated that during the construction phase between 200 and 300 people would be working on the site for a period of six to nine months, of which approximately 70% (140-210) of the employment opportunities would be available to low skilled (e.g. construction labourers, security staff, etc.) and semi-skilled workers (e.g. drivers, equipment operators, etc.) and 30% (60-90) highly skilled personnel (engineers, land surveyors, project managers etc.). The low and semi-skilled opportunities are likely to be available to local residents in the area, specifically historically disadvantaged residents from De Aar (and possibly Britstown and Hanover). However, the low education and skills levels in the area may hamper potential opportunities for local communities, especially the skilled jobs. Due the relatively short timeframe of the construction phase the potential for meaningful training and skills development is likely to be limited. In addition, the majority of these opportunities are likely to be linked to the contractors appointed to manage the construction phase.

The capital expenditure associated with the construction phase is estimated to be in the region of R 800-900 million. In terms of business opportunities for local companies, expenditure during the construction phase would create business opportunities for the regional and local economy. However, given the technical nature of and high import content associated with the proposed project, the opportunities for the local economy of De Aar (and possibly Britstown and Hanover) are likely to be limited.

The sector of the local economy that is most likely to benefit during construction and decommissioning is the local service industry (including accommodation, catering, cleaning, transport, security, etc.). Based on information from other solar energy projects, the total wage bill for a six to nine month construction period would be in the region of R 35-40 million, which would create opportunities for local businesses in De Aar (and possibly Britstown and Hanover).

The creation of employment and business opportunities during the construction phase is likely to result in a short-term, local impact of low intensity. The significance of this potential impact is, therefore, assessed to be **low (positive)**. However, with the effective implementation of the proposed optimisation measures the potential social impact is considered to be of **MEDIUM (POSITIVE)** significance (see Table 5.26).

Decommissioning Phase:
Typically, the main social impact associated with the decommissioning phase is linked to the loss of jobs and associated income. This has implications for the households who are directly affected, the communities within which they live and the relevant local authorities. Decommissioning would also provide temporary employment for an estimated 50 to 100 people for a period of six to 12 months.

Given the relatively small number of people employed during the operational phase (approximately 30 to 40) and that the loss of jobs and income associated can be effectively managed with the implementation of a retrenchment and downscaling programme, the impact is considered to be short-term, local and of low

intensity. The significance of this potential impact is, therefore, assessed to be **LOW** before and after mitigation (see Table 5.27).

Optimisation/mitigation:

Construction phase:
In order to enhance local employment and business opportunities associated with the construction phase the following measures should be implemented:

- The contractor appointed should, where reasonable and practical, implement a 'locals first'[1] employment policy, especially for semi- and low-skilled job categories, and appoint local contractors/sub-contractors with BEE criteria;
- The ELM should be contacted to establish the existence of a skills database for the area. If such a database exists, it should be made available to the appointed contractor;
- I&APs on the project database should be informed of potential job opportunities for locals and the intended employment procedures;
- The establishment of an employment office in De Aar should be considered;
- The recruitment selection process should seek to promote gender equality and the employment of women wherever possible;
- Training and skills development programmes for locals should, where feasible, be initiated prior to the initiation of the construction phase; and
- A database of local companies, specifically BEE companies, which qualify as potential service providers (e.g. construction companies, catering companies, waste collection companies, security companies etc.) should be developed prior to the commencement of the tender process for construction contractors. These companies should be notified of the tender process and invited to bid for project-related work.

It is also recommended that the ELM, in conjunction with the local Chamber of Commerce and representatives from the local hospitality industry, should identify strategies aimed at maximising the potential benefits associated with the proposed project.

Decommissioning Phase:

- Retrenchment packages are to be provided for all staff that stand to lose their jobs; and
- The option of establishing an Environmental Rehabilitation Trust Fund to cover the costs of decommissioning and rehabilitation of disturbed areas should be investigated. The Trust Fund could be funded by a percentage of the revenue generated from the sale of energy to the national grid over the 20 year operational life of the facility.

[1] Note that while preference to local employees and companies is recommended, it is recognised that a competitive tender process may not guarantee the employment of local labour for the construction phase.

Table 5.26: Assessment of the potential social impact related to employment and the creation of business during construction.

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Local	Local
Duration	Short-term	Short-term
Intensity	Low	Low
Probability	Probable	Probable
Confidence	High	High
Significance	**Low (positive)**	**MEDIUM (POSITIVE)**
Cumulative impact	Low (positive)	Low (positive)
Nature of Cumulative impact	There are a number of other renewable energy projects proposed in the area. The development of these projects would contribute to employment and the development of skills in the area.	
Degree to which impact can be reversed	Fully reversible	
Degree to which impact may cause irreplaceable loss of resources	N/A	
Degree to which impact can be mitigated / optimised	Low	

Table 5.27: Assessment of the potential social impact related to the loss of jobs during decommissioning.

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Local	Local
Duration	Short-term	Short-term
Intensity	Low	Low
Probability	Probable	Probable
Confidence	High	High
Significance	**Low**	**LOW (NEUTRAL)**
Cumulative impact	Low	Low
Nature of Cumulative impact	Decommissioning would contribute to local unemployment in the area. However, decommissioning would also create some temporary employment opportunities.	
Degree to which impact can be reversed	Fully Reversible	
Degree to which impact may cause irreplaceable loss of resources	N/A	
Degree to which impact can be mitigated / optimised	Very Low	

5.5.5.2 Influx of job seekers to the area

Description of impact:

The establishment of the proposed projects is likely to attract job seekers to the area during the construction phase, which could pose a number of risks to local farmers in the vicinity of the site and the local community in De Aar.

Assessment:

This risks related to the influx of job seekers and the impact on existing social networks and community structures are similar to that described for the operation phase (see Section 5.3.3). Although construction phase impacts are generally short-term in nature, in some cases, they may persist for a long period or be permanent (e.g. HIV/AIDs and unwanted pregnancies). The implementation of a local employment strategy, specifically for low and semi-skilled employment opportunities, would reduce these risks to a large extent. However, the low education and skills levels in the area may hamper potential opportunities for local communities.

In the case of the local farmers the issue of personal safety is regarded as the most significant social issue. It is anticipated that no construction personnel, apart from security, would be accommodated on the site. Therefore, the potential safety risk to local farmers is considered to be effectively mitigated.

The potential risk posed by construction workers is considered to have a localised, long-term to permanent of low intensity for the community as a whole. The significance of this potential impact is, therefore, assessed to be **medium** before mitigation. However, with the effective implementation of the proposed mitigation measures the potential social impact is considered to be of **LOW** significance (see Table 5.28).

Mitigation:

- A 'locals first' employment policy should be implemented (see Section 5.5.5.1);
- A policy that no employment opportunities would be offered at the gate should be implemented. This should be linked to the possible establishment of employment office in De Aar;
- An Environmental Monitoring Committee (EMC) should be established in order to monitor the construction phase and the implementation of the recommended mitigation measures. The forum should include representatives from the local community, local councillors, farmers and the contractor;
- A Code of Conduct should be developed in consultation with the EMC. The code should identify what types of behaviour and activities by construction workers are not permitted. All dismissals must comply with the South African labour legislation. All workers are to be informed at the outset of the construction phase of the conditions contained on the Code of Conduct;
- Contractor is to implement an HIV/AIDS awareness programme for all construction workers at the outset of the construction phase;
- The movement of construction workers on and off the site is to be closely managed and monitored by the contractor;
- No construction workers, with the exception of security personnel, should be permitted to stay overnight on the site;
- The contractor should be responsible for making the necessary arrangements for transporting workers to and from site on a daily basis;
- The contractor should make necessary arrangements to enable workers from outside the area to return home over weekends and or on a regular basis during the construction phase; and
- The contractor should make the necessary arrangements for ensuring that all non-local construction workers are transported back to their place of residence once the construction phase is completed.

Table 5.28: Assessment of the potential social impact related to the influx of construction workers.

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Local	Local
Duration	Long-term to Permanent	Long-term to Permanent
Intensity	Low	Low
Probability	Probable	Probable
Confidence	High	High
Significance	**Medium**	**LOW**
Cumulative impact	Low	Low
Nature of Cumulative impact	The presence of construction workers involved with other renewable energy projects in the area may exacerbate the risks.	
Degree to which impact can be reversed	Irreversible (in case of HIV/AIDs, unwanted pregnancies, etc.)	
Degree to which impact may cause irreplaceable loss of resources	Low	
Degree to which impact can be mitigated / optimised	Low	

5.5.5.3 Loss of farm labour to the construction phase

Description of impact:
Since local farmers are unlikely to be in a position to compete with the salaries offered during the construction phase, farm labourers may be tempted to resign from their current positions on farms in order to take up employment for the contractor. The loss of skilled and experienced farm labour could have an impact on local farmers.

Assessment:
The proposed project on its own is unlikely to result in the significant loss of farm labour and, considering the unemployment rate in De Aar, farm labour can be replaced. However, the impact could be exacerbated by the security of tenure that entitles permanent farm labourers to stay on in their houses located on the farm. The net effect is that the farmer may have to incur costs associated with the construction of new dwellings. The farmer may also have to continue subsidising services such as potable water to people who are no longer in their employ.

It should also be noted that farm workers that take up jobs during the construction phase may also be a risk. While some farm workers may be re-employed once the construction has been completed, others may not be so fortunate.

The potential impact related to the loss of farm labour is considered to be localised, short-term and of low intensity for the community as a whole. The significance of this potential impact is, therefore, assessed to be **VERY LOW** before and after mitigation (see Table 5.29).

Mitigation:
- All employment seekers (including farm workers) should be informed that the nature of the work is temporary.

Table 5.29: Assessment of the potential social impact related to the loss of farm labourers during construction.

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Local	Local
Duration	Short-term	Short-term
Intensity	Low	Low
Probability	Probable	Probable
Confidence	High	High
Significance	**Very Low**	**VERY LOW**
Cumulative impact	Low	Low
Nature of Cumulative impact	While the proposed project on its own is unlikely to result in a significant loss of farm labour, the proposed establishment of a number of solar energy projects near De Aar has the potential to impact the farming sector.	
Degree to which impact can be reversed	Fully Reversible	
Degree to which impact may cause irreplaceable loss of resources	Low	
Degree to which impact can be mitigated / optimised	None	

5.5.5.4 Increased risk of stock theft, poaching and damage to farm infrastructure

Description of impact:

The presence of construction workers on the site increases the potential risk of stock theft and poaching. The movement of construction workers on and off the site also poses a potential threat to farm infrastructure, such as fences and gates, which may be damaged. Livestock and game losses may also result from gates being left open and/or fences being damaged.

Assessment:

The potential impact related to stock theft, poaching and damage to farm infrastructure is considered to be localised, short-term and of low intensity for the community as a whole. The significance of this potential impact is, therefore, assessed to be **VERY LOW** before and after mitigation (see Table 5.30).

Mitigation:

- The proponent / contractor should enter into an agreement with the landowner whereby damages to farm property, stock theft and disruptions to farming activities would be compensated;
- A Environmental Monitoring Committee should be established and a Code of Conduct should be develop (see Section 5.5.5.2); and
- No construction workers, with the exception of security personnel, should be permitted to stay overnight on the site.

Table 5.30: Assessment of the potential social impact related to stock theft, poaching and damage to farm infrastructure during construction.

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Local	Local
Duration	Short-term	Short-term
Intensity	Low	Low
Probability	Probable	Probable
Confidence	High	High
Significance	**Very Low**	**VERY LOW**
Cumulative impact	Low	Low
Nature of Cumulative impact	Due the relatively large number of projects proposed in the area there is a potential for an increase in stock theft in broader region.	
Degree to which impact can be reversed	Fully Reversible	
Degree to which impact may cause irreplaceable loss of resources	Low	
Degree to which impact can be mitigated / optimised	None	

5.5.5.5 Increased risk of veld fires

Description of impact:
The presence of construction workers and construction-related activities on the site poses an increased risk of veld fires, which in turn poses a threat to humans, livestock, wildlife and farmsteads / infrastructure.

Assessment:
The potential risk of veld fires is heightened by windy conditions in the area, specifically during the dry, winter months. The livelihoods of the farmers in the area are dependent on grazing for stock farming (beef cattle and sheep). Any loss of grazing due to a fire could, therefore, have an impact on their livelihoods.

The potential impact related to veld fires is considered to be localised, short-term and of medium to high intensity. The significance of this potential impact is, therefore, assessed to be **medium** before mitigation and **VERY LOW** after mitigation (see Table 5.31).

Mitigation:
- The Contractor must comply with the requirements of the Veld & Forest Fires Act, 1998 (No. 101 of 1998) in terms of establishing a Fire Protection Association with the landowners;
- The proponent / contractor should enter into an agreement with the landowner/s whereby damages to farm property and stock losses would be compensated;
- Contractor should ensure that open fires on the site for cooking or heating are not allowed except in designated areas;
- Contractor should ensure that construction related activities that pose a potential fire risk, such as welding, are properly managed and are confined to areas where the risk of fires has been reduced (e.g. clearing working areas and avoiding working in high wind conditions);
- Contractor should provide adequate fire fighting equipment on site; and
- Contractor should provide fire-fighting training to selected construction staff.

Table 5.31: Assessment of the potential social impact related to veld fires during construction.

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Local	Local
Duration	Short-term	Short-term
Intensity	Medium to High	Low
Probability	Probable	Probable
Confidence	High	High
Significance	**Medium**	**VERY LOW**
Cumulative impact	Insignificant	Insignificant
Nature of Cumulative impact	None (provided losses are compensated for).	
Degree to which impact can be reversed	Fully Reversible	
Degree to which impact may cause irreplaceable loss of resources	Low	
Degree to which impact can be mitigated / optimised	Medium	

5.5.5.6 Impacts associated with movement of construction vehicles

Description of impact:
The movement of heavy construction vehicles during the construction phase has the potential to damage roads and create noise and dust. In addition, the movement of construction vehicles may pose safety risks for other road users, specifically between De Aar and the site.

Assessment:
The locally manufactured equipment would be transported to site by road from Cape Town and Johannesburg. The modules would be shipped in via either Durban or Cape Town, depending on supplier, and then transported to site by road. The current road use frequency in the area and specifically along the Hydra substation road is considered to be low.

The potential impact related to the movement of heavy construction vehicles is considered to be local to regional in extent, short-term and of medium intensity. The significance of this potential impact is, therefore, assessed to be **VERY LOW** before and after mitigation (see Table 5.32).

Mitigation:
- The option of using rail to transport components and equipment to De Aar from Cape Town, Durban and Johannesburg should be investigated;
- A permit must be obtained from the relevant Provincial Authority for a vehicle carrying an abnormal load (e.g. inverter buildings and transformers);
- The proponent / contractor should enter into an agreement with the landowner/s whereby damages to farm roads would be compensated;
- Dust suppression measures must be implemented for heavy vehicles such as wetting of gravel roads on a regular basis and ensuring that vehicles used to transport sand and building materials are fitted with tarpaulins or covers; and
- All vehicles must be road-worthy and drivers must be qualified, made aware of the potential road safety issues and the adherence to speed limits.

Table 5.32: Assessment of the potential social impact related to the movement of heavy construction vehicles.

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Local to Regional	Local to Regional
Duration	Short-term	Short-term
Intensity	Medium	Low
Probability	Probable	Probable
Confidence	High	High
Significance	**Very Low**	**VERY LOW**
Cumulative impact	Low	Low
Nature of Cumulative impact	Damage to roads related to the numerous renewable energy projects in the area may affect the farming activities in the area and result in higher maintenance costs for vehicles of local farmers and other road users.	
Degree to which impact can be reversed	Fully Reversible	
Degree to which impact may cause irreplaceable loss of resources	Low	
Degree to which impact can be mitigated / optimised	Low	

5.5.6 HERITAGE AND CULTURAL ENVIRONMENT

5.5.6.1 Heritage resources

Description of impact:
The proposed project could have an impact on heritage resources (including artefacts, palaeontology, rock art) during decommissioning (removal of infrastructure).

Assessment:
Although the site is highly disturbed from past and present farming activities, scattered Middle Stone Age artefacts were discovered close to the rocky outcrops on site, as well as on neighbouring properties. Thus earthmoving activities could expose in situ artefacts on site. Once all infrastructure is removed there would be a potential gap in the knowledge of regional archaeological and movement patterns.

The potential impact during operation is considered to be a localised, permanent impact of low to medium intensity. The significance of this impact is, therefore, assessed to be **low to medium** before mitigation and **LOW** with mitigation (see Table 5.33).

Mitigation:
Mitigation is as per Section 5.4.1.

Table 5.33: Assessment of the potential impact on heritage resources during the decommissioning phase.

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Local	Local
Duration	Permanent	Permanent
Intensity	Low to Medium	Low
Probability	Probable	Probable
Confidence	Medium to High	Medium
Significance	**Low to Medium**	**LOW**
Cumulative impact	Medium	Low
Nature of Cumulative impact	The numerous other proposed renewable energy projects around De Aar could result in a significant loss of heritage resources.	
Degree to which impact can be reversed	Irreversible	
Degree to which impact may cause irreplaceable loss of resources	Low	
Degree to which impact can be mitigated / optimised	Low	

5.6 CUMULATIVE IMPACT

The EIA Regulations 2010 require that the cumulative impact of each identified potentially significant impact is described and assessed. A "cumulative impact", in relation to an activity, "*means the impact of an activity that in itself may not be significant, but may become significant when added to the existing or potential impacts eventuating from similar or diverse activities or undertakings in the area*".

De Aar has been identified as a Renewable Energy Hub. As a result, a number of photovoltaic power projects are proposed in the area, most of these being concentrated around the existing Hydra substation, south-east of the town. These projects, together with that proposal by Business Venture Investments 1421 (Pty) Ltd, would have a cumulative impact on the biophysical and socio-economic environment.

The cumulative impact related to each of the impacts identified is assessed in Section 5.2 to 5.4 (see impact tables) with the key findings being summarised below. It should be noted that the significance rating after mitigation assumes that all projects would implement similar mitigation / optimisation measures to that proposed for the current project.

- **Vegetation**
  Since the Northern Upper Karoo vegetation is widespread and not threatened, the anticipated cumulative impact is considered to be of **LOW** significance before and after mitigation.

- **Fauna**
  All impacts on terrestrial fauna are considered to be of **LOW** significance, except the potential increase in bird strikes which is considered to be of **MEDIUM** significance. This rating is related to the additional power line infrastructure that would be installed and the potential increase in mortality of Ludwig's Bustard (listed as *Vulnerable* and *Endangered*), which is specifically vulnerable to power line collisions.

- **Freshwater**
  The nature of these photovoltaic power projects allows them to have minimal impact on surface water features. The overall impact on fresh water resources is considered to range from **VERY LOW** to **LOW** significance with mitigation.

- **Groundwater**
  Given the relatively small area that these proposed developments would occupy in the landscape, it is considered improbable that they would have any cumulative impact on recharge of Karoo aquifers in the vicinity of De Aar. Effective stormwater management (specifically stormwater retention) would negate most negative effects. Similarly, the cumulative volume[2] of water required during construction (an estimated 2 000 KL/d) and operation (an estimated 800 KL/d) is relatively small, particularly as the proposed energy initiatives are spread a large area (> 250 km^2). This should be compared to the approximately 5 500 KL/d that is abstracted from the municipal well fields. Cumulative impacts on groundwater resources are considered to be **insignificant** to **VERY LOW** significance.

- **Socio-economic**
  A reduction in carbon emissions via the use of renewable energy and associated benefits in terms of global warming and climate change is considered to be of **HIGH (POSITIVE)** significance. However, the visual impact associated with the projects on the areas sense of place and landscape character is considered to be of negative **MEDIUM** to **HIGH** significance.

  The establishment of a Renewable Energy Hub in the region would create significant economic opportunities for the area and go a long way to offsetting the negative socio-economic impacts, such as job losses, associated with the scaling down of the railway linked activities in De Aar over the last 10-15 years. The establishment of Community Trusts, funded by revenue from these projects, provides an opportunity to generate a reliable and steady revenue stream over a 20-year period. This revenue could be used to fund development initiatives in the area and support the local economic and community development. This benefit is considered to be of **HIGH (POSITIVE)** significance. The impact associated with the creation of local employment (estimated to be in the order of 150 to 200 jobs) and business opportunities is considered to be **LOW (POSITIVE)** significance. However, the influx of potential job seekers could have a **MEDIUM** significant impact on existing social networks and community structures.

- **Heritage**
  The cultural landscape and sense of place is characterised by the Stone Age archaeology and Anglo-Boer War events. Old railway stations, blockhouses and foundations have been discovered in the surrounding landscapes closer to town. These two time periods have provided a unique sense of place in and around De Aar. In addition, earthmoving activities could expose in situ heritage objects related to the Stone Age and Anglo-Boer War. The cumulative impact on heritage resources and the cultural landscape is considered to be of **MEDIUM** and **LOW** significance, respectively.

5.7 NO-GO ALTERNATIVE

The No-Go alternative relates to the option of not developing the proposed power plant and associated infrastructure (i.e. the Status Quo). If the proposed project is not developed, the current land use activities are assumed to continue in the long-term. The site, Portion 3 of Farm Hartebeestplaats 135, is currently used primarily to graze and water small game and livestock (including Springbok, Hartebeest and Bontebok) and as a small guest lodge, 'Kampfontein'. The site has five boreholes (diesel-powered and wind pumps), which

[2] Volume has been estimated based on the size of other proposed renewable energy projects in the surrounding area.

used on a rotational basis for water supply. Other infrastructure on site includes: farm access roads; shooting range; brickworks; radio tower; and 400 kV and 769 kV power lines.

Land use in the area surrounding De Aar currently consists of livestock farming. However, due to the arid nature of the area, the carrying capacity of the land is low. The land and climate are also not conducive to the cultivation of crops and pastures.

The potential impacts related to the no-go alternative are summarised below.

- **Vegetation**
  There would be little change in the vegetation on site if the current grazing intensity and carrying capacity remained. No additional impact is anticipated. Over grazing, although not anticipated, could result in impacts similar to that of the proposed project.

- **Fauna**
  The study area contains no unique or important faunal habitats relative to the surrounding area. The no-go alternative would result in no change to the existing land use activities on the site and associated impacts on faunal species and habitats.

- **Freshwater**
  The streams on site have been significantly modified into stormwater drainage channels and instream dams to allow for stormwater management along the N10 and in the lower lying areas on the site. Existing land use activities are all largely at a small scale and have an impact no greater than that of the proposed project.

- **Groundwater**
  Current operations on the farm are unlikely to have any significant impact on the underlying groundwater resources. Groundwater use is small (approximately 15 KL/d) and domestic wastewater and sewage is disposed in a septic tank / soak-away system. The soak-away is 250 m from the closest borehole, and boreholes located down-gradient of the soak-away are at least 370 m distant.

- **Socio-economic**
  The no-go option would represent a lost opportunity for South Africa to supplement its current energy needs with clean, renewable energy given South Africa's position as one of the highest per capita producer of carbon emissions in the world. There would also be a lost opportunity in terms of the employment and business opportunities associated with the proposed project and the benefits associated with the establishment of a Community Trust. The no-go option would represent a negative social cost of **HIGH** significance.

- **Heritage**
  The site is already highly disturbed from past and present farming activities. No further destruction or disturbance to the cultural landscape is considered likely to occur.

6. CONCLUSIONS AND RECOMMENDATIONS

Business Venture Investments 1421 (Pty) Ltd is proposing to develop the De Aar Solar One Photovoltaic Power Project on Portion 3 of Farm Hartebeestplaats 135 (locally referred to as Kampfontein). The proposed photovoltaic power plant would consist of a 25 to 30 MWp AC plant (capacity is subject to the final choice of technology). The proposed plant would be connected to the existing Hydra substation via a 132 kV overhead power line of approximately 2 to 2.5 km long.

CCA was appointed as the EAP to undertake a Scoping and EIA process in terms of Chapter 5 of NEMA, as amended. The Scoping and EIA process was undertaken so as to comply with the requirements of the EIA Regulations 2010. Eight specialist studies were undertaken to address the potential impacts associated with the key issues raised during the Scoping Study. The findings of the specialist studies have been integrated and synthesised into this Draft EIR. The two main objectives of this Draft EIR are, firstly, to assess the environmental significance of potential impacts resulting from the proposed project, as well as the Cumulative Impact and the No-Go Alternative, and secondly to suggest ways of mitigating negative impacts and optimising benefits.

This chapter summarises the key findings of the study and presents recommendations in terms of mitigation and optimisation measures that should be implemented if the proposed project goes ahead.

6.1 CONCLUSIONS

The potential impacts related to each phase of the proposed project are discussed below and summarised in Table 6.1.

6.1.1 FIT WITH LEGISLATION, POLICY AND PLANNING

A review of the relevant legislation, policies and documents pertaining to the energy sector indicate that solar energy and the establishment of photovoltaic power plants are supported at a national, provincial and local level. In this regard De Aar has been identified as a Renewable Energy Hub. Thus the establishment of the proposed project is supported by the relevant policy and planning documentation and has the potential to support a number of key strategies in the district and local IDPs.

6.1.2 CONSTRUCTION AND DECOMMISSIONING PHASES

The majority of the impacts associated with the construction and decommissioning phases would be very localised (i.e. occurring on site only) and of short-term duration (i.e. reversible). All impacts associated with these two phases, except one, are considered to be **INSIGNIFICANT** or of **VERY LOW to LOW** significance with mitigation. The most significant construction phase impact is related to the creation of employment for between 200 and 300 people for a period of six to nine months and business opportunities particularly in the local service industry, which is considered to be of **MEDIUM (POSITIVE)** significance with mitigation.

6.1.3 OPERATION PHASE

The assessment is based on an indicative layout as presented in Figure 3.4. This layout is the result of an iterative design process, which has been informed to a certain extent by recommendations made in the specialist baseline studies that were undertaken during the Scoping Study Phase. The proposed layout has avoided the rocky outcrop areas, which are considered to be more sensitive from a vegetation, fauna and visual perspective. In addition, a 30 m wide buffer with a 2 m high berm has been incorporated into the proposed layout in order to reduce the visual impact. The visual impact is further reduced by the proposed planting of vegetation along N10 and Hydra substation access road.

The assessment has also considered a number of alternatives, including:

- Technology: The proposed project would use either silicone crystalline or thin-film modules, configured on fixed frames or on trackers;
- Access roads: An estimated 14.5 km of access roads would be required between the individual solar arrays. Although the exact location of these within the proposed layout is unknown at this stage, the assessment assumes that these could be located anywhere within the proposed layout footprint; and
- Power line: Three alternative power line route options from the north-eastern corner of the site to the Hydra substation are proposed, with Option 1a being the proponent's preferred alternative.

In general the impacts associated with the operation phase are long-term, as the Power Purchase Agreement is valid for a period of 20 years, after which the Agreement can be renewed or the power plant decommissioned. The key negative impacts related to the operation phase include:

- *Loss of vegetation and possible change in species composition:* The Northern Upper Karoo vegetation found in the study area is widespread and is classified as Least Threatened. The impacts related to the clearing of an estimated 14 ha of vegetation within the development footprint and the possible change in species composition due to increased shading and reduced rainfall underneath the modules / solar arrays are considered to be **MEDIUM** significance with mitigation; and
- *Visual impact:* The area already has a number of existing visual intrusions in the rural landscape, particularly the numerous power lines that pass through the area and the Hydra substation. The existing visual clutter has increased the visual absorption capacity of the area. The visual impacts related to both the solar arrays and the power line are considered to be of **MEDIUM** significance with mitigation.

The key positive impacts related to the operation phase include:

- *Development of a clean, renewable energy facility:* South Africa currently relies on coal-powered energy to meet more than 90% of its energy needs. As a result South Africa is one of the highest per capita producers of carbon emissions in the world and Eskom, as an energy utility, has been identified as the world's second largest producer carbon emissions. Although the overall contribution of the proposed project is relatively small it would help to offset the total carbon emissions associated with energy generation in South Africa. This impact is considered to be of **MEDIUM (POSITIVE)** significance; and
- *Establishment of a Community Trust:* The establishment of a Community Trust funded by the proposed project could fund development initiatives in the area and support local and community development. The 20-year timeframe also allows local municipalities and communities to undertake long-term planning for the area. This impact is considered to be of **MEDIUM to HIGH (POSITIVE)** significance with mitigation.

The remaining negative impacts are considered to be **INSIGNIFICANT** or range from **VERY LOW to LOW-MEDIUM** significance with mitigation, while the positive impacts are considered to be of **LOW (POSITIVE)** significance. The significance ratings are associated, to a large extent, with the following:

- The relatively small scale of the project (i.e. 25 to 30 MW capacity covering an area of 75 to 80 ha);
- The disturbed nature of the site (including heritage resources, watercourses and vegetation);
- There are no unique or important faunal habitats found on site relative to the surrounding area; and
- No species of conservation concern (vegetation or fauna), except for the possible occurrence of the Ludwig's Bustard (listed as *Vulnerable* and *Endangered*), were found to or expected to occur on site.

The assessment summary provided above and in Table 6.1 relates to all alternatives (technologies, access roads and power lines), as well as slight changes to the indicative layout, provided the modules / solar arrays avoid the proposed freshwater buffers and the rocky outcrop areas. Although all power line alternatives are assessed to be of similar significance, Option 2 is the preferred alternative from an avifaunal perspective as it runs parallel to the existing power lines for a greater distance compared to Option 1 (the proponent's preferred alternative) and 1a.

6.1.4 CUMULATIVE IMPACT

De Aar has been identified as a Renewable Energy Hub. As a result, a number of photovoltaic power projects are proposed in the area, most of these being concentrated around the existing Hydra substation, south-east of the town. These projects, together with the proposed project, would have a cumulative impact on the biophysical and socio-economic environment. The cumulative impacts are discussed below and summarised in Table 6.2.

The cumulative impact on the vegetation, freshwater resources and groundwater are considered to range from **VERY LOW to LOW** significance with mitigation. All cumulative impacts on terrestrial fauna are considered to be of **LOW** significance, except the potential increase in bird strikes which is considered to be of **MEDIUM** significance. This rating is related to the additional power line infrastructure that would be installed and the potential increase in mortality of Ludwig's Bustard (listed as *Vulnerable* and *Endangered*), which is specifically vulnerable to power line collisions.

The key cumulative socio-economic impacts include:

- A reduction in carbon emissions via the use of renewable energy and associated benefits in terms of global warming and climate change is considered to be of **HIGH (POSITIVE)** significance;
- The visual impact associated with the projects on the areas sense of place and landscape character is considered to be of **MEDIUM to HIGH** significance;
- The influx of potential job seekers could have a **MEDIUM** significant impact on existing social networks and community structures;
- Although the cumulative impact associated with the creation of local employment (estimated to be in the order of 150 to 200 jobs) and business opportunities is considered to be **LOW (POSITIVE)** significance, it would go a long way to offsetting the negative socio-economic impacts, such as job losses, associated with the scaling down of the railway linked activities in De Aar over the last 10-15 years; and
- The establishment of Community Trusts, funded by revenue from these projects, provides an opportunity to generate a reliable and steady revenue stream over a 20-year period. This revenue could be used to fund development initiatives in the area and support the local economic and community development. This benefit is considered to be of **HIGH (POSITIVE)** significance.

The cumulative impact on heritage resources and the cultural landscape is considered to be of **MEDIUM** and **LOW** significance, respectively.

6.1.5 NO-GO ALTERNATIVE

The No-Go alternative relates to the option of not developing the proposed power plant and associated infrastructure (i.e. the Status Quo). If the proposed project is not developed, the current land use activities are assumed to continue in the long-term, including grazing and watering small game and livestock, and operating a small guest lodge, shooting range and a brickworks.

There would be no additional impacts on the vegetation, fauna, freshwater, groundwater and heritage resources on site provided that current management and farming practices remained as at present in terms of grazing intensity and carrying capacity. However, the no-go option would represent a lost opportunity for South Africa to supplement its current energy needs with clean, renewable energy given South Africa's position as one of the highest per capita producer of carbon emissions in the world. There would also be a lost opportunity in terms of the employment and business opportunities associated with the proposed project and the benefits associated with the establishment of a Community Trust. The no-go option would represent a negative social cost of **HIGH** significance.

6.1.6 RECOMMENDATION / OPINION OF ENVIRONMENTAL ASSESSMENT PRACTITIONER

The key principles of sustainability, including ecological integrity, equity and social justice, and economic efficiency, are integrated below as part of the supporting rationale for recommending an opinion on whether the proposed project should be approved.

- Ecological integrity

  The use of renewable energy (e.g. solar and wind) is considered to have significant ecological benefits. South Africa is among the top 20 emitters of greenhouse gases in the world, largely because of the economy's dependence on fossil fuels. The proposed photovoltaic power project, together with a number of others proposed in the area, would help to offset the total carbon emissions associated with energy generation in South Africa. Reduced carbon emissions through the use of renewable energy would have benefits in terms of global warming and climate change. In terms of site location, the proposed project is located in an area that has some of the highest solar radiation intensities in South Africa and is considered to be an efficient use of available resources.

  The proposed project would result in the clearing of an estimated 14 ha and the shading of a further approximately 50 ha of Northern Upper Karoo vegetation. However, in terms of positioning on site, the proposed layout has avoided the more sensitive rocky outcrop areas of the site and is located largely in the more disturbed areas. This vegetation type is widespread and classified as Least Threatened, and there are no unique or important faunal habitats found on site relative to the surrounding area. Although the localised impact on the vegetation is considered to be the most significant biophysical impact, it is deemed to be largely reversible at the end of the project when the power plant is decommissioned and the site rehabilitated. Mitigation has been proposed to further minimise the impact on the biophysical environment, e.g. freshwater buffers are proposed around the drainage channels on site.

  The proposed power line would add to the potential risk of bird strikes and electrocution, especially to the Ludwig's Bustard (listed as *Vulnerable* and *Endangered*). However, this impact is not considered to be a "new" impact in the area, due to the numerous existing power lines linking to the Hydra substation. This impact has been mitigated by locating the proposed power line parallel to the existing high voltage power lines on site as far as possible.

  In summary, the proposed project would result in the loss of some ecological integrity in the study area, but it is considered to be small and localised.

- Equity and social justice

  The landowner has entered into a 20-year lease agreement with the proponent and as such the loss of productive farmland would be offset by the income the farmer would receive from the lease agreement. The effect on the landowner would be further offset as it is the intention to allow small game and / or livestock to graze between the modules / solar arrays.

  The proposed project would create a number of local employment and business opportunities. These benefits to the local economy would extend over the operational lifespan of the proposed project. It is anticipated that a large number of the low and medium skilled employment opportunities could be sourced from the local labour force in and around De Aar with the implementation of a skills development and training programme, especially during the construction phase. In terms of business opportunities for local companies, procurement would create business opportunities for the regional and local economy. However, given the technical nature of and high import content associated with the proposed project, the opportunities for the local economy are likely to be limited. A percentage of

the monthly wage bill earned by permanent staff would be spent in the regional and local economy, which would benefit local businesses in De Aar (and possibility Britstown and Hanover).

No indigenous groups live on site and the proposed project would not impact any public resources or community access routes. The proposed abstraction and use of groundwater would not affect the water supply of De Aar or neighbouring farmers, which are entirely dependent on groundwater.

The proposed project would alter the local visual landscape / rural character of the site, which would have a visual impact in the immediate surrounding area and especially along the N10 national road. This impact is mitigated to a certain extent by the existing visual clutter in the rural landscape, which has increased the visual absorption capacity for the proposed project, as well as the proposed berm along the N10. The potential visual impact may in turn have an impact on tourism. This is, however, considered to be of similar significance to the potential benefit tourism may incur if De Aar becomes a Renewable Energy Hub with the anticipated attraction of visitors.

Thus, in terms of the issue of equity and social justice, the proposed project is considered to result in the equitable distribution of positive and negative impacts with no one group or community being adversely affected.

- Economic efficiency

  South Africa is facing a rising demand for power and is looking for other energy sources, including renewable energy, to decrease its dependence on the coal-fired power that provides most of the country's electricity. As such, renewable energy technologies are anticipated to play a key role in meeting South Africa's energy needs into the future. However, renewable energy sources are often criticised for being too costly, when compared with other technologies (e.g. coal). Solar energy is currently not considered to be entirely efficient as it has to be cross-subsidised by other generation means. This said, it is expected that in the long-term renewable energy will become more economically efficient as technologies develop (including the storage of electricity), technology costs decrease and the cost of other forms of electricity generation increase.

  The proposed project complements and supports a number of key local economic development and socio-economic initiatives. One of the key economic opportunities identified for the area is the establishment of De Aar as a Renewable Energy Hub. This is seen as a critical component to the revitalisation of both the broader District and the town of De Aar, as it would create significant economic opportunities for the area and go a long way to offsetting the negative socio-economic impacts associated with the downscaling of Transnet railway operations over the last 10 to 15 years.

  The proposed project is considered ideally located in order to link into the national grid, due to its close proximity to the existing Hydra substation. Locally, the establishment of the proposed project would strengthen the existing electricity grid for the area, providing power in a short space of time (potentially less than two years to commissioning).

From the above sustainability criteria, the nature and extent of the proposed development, compliance with the relevant legal, policy and planning documentation (i.e. "need and desirability") and the findings of the specialist studies, it is the opinion of CCA that the proposed De Aar Solar One Photovoltaic Power Project is supported from an environmental perspective and should be considered for Environmental Authorisation, subject to the implementation of the identified recommendations.

Table 6.1: Summary of the significance of the potential impacts associated with the proposed De Aar Solar One Photovoltaic Power Plant.

No.	Potential impact			Significance	
				Without mitigation	With mitigation
1. Construction phase					
1.1	Vegetation	1.1.1 Loss of vegetation		Assessed as part of 2.1 below.	
1.2	Fauna	1.2.1 Direct mortality		VL	**VL**
1.3	Freshwater	1.3.1 Disturbance and loss of freshwater habitat		L	**VL**
1.4	Groundwater	1.4.1 Abstraction		Insig-VL	**INSIG**
		1.4.2 Contamination		VL	**INSIG**
1.5	Socio-economic	1.5.1 Creation of employment and business opportunities		L (+ve)	**M (+VE)**
		1.5.2 Influx of job seekers		M	**L**
		1.5.3 Loss of farm labour		VL	**VL**
		1.5.4 Stock theft, poaching and damage to farm infrastructure		VL	**VL**
		1.5.5 Veld fires		M	**VL**
		1.5.6 Movement of construction vehicles		VL	**VL**
2. Operation phase					
2.1	Vegetation	2.1.1 Loss of vegetation		M	**M**
		2.1.2 Change of species composition		M	**M**
2.2	Fauna	2.2.1 Loss and alteration of faunal habitats		L	**L**
		2.2.2 Bird strikes and interactions		L-M	**L-M**
		2.2.3 Barrier effect		Insig.	**INSIG.**
2.3	Freshwater	2.3.1 Disturbance and loss of freshwater habitat		L	**VL**
		2.3.2 Flow modification		L	**VL**
		2.3.3 Runoff modification		L-M	**L**
2.4	Groundwater	2.4.1 Recharge		M	**INSIG-VL**
		2.4.2 Abstraction		Insig-VL	**INSIG**
		2.4.3 Contamination		M-H	**L**
2.5	Socio-economic	2.5.1 Development of a clean, renewable energy facility		M (+ve)	**M (+VE)**
		2.5.2 Creation of employment and business opportunities		L (+ve)	**L (+VE)**
		2.5.3 Influx of job seekers		M	**L**
		2.5.4 Visual impact / Sense of place	Solar arrays	M-H	**M**
			Power lines	M	**M**
			Buildings	L-M	**L-M**
		2.5.5 Tourism		L (-ve & +ve)	**L (-VE & +VE)**
		2.5.6 Civil aviation		VL	**VL**
		2.5.7 Establishment of a Community Trust		L (+ve)	**M-H (+VE)**
		2.5.8 Loss of grazing and increase risk of erosion		L	**L**
2.6	Heritage & cultural	2.6.1 Loss of heritage resources		M	**L**
		2.6.2 Cultural landscape		L-M	**L**
3. Decommissioning phase					
3.1	Socio-economic	3.1.1 Loss of jobs and business opportunities		L	**L (NEUTRAL)**
3.2	Heritage & cultural	3.2.1 Loss of heritage resources		L-M	**L**

VL – Very Low; L = Low; M = Medium; H = High; Insig= Insignificant All impacts are negative unless otherwise indicated

Table 6.2: Summary of the significance of the potential cumulative impacts associated with De Aar becoming a Renewable Energy Hub.

No.	Potential impact		Significance	
			Without mitigation	With mitigation
1. Construction phase				
1.1	Vegetation	1.1.1 Loss of vegetation	Assessed as part of 2.1 below.	
1.2	Fauna	1.2.1 Direct mortality	L	**L**
1.3	Freshwater	1.3.1 Disturbance and loss of freshwater habitat	L-M	**VL**
1.4	Groundwater	1.4.1 Abstraction	VL	**VL**
		1.4.2 Contamination	VL	**VL**
1.5	Socio-economic	1.5.1 Creation of employment and business opportunities	L (+ve)	**L (+VE)**
		1.5.2 Influx of job seekers	L	**L**
		1.5.3 Loss of farm labour	L	**L**
		1.5.4 Stock theft, poaching and damage to farm infrastructure	L	**L**
		1.5.5 Veld fires	Insig	**INSIG**
		1.5.6 Movement of construction vehicles	L	**L**
2. Operation phase				
2.1	Vegetation	2.1.1 Loss of vegetation	L	**L**
		2.1.2 Change of species composition	L	**L**
2.2	Fauna	2.2.1 Loss and alteration of faunal habitats	L	**L**
		2.2.2 Bird strikes and interactions	M	**M**
		2.2.3 Barrier effect	L	**L**
2.3	Freshwater	2.3.1 Disturbance and loss of freshwater habitat	L	**VL**
		2.3.2 Flow modification	L-M	**L**
		2.3.3 Runoff modification	L-M	**L**
2.4	Groundwater	2.4.1 Recharge	M	**INSIG-VL**
		2.4.2 Abstraction	VL	**VL**
		2.4.3 Contamination	H	**L**
2.5	Socio-economic	2.5.1 Development of a clean, renewable energy facility	H (+ve)	**H (+VE)**
		2.5.2 Creation of employment and business opportunities	L (+ve)	**L (+VE)**
		2.5.3 Influx of job seekers	M	**M**
		2.5.4 Visual impact / Sense of place	M-H	**M-H**
		2.5.5 Tourism	L (-ve & +ve)	**L (-VE & +VE)**
		2.5.6 Civil aviation	L	**L**
		2.5.7 Establishment of a Community Trust	H (+ve)	**H (+VE)**
		2.5.8 Loss of grazing and increase risk of erosion	L	**L**
2.6	Heritage & cultural	2.6.1 Loss of heritage resources	M-H	**L**
		2.6.2 Cultural landscape	M	**L**
3. Decommissioning phase				
3.1	Socio-economic	3.1.1 Loss of jobs and business opportunities	L	**L**
3.2	Heritage & cultural	3.2.1 Loss of heritage resources	M	**L**

VL – Very Low; L = Low; M = Medium; H = High; Insig= Insignificant All impacts are negative unless otherwise indicated

6.2 RECOMMENDATIONS

This section summarises the key mitigation measures recommended as part of the EIA.

6.2.1 GENERAL CONSIDERATIONS

- All phases of the proposed project (including construction, operational and decommissioning) must comply with the EMP presented in Appendix 6. This EMP includes the majority of the recommendations related to the construction and operation phases (some of which are listed below), as well other measures considered necessary to minimise the potential impacts on the environment.

6.2.2 KEY DESIGN CONSIDERATIONS

Layout considerations

- The final layout is to avoid the more sensitive rocky outcrop areas, as currently proposed.
- The proposed footprint of the modules / solar array, and associated operation activities, should remain, as far as possible, outside of the delineated freshwater buffers indicated in Figure 5.1.
- A set back (buffer) of at least 10 m (or as required by the municipal by law) from all farm boundaries must be included in the proposed layout design.
- The substation, maintenance and storage buildings should be clustered and located in low-lying areas, as proposed.

Groundwater abstraction, usage and contamination

- Groundwater tests (including drawdown tests and 48 hr constant discharge pumping tests) are to be undertaken on at least four existing boreholes in order to determine the exact borehole yields and the most appropriate pumping regime during construction and operation.
- The proposed septic tank and soak-away system must be sited at least 50 m from the nearest production borehole.
- Water-saving devices (e.g. dual flush toilets, waterless urinals, etc.) should be installed in the offices.
- Opportunities for the reuse and recycling of water during operation should be investigated.
- All components (e.g. inverters and transformer, chemical and fuel storage facilities, etc.) that have a potential to contaminate groundwater are to be established on low permeability, bunded surfaces.

Stormwater drainage

- All access roads must be designed to ensure that stormwater flow is not impeded. In this regard, culvert or pipes are to be sufficiently wide to accommodate and distribute the flow.
- The stormwater management plan must incorporate the following in order to manage stormwater before it leaves the site:
  - > All existing drainage channels are to be incorporated into the stormwater drainage system;
  - > Stormwater is to be, where possible, directed into natural vegetated areas;
  - > The stormwater drainage channel along the N10 and a portion of the existing dam (size to be determined by estimated stormwater volume for the developed site) in the north-western corner of the site are to be retained in the proposed buffer along the N10. The formalised drainage channel may need to be moved slightly to accommodate the proposed berm; and
  - > Overflow from the dam is to continue down the existing drainage channel and under the N10.

Fauna

- The solar arrays and mounting systems should, if possible, be designed to not create opportunities for birds to construct nests.

Aesthetics

- The proposed berm along the N10 must have a sinuous, undulating shape with variable heights to look as natural as possible. In addition, rocks from the construction areas could be placed on the berm to simulate the characteristic outcrops of the area and help to create faunal habitats.
- Detailed specifications for the berm and all screen planting must be prepared by a qualified landscape architect. Planting on the proposed berm should only use locally occurring species to blend with the surrounding landscape
- Cables should be located underground as far as possible.
- The design of the buildings should be compatible in scale and form with rural buildings in the area.
- All yards and storage areas should be enclosed by masonry walls.
- The colour of the solar array structures, such as the supports and the rear of the panels, should be in the dark grey or green range in order to minimise visibility and avoid reflectivity.
- Signage related to the development should be discrete and confined to the entrance gate/s. No other corporate or advertising signage and billboards is to be permitted, particularly along the N10.
- External lighting should be confined to the maintenance and storage areas. Lights should be low-level and fitted with reflectors to avoid light spillage.

6.2.3 KEY BIOPHYSICAL CONSIDERATIONS

- Multiple boreholes should be used for shorter durations during construction and operation in order to reduce the extent of the radius of influence.
- Disturbed areas are to be rehabilitated after construction with suitable indigenous plant species. A suitably experience rehabilitation / landscaping contractor should be appointed to compile a rehabilitation plan for those areas damaged by construction activities.
- The option of establishing an Environmental Rehabilitation Trust Fund to cover the costs of decommissioning and rehabilitation of disturbed areas should be investigated. The Trust Fund could be funded by a percentage of the revenue generated from the sale of energy over the 20-year operational life of the facility.
- An avifaunal monitoring programme is to be established for the first 12 months of operation in order to contribute to the research database. Details of the monitoring programme are included in the EMP.
- The establishment of invasive alien vegetation on site, particularly within the drainage channels, is to be monitored and removed on an ongoing basis.

6.2.4 KEY SOCIO-ECONOMIC CONSIDERATIONS

Employment and training

- Where reasonable and practical, a ‘locals first’ employment policy should be implemented, especially for semi- and low-skilled job categories, during the construction and operation phases. Details of the proposed employment policy are included in the EMP.
- Local contractors/sub-contractors with BEE criteria should be considered for appointment. A database of local companies which qualify as potential service providers should be developed prior to the commencement of the construction tender process. These companies should be notified of the tender process and invited to bid for project-related work.
- Training and skills development programmes for locals during the construction and operation phases should be implemented.

Transport

- The option of using rail to transport components and equipment to De Aar from Cape Town, Durban and Johannesburg should be investigated.

Establishment of a Community Trust

- Opportunities for establishing a Community Trust should be investigated, in consultation with the ELM. The following should be investigated and implemented:
  - > The criteria for identifying and funding community projects and initiatives in the area should be investigated. The criteria should be aimed at maximising the benefits for the community as a whole and not individuals within the community; and
  - > Strict financial management controls, including annual audits, should be implemented to ensure that the funds generated for the Community Trust from the proposed project are managed for benefit of the community as a whole.

Tourism

- The option of establishing a renewable energy interpretation centre at entrance to the site should be investigated. The centre should include a viewing area where passing visitors can stop and view the site.

6.2.5 KEY HERITAGE CONSIDERATIONS

- A basic heritage management plan must be implemented prior to and during construction. The specifics of this plan have been included in the EMP.

6.2.6 LICENCE AND PERMIT REQUIREMENTS

- Water use licence applications must be submitted to DWA (Northern Cape Regional Office) in order to:
  - > confirm the need for a Water Use Licence for altering the bed and banks of a watercourse (Water Use Activity 21i) for the access roads; and
  - > apply for the abstraction and use of groundwater during construction and operation.
- A sampling permit must be obtained from the South African Heritage Resources Agency (SAHRA) prior any sampling required as per the heritage management plan.
- A permit must be obtained from the relevant Provincial Authority for any abnormal loads (e.g. inverter buildings and transformers).

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