PROPOSED DEVELOPMENT OF A PHOTO-VOLTAIC SOLAR POWER GENERATION FACILITY ON PORTION 1 (REMAINING EXTENT) OF THE FARM KLEIN ZWART BAST 188 NEAR KENHARDT IN THE NORTHERN CAPE

For:

BioTherm Energy (Pty) Ltd

ENVIRONMENTAL IMPACT ASSESSMENT (EIA) REPORT

NEAS Reference: DEA/EIA/0000525/2011
DEA EIA reference number: 12/12/20/2430

September 2012

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DRAFT ENVIRONMENTAL IMPACT ASSESSMENT (EIA) REPORT: PROPOSED DEVELOPMENT OF A PHOTO-VOLTAIC SOLAR POWER GENERATION FACILITY ON PORTION 1 (REMAINING EXTENT) OF THE FARM KLEIN ZWART BAST 188 NEAR KENHARDT IN THE NORTHERN CAPE

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September 2012

DEA & LEGAL REQUIREMENTS FOR SOLAR ENERGY FACILITIES: INFORMATION LIST FOR EIA PROJECTS:

1. General Site Information		
No.	**Information**	**Reference/Provided**
1.1	Description of all affected farm portions	Section 2.5, & 7.1, Appendix 4
1.2	21 Digit Surveyor General Codes of all affected farm portions	Section 2.5
1.3	Copies of deeds of all affected farm portions	Appendix 4
1.4	Photos of areas that give a visual perspective of all parts of the site	Section 7.12, 9.3.7, Appendix 6 & 7.3
1.5	Photographs from sensitive visual receptors (Tourism routes, tourism facilities, etc.)	Section 7.12, 9.3.7 & Appendix 7.3
1.6	Solar plant design specifications including: • Type of technology • Structure height • Surface area to be covered (including associated infrastructure such as roads) • Structure orientation • Laydown area dimensions (Construction period and thereafter) • Generation capacity of the facility as a whole at delivery points	Section 3, 10, Appendix 1 as well Figure 10-1
2. Site maps and GIS information		
No.	**Information**	**Reference/Provided**
2.1	All maps/information layers must also be provided in ESRI Shapefile format	Contained in the CD version of this report
2.2	All affected farm portions must be indicated	Section 2.5, & 7.1, Appendix 1 & 4
2.3	The exact site of the application must be indicated (The areas that will be occupied by the application)	Figure 10-1 and Appendix 1
2.4	A status quo map/layer must be provided that includes the following: Current use of the land on site including:	Section 7.2 & Figure 7-2
	2.4.1 Building and other structures	Figure 7-1 & Figure 7-2
	2.4.2 Agricultural fields	N/A: None
	2.4.3 Grazing areas	Section 7.2 & Figure 7-2
	2.4.4 Natural vegetation areas (Natural veld not cultivated for the preceding 10 years) with an indication of the vegetation quality as well as fine scale mapping in respect of critical Biodiversity Areas and Ecological Support areas.	Section 7.7, 9.3.2, 9.3.6 & Appendix 7.1 and 7.2
	2.4.5 Critically endangered and endangered vegetation areas that occur on the site	None; please refer to Sections 7.7, 9.3.2& Appendix 7.1
	2.4.6 Bare areas which may be susceptible to soil erosion	Section 9.3.2, 9.3.6, Figure 10-1, and Appendix 1, 7.1 & 7.4

	2.4.7 Cultural historical sites and elements	Section 7.14, 9.3.5 and Appendix 7.4
	2.4.8 Rivers, streams and water courses	Section 7.9 & 9.3.4
	2.4.9 Ridgeline and 20m continuous contours with height references in the GIS database	Figure 7-8
	2.4.10 Fountains, boreholes, dams (in-stream as well as off- stream) and reservoirs	Section 7.9 & 9.3.4
	2.4.11 High potential agricultural areas as defined by the Department of Agriculture, Forestry & Fisheries	N/A the site does not fall within an area which has high agricultural potential as defined by DAFF. Located in a very arid region of southern Africa, refer to Section7.6, 9.3.6 and Appendix 7.4
	2.4.12 Buffer zones (also where it is dictated by elements outside the site): • 500m from any irrigated agricultural land • 1km from residential areas • Indicate isolated residential, tourism facilities on or within 1km of the site	No irrigated agricultural land occurs within 500 m of the site, there are no tourism facilities within close proximity to the facility. No residential area exist within 1km of the site
	2.4.13 A slope analysis map/layer that include the following slope ranges: • Less than 8% slope • Between 8% and 12% slope • Between 12% and 14% slope • Steeper than 18% slope	Section 7.4, Figure 7-5 & Figure 7-7
	2.4.14 A map/layer that indicate locations of birds and bats including roosting and foraging areas	N/A this was not identified as being a significant issue, and due to the nature of PV technology this is not considered to be of concern in this specific project. Please refer to section 7.8.2 & 9.3.2
2.5	A site development proposal map(s)/layer(s) that indicates:	Section 10, Figure 10-1 and Appendix 1 & 3
	2.5.1 Position of solar facility	
	2.5.2 Foundation footprint	
	2.5.3 Permanent laydown area footprint	
	2.5.4 Construction period laydown footprint	
	2.5.5 Internal road indicating width (construction period width and operation period width) and with numbered sections between the other site elements which they serve	
	2.5.6 River, stream and water crossing of roads and cables indicating the type of bridging structures that will be used	
	2.5.7 Substation(s) and transformer(s) sites including their entire footprint	
	2.5.8 Cable routes and trench dimensions (where they	

	are not along the internal roads)	
	2.5.10 Connection routes to the distribution/transmission network	
	2.5.11 Cut and fill areas along roads and at substation/ transformer sites indicating the expected volume of each cut and fill	
	2.5.12 Borrow pits	
	2.5.13 Spoil heaps (Temporary for topsoil & subsoil and permanently for excess material)	
	2.5.14 Buildings, including accommodation	

3. Regional map and GIS information

No.	Information	Reference/Provided
3.1	All maps/information layers must also be provided in ESRI Shape file format	Contained in the CD version of this report
3.2	The map/layer must cover an area of 20km around the site	Figure 7-1 & Figure 7-2
3.3	Indicate the following: • Roads including their types (tarred or gravel) • Railway lines and stations • Industrial areas • Harbours and airports • Electricity transmission and distribution lines and substations • Pipelines • Water sources to be utilized during construction and operational phases • Critical Biodiversity areas and Ecological Support area • Critically Endangered and endangered vegetation areas/agricultural fields • Irrigated areas • An indication of new roads or changes and upgrades that must be done to existing roads in order to get equipment onto the site, including cut and fill areas and crossings of rivers and streams	Figure 10-1, read in conjunction with Section 7 and Appendices 7.1 – 7.6.

The following amendments and additional information are required for the EIR (DEA FSR Acceptance Letter, 21/08/2012):

No.	Information	Reference/Provided
a)	Details of the future plans for the site and infrastructure after decommissioning in 20-30 years and the possibility of upgrading the proposed infrastructure to more advanced technologies.	Section 3.2.3 & 9.3 as well Appendix 8 (EMPR)
b)	The total footprint of the proposed development should be indicated. Exact locations of the solar energy facility, and associated infrastructure should be mapped at an appropriate scale.	Section 10, Figure 10-1 and Appendix 1
c)	Also, it must be clearly indicated into **how many phases the project** will be developed, with how much generation capacity and footprint per phase.	Section 1, 2.1, 10, 10, 2.1 & 3
d)	Should a Water Use License be required, proof of application for a license needs to be submitted.	Please refer to section 3.2.4 & Appendix 3. Please note that it has been determined that there is no requirement for the submission of a WULA from the DWA or DoE for solar PV projects in the bidding phase of the IPP bidding process.
e)	Possible impacts and effects of the development on the vegetation ecology with regard to lowland-highland interface in the locality should be indicated.	Section 9.3.2 and Appendix 7.1
f)	The impacts of the proposed facility on avifauna and bats must be assessed in the E IA phase.	Not identified as being a significant issue – Refer to section 7.8.2 & 9.3.2
g)	Possible impacts and effects of the development on the surrounding industrial area.	N/A, there is no industrial activities in close proximity to the site.
h)	The EIR should include information on the following: • Environmental costs VS benefits of the solar energy facility activity; and • Economic viability of the facility to the surrounding area and how the local community will benefit.	Section 2.7, 7.16 & 9.3.9
i)	Information on services required on the site, e.g. sewage, refuse removal, water and electricity. Who will supply these services and has an agreement and confirmation of capacity been obtained?	Section 3.2.4. an expansion application will be made on existing agreements with eh municipality.
j)	A construction and operational phase EMP to include mitigation and monitoring measures.	Appendix 8
k)	Should blasting be required, appropriate mitigation measures should be provided.	N/A – no blasting would be required during the construction or operation phase of the development
l)	A copy of the **final** site layout plan. Existing	Appendix 1, Section 10 and

	infrastructure must be used as far as possible e.g. roads. The layout plan must indicate the following: • Solar energy facility and its associated infrastructure; • Foundation footprint; • Internal roads indicating width (construction period width and operation period width) and with numbered sections between the other site elements which they serve (to make commenting on sections possible); . • All existing infrastructure on the site, especially roads; • Environmental sensitive features and buffer areas. • Buildings, including accommodation; and • All "no-go" areas.	Figure 10-1
m)	An environmental sensitivity map indicating environmental sensitive areas and features identified during the EIA process.	Figure 9-2
n)	A map combining the final layout plan superimposed (overlain) on the environmental sensitivity map.	Figure 10-1 & Appendix 1

1. EXECUTIVE SUMMARY

BioTherm Energy (Pty) Ltd is proposing to develop a commercial photo-voltaic (PV) solar power facility on Portion 1 (remaining extent) of the farm Klein Zwart Bast No. 188 approximately 42 km's south-west of the town of Kenhardt in the Northern Cape Province. The proposed development will be referred to as the Aries II PV Solar Energy Facility, relating to the Eskom Aries Substation located adjacent to the site. A 10 MW facility is located within the area assessed as part of the environmental assessment (DEA Ref: 12/12/20/2098/2).

The proposed project would entail the development of a Photo-voltaic (PV) solar power plant up to 194 hectares in extent with a generation capacity of +/- 100 MW, covering the entire feasible area. The final capacity would be dependent on the continuing development of photovoltaic technologies, as more efficient modules may become available by the time that the project would begin construction. The envisaged generation capacity is, however, expected to range between 75 – 100 MW. The development footprint can however not exceed 194 hectares; however the generation capacity may vary based on the availability of more efficient PV panels. The IPP Procurement programme currently allows for a maximum export capacity of 75MW for solar PV projects that are being entered into the Department of Energy's REIPP programme. . However, the available generation capacity allocation will determine if the site is to be developed in phases as a reduction the maximum allocation will allow several smaller plants to be constructed.

The proposed project would include several, Listed Activities, which may not commence prior to obtaining an Environmental Authorisation in terms of Section 24 of the National Environmental Management Act, 1998 (Act No. 107 of 1998)[NEMA]. An application for Environmental Authorisation, in terms of NEMA, for activities listed in Government Notices R.544 R.545 and R546 of 18 June 2010, was submitted to the Competent Authority (CA), the national Department of environmental Affairs (DEA), on 17 November 2011. The application was acknowledged on 23 November 2011(Appendix 2), and issued with the project reference number **12/12/20/2430**.

The EIA was commissioned to determine the available area for construction of the PV facility, taking all environmental aspects into consideration. A site layout plan integrating all the relative specialist assessments was developed (Appendix 1). The plan identifies areas on the site that are considered to be "no go" areas, where no development should occur. Furthermore, feasible areas within the assessment location were identified. Ultimately, 194 hectares of the 425 hectares assessed have been proposed for authorisation. This area can accommodate approximately 100 MW of electricity for delivery into the national electrical grid.

The Environmental Impact Report presented a comprehensive assessment of the anticipated environmental impacts over the full life-cycle of the proposed Aries II PV facility on Portion 1 (remaining extent) of the farm Klein Zwart Bast 188. Table 1-1 contains a summary of the environmental impact assessment significance rating. The project could potentially result in direct and indirect negative impacts of significance in the absence of appropriate environmental management solutions. The environmental assessment practitioner (EAPs) however, believes that appropriate/ feasible mitigations are readily available to the proponent that would effectively reduce the significance of any potentially negative impacts to within acceptable levels. These impacts and the mitigation measures that were assessed as part of the detailed Environmental assessment report (EIR)

have been incorporated into this draft EMPr (Appendix 8). This draft EMPr, once approved by the DEA, will be the Aries II PV Solar Energy Facility's formal plan to manage the development and associated environment in an appropriate and responsible manner.

Renewable power generation has various social and environmental advantages such as:

- Clean form of energy compared to conventional coal firing methods. PV power generation does not emit any harmful pollutants to the atmosphere.
- The project has global significance as it reduces carbon dioxide released into the atmosphere
- Local communities' skills development, employment creation as well as capacity building benefits gets created by the proposed development in an area of South Africa with limited economic development opportunities

Table 1-1: Tabular Summary of Impact Assessment

Aspect	Impact Significance (No mitigation)	Impact Significance (mitigation)
Construction & Operation		
Fauna & Flora	Moderate (-)	Low (-)
Waste Generation	Low (-)	Low (-)
Ground/Surface water Quality	Low (-)	Moderate (-)
Surface Water Runoff (During construction & Operation	Low (-)	Negligible (-)
Heritage	Low (-)	Negligible (-)
Soil & Agricultural Potential		
• Impacts on current land capability/land-use	Negligible (-)	Negligible (-)
• impacts in respect of potential for alternative land-use	Negligible (-)	Negligible (-)
Visual	Moderate (-)	Moderate (-)
Traffic	Negligible (-)	Negligible (-)
Socio Economic	Negligible (-)	Negligible (-)
• Negative impacts on Socio Economics (mainly during Construction)	Low (-)	Moderate (-)
• Positive Impact on Socio Economic	Moderate (+)	Moderate (+)

It is the EAP's opinion that the EIA process to date has been undertaken in an independent, scientifically correct manner, and in compliance with the requirements of applicable legislation. It is, therefore, recommended that the EIA Report be accepted by the Department of Environment Affairs (DEA). Furthermore, it is the EAP's opinion that the positive project impacts are deemed significant, and the negative project impacts can be mitigated to the extent that no significant, or residual, environmental damage will result from project approval. Therefore, it is recommended that the application for Environmental Authorisation be viewed favourably by the Competent Authority, provided that the proposed mitigation and conditions put forward in the EIA and associated EMPr are adhered to and made legally binding to the proponent (i.e. The Project Company).

The draft Environmental Impact Assessment Report (EIR) is being made available to registered Interested and Affected Parties and other stakeholders for review and comment from 28 September 2012 to 7 November 2012. The availability of the draft EIR has also been advertised in a local newspaper (Refer to Section 6).

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ABBREVIATIONS

AAA:	Astronomy Advantage Areas
AM:	After Mitigation
AIA:	Archaeological Impact Assessment
BAT:	Best Available Technique
BEP:	Best Environmental Practice
BID:	Background Information Document
BM:	Before Mitigation
BPEO:	Best Practicable Environmental Option
BioTherm:	BioTherm Energy (Pty) Ltd
CARA	Conservation of Agricultural Resources Act
CER	Certified Emission Reduction
DAFF:	Department of Agriculture, Forestry and Fisheries
DEA:	Department of Environmental Affairs
DoE	Department of Energy
DWA:	Department of Water Affairs
EAP:	Environmental Assessment Practitioner
ECO:	Environmental Control Officer
EIA:	Environmental Impact Assessment
EIR	Environmental Impact Report
EMPr:	Environmental Management Programme Report
HIA:	Heritage Impact Assessment
IAPs:	Interested and Affected Parties
IDP:	Integrated Development Plan
IPP:	Independent Power Producer
IRP:	Integrated Resource Plan
LED	Local Economic Development
NCDENC	Northern Cape Department of Environment and Nature Conservation
NEMA:	National Environmental Management Act, No. 107 of 1998
NEMA EIA Regulations:	Regulations GN R.543, R.544, 545 and R.546 (18 June 2010), as amended. promulgated in terms of Section 24(5) read with Section 44, and Sections 24 and 24D of the National Environmental Management Act, 1998
NHRA:	National Heritage Resources Act
NWA:	National Water Act (Act No. 36 of 1998)
PES	Present Ecological State
PoSEIA:	Plan of Study for EIA
PPP:	Public Participation Process
RDL:	Red Data Listed
SAHRA:	South African heritage resource Agency
SANBI:	South African National Biodiversity Institute
SKA:	Square Kilometre Array
SR:	Scoping Report
TOPS:	Threatened Or Protected Species
VIA:	Visual Impact Assessment

2. INTRODUCTION

2.1. BACKGROUND

BioTherm Energy (Pty) Ltd is proposing to develop a commercial photo-voltaic (PV) solar power facility on Portion 1 (remaining extent) of the farm Klein Zwart Bast No. 188 approximately 42 km's south-west of the town of Kenhardt in the Northern Cape Province. The proposed development will be referred to as the Aries II PV Solar Energy Facility, relating to the Eskom Aries Substation located adjacent to the site. A 10 MW facility is located within the area assessed as part of the environmental assessment (DEA Ref: 12/12/20/2098/2).

As one can see from the national solar radiation map (Figure 2-1), the levels of solar radiation in the north-western extent of the Northern Cape are very high (>8001 MJ/m^2/annum). This potential for electricity generation via renewable energy source is significant. The site is located in an area of South Africa very suitable for PV solar power generation.

The proposed project would entail the development of a Photo-voltaic (PV) solar power plant up to 194 hectares in extent with a generation capacity of +/- 100 MW, covering the entire feasible area. The final capacity would be dependent on the continuing development of photovoltaic technologies, as more efficient modules may become available by the time that the project would begin construction. The envisaged generation capacity is, however, expected to range between 75 – 100 MW. The development footprint can however not exceed 194 hectares; however the generation capacity may vary based on the availability of more efficient PV panels. The IPP Procurement programme currently allows for a maximum export capacity of 75MW for solar PV projects that are being entered into the Department of Energy's REIPP programme. . However, the available generation capacity allocation will determine if the site is to be developed in phases as a reduction the maximum allocation will allow several smaller plants to be constructed.

The IPP Procurement programme currently allows for a maximum export capacity of 75MW for solar PV projects. However, the available allocation will determine if the site is to be developed in phases as a reduction the maximum allocation will allow several smaller plants to be constructed. Maximum Export Capacity (MEC) is by definition the contracted maximum export value (in MW) of an entire generation station in accordance with the generator's connection agreement. On the other hand generation capacity by definition is the maximum output (MW) that generating equipment can supply to system load

The Environmental Impact Assessment (EIA) is considered one of the early steps in evaluating the feasibility of a project of this scale. EScience Associates (ESA) has been appointed by BioTherm Energy (Pty) Ltd as independent Environmental Assessment Practitioners (EAPs) to conduct the scientific investigations of the EIA, and to facilitate the associated legal and administrative processes on their behalf. The main aim of the EIA is to assess the significance of potential environmental and socio-economic impacts, and to provide this information to the public and relevant Government Authorities who are responsible for making decisions on the environmental approvals that the project would require before it may commence. The key Competent Authority (CA) responsible in this case is the National Department of Environmental Affairs (DEA).

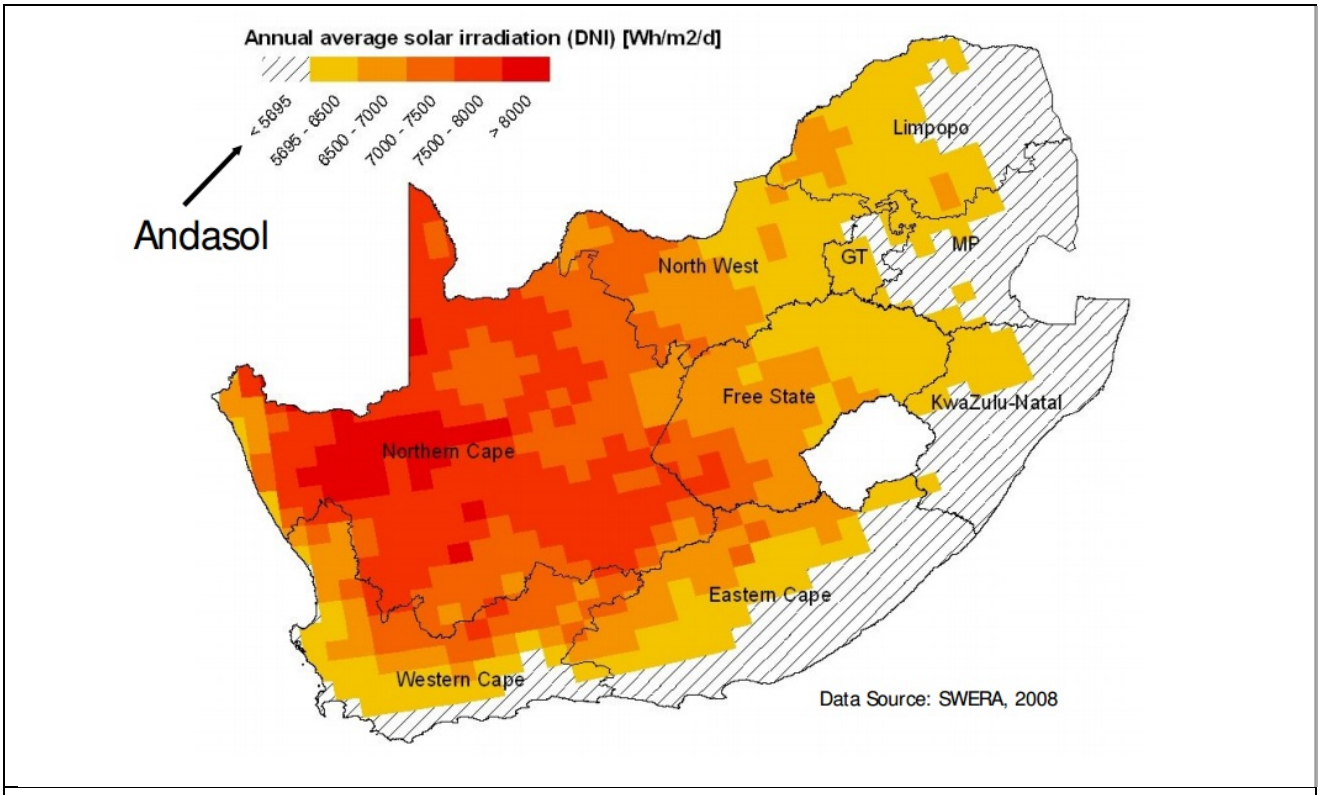


Figure 2-1: Annual Solar Radiation map (Source: SWERA, 2008)

The proposed project would include several, Listed Activities, which may not commence prior to obtaining an Environmental Authorisation in terms of Section 24 of the National Environmental Management Act, 1998 (Act No. 107 of 1998)[NEMA]. An application for Environmental Authorisation, in terms of NEMA, for activities listed in Government Notices R.544 R.545 and R546 of 18 June 2010, was submitted to the Competent Authority (CA), the national Department of environmental Affairs (DEA), on 17 November 2011. The application was acknowledged on 23 November 2011(Appendix 2), and issued with the project reference number **12/12/20/2430**.

Due to the nature and/or scale of some of the activities that would be associated with the proposed project, NEMA requires that the potential environmental impacts must be considered, investigated, assessed and reported on to the CA through a Scoping and detailed Environmental Impact Assessment process, described in Regulations 26–35 of Government Notice R.543 (the so-called NEMA EIA 2010 amendment Regulations), promulgated in terms of Section 24(5) of NEMA. The nature and extent of the solar facility as well the significance of potential environmental impacts associated with the proposed development (Construction, Operation and Decommissioning Phases) are reported in the Environmental Impact Report (EIR).

The site investigated for the proposed PV power plant has been selected for, amongst other reasons, its proximity to an existing electrical substation, its location in terms of annual average direct irradiation and its topography. Figure 2-2 below shows (in shaded black) the ideal position of solar power plants in the Northern Cape, taking into consideration annual average direct normal irradiation > 7.0 kWh/m^2/d, slope < 1%, distance to high-voltage transmission lines < 20 km, and absence of environmentally sensitive areas. The proposed site is indicated by the red dot on the map.

Although the map below indicates potential suitability for the installation of large concentrating solar thermal power plants (a different type of solar power generation technology than the proposed PV technology, the information can be applied to PV

Power Plants, and the site for the proposed photovoltaic solar power plant is accordingly considered to be in an ideal position to take advantage of the required environmental conditions for sustainable renewable electricity generation. The EIA-process does however recognize the site specific nature of environmental aspects, and following on from the regional scale information as indicated in the map, a site-specific EIA was conducted.

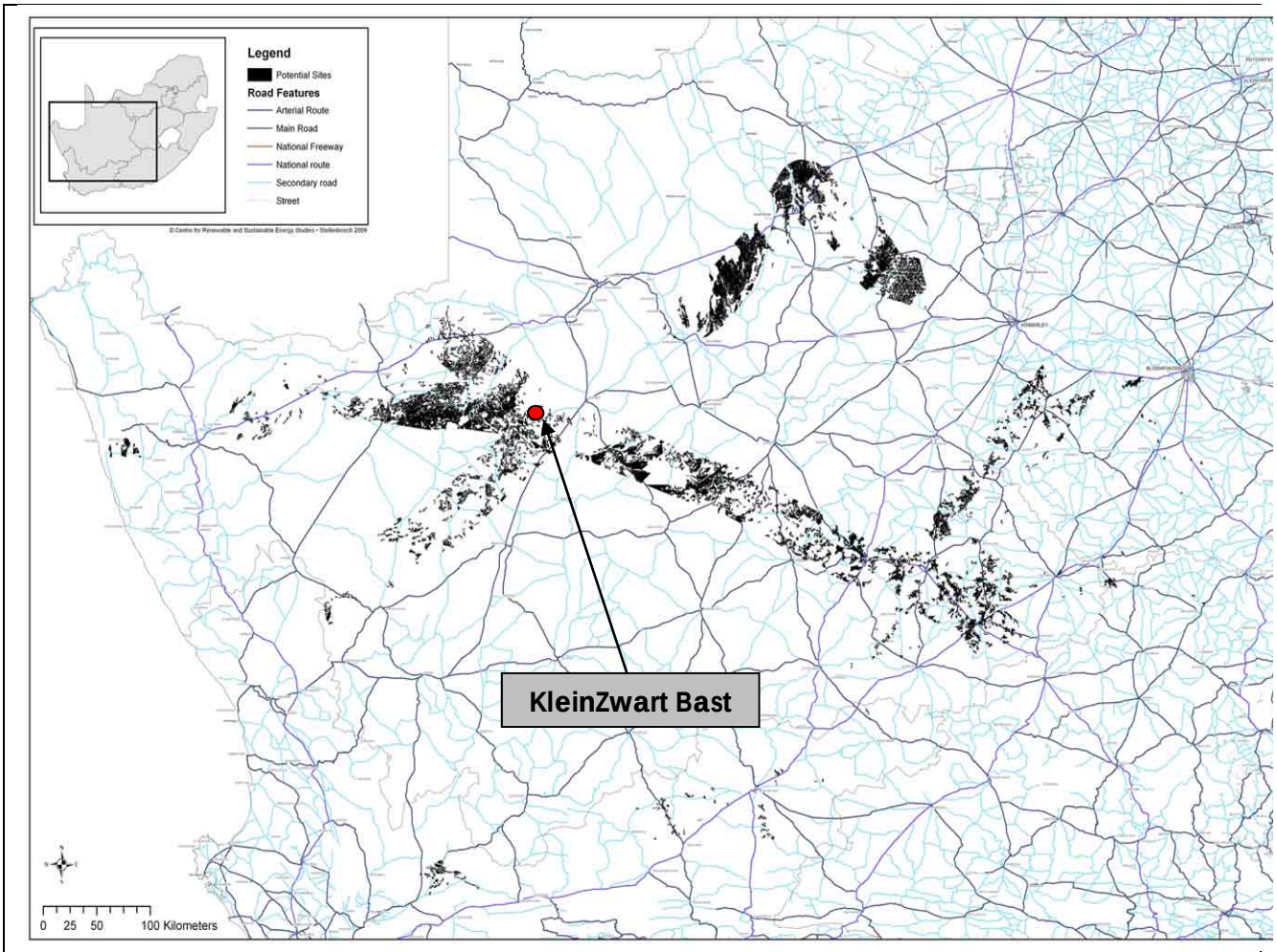


Figure 2-2: Map of South Africa indicating potentially suitable areas large concentrating solar power plants (Source: http://www.crses.sun.ac.za/html/solar.htm)

2.2. WHAT IS AN EIA?

An Environmental Impact Assessment (EIA) is a methodical and systematic process to identify potential positive and negative impacts on the bio-physical, socio-economic and /or cultural environment that may result from an activity (i.e. establishment and operation of a PV Solar power generation facility). The minimum requirements for EIA practice in South Africa are largely prescribed in Regulations (GN. R. 543 of 18 June 2010) under the National Environmental Management Act (Act N0. 107 of 1998)[NEMA]. The 2010 NEMA EIA Regulations lay out clear enviro-legal administrative requirements for EIA process, public participation (stakeholder engagement) and reporting alike.

An EIA in South Africa is predominantly undertaken in response to, and within the bounds of, a well-defined and robust legal environmental framework (Aucamp, 2010). A myriad of 'environmental' Acts, Regulations, Policies and Guidelines have relevance in this regard (refer to Section 4), all of which aim at giving effect to the fundamental environmental rights enshrined upon all South African Citizens within section 24 of the constitution, 1996 (Act No. 108 of 1996)(Fugle and Rabie, 2009).

The EIA aims to ensure effective compliance and governance concerning the sustainable use of environmental resources, while simultaneously focusing on key issues such as stakeholder empowerment, and providing access to relevant and concise information to enable informed decision-making by competent authorities exercising a regulatory role in any aspect of the project. The EIA process is also used to examine alternatives and management measures to minimise negative and optimise positive impacts resulting from a project, or activity. The ultimate objectives of the EIA process are to prevent significant detrimental impact on the environment and to ensure sustainable development into the future.

An EIA should not aim to stop, hinder or obstruct development, but should rather act as a 'green-filter' to development proposals, that seeks to ensure that developments/activities proceed in an environmentally acceptable and sustainable manner (unless of course significant impact may result from an activity that truly renders the undertaking of that activity 'fatally flawed').

The EIA has to consider the different perspectives and requirements of all role players, who derive different benefits from participating in the EIA process. These include the following:

- Decision-making Authorities:
  - Enables informed decision-making;
  - Ensuring protection of environmental quality;
  - Supporting the management, monitoring and sustainable utilisation of resources; and
  - Understanding demands on bulk services, waste disposal sites, etc.

- Project Proponents:
  - Pro-actively considering environmentally sustainable design and management principles in all that they undertake;
  - Investigating natural resource opportunities and constraints;
  - Identifying the risks and opportunities associated with environmental and operational aspects;
  - Evaluating the potential for pollution and the prevention thereof; and
  - Optimising energy, water and other resource use.

- Interested and affected parties (IAPs):
  - Providing an opportunity to be informed and give comment / express concerns;
  - Protecting environmental rights;
  - Utilising local and indigenous knowledge;
  - Increasing knowledge and environmental awareness; and
  - Informing the decision-making process.

2.3. PURPOSE OF THE ENVIRONMENTAL IMPACT REPORT

This section of the report gives a brief background of the purpose of the Environmental Impact report (EIR) as there is more often than not, misinterpretation between the Scoping phase and the Environmental Impact Assessment phase of the EIA process. The Scoping and Environmental Impact Assessment (EIA) process flow diagram is presented in Figure 2-3.

This section of the report gives a brief background of the purpose of the Environmental Impact report (EIR) as there is more often than not misinterpretation between the Scoping phase and the Environmental Impact Assessment phase of the EIA process. The Scoping

and Environmental Impact Assessment (EIA) process flow diagram is presented in Figure 2-3.

The EIA process is divided into two main phases: Scoping and EIA. Scoping is a critical stage of any EIA process, and it is the initial step in involving interested and affected parties (IAPs) in environmental considerations for all stages of planning and development processes. Scoping involves the identification of various priority issues from a broad range of issues that should be addressed in the EIA, therefore scoping is the first critical step in compiling an EIA. Its main purpose is to identify the most important and significant issues that must be further investigated as part of the EIA and exclude issues that are of no concern; it therefore focuses the assessment on key issues.

Scoping focuses the EIA process on significant issues and always involves participation by interested and affected parties (government, the public, proponent and industries) in order to help identify key issues of concern. It gives IAPs an opportunity to participate in planning decisions of the development.

The above scoping process resulted in producing a final Scoping Report and plan of study for EIA (PoSEIA) for the competent authority. The final Scoping Report and PoSEIA on were approved on 21 August 2012 by the DEA, and the detailed visual, heritage, soil and biodiversity studies were undertaken and finalised as well as made available for stakeholder review, together with this draft EIA Report and draft Environmental Management Plan (EMPr) (See Appendix 8).

This EIR therefore includes the investigation undertaken as outlined in the Scoping Report and the PoSEIA. All the relevant aspects identified in the scoping process have been investigated and assessed in detail (see Section 9 of the EIR) to determine the significance of each potential identified impact and accordingly apply relevant mitigation measures. These mitigation measures will ensure that impacts likely to occur are reduced/ eliminated as to protect the integrity of the receiving environment.

The Environmental Impact Assessment phase of the EIA process (See Figure 2-3) therefore assesses the impact of all significant impacts and alternatives on the environment in order to propose adequate mitigation measures (Aucamp, 2009).

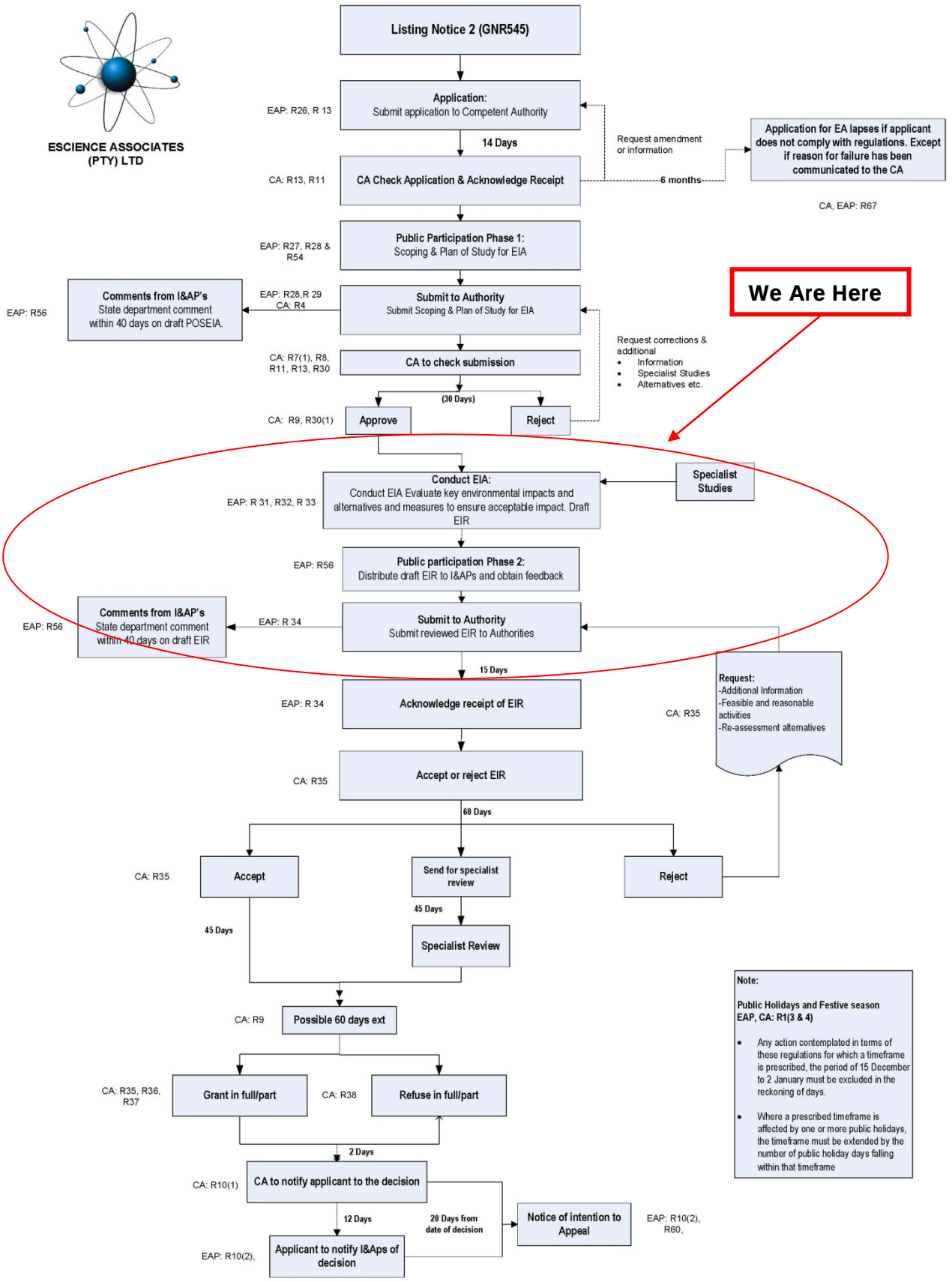


Figure 2-3: Scoping & EIA Process as prescribed by the NEMA 2010 EIA regulations (ESA, 2012)

2.4. DETAILS OF ENVIRONMENTAL ASSESSMENT PRACTITIONERS (EAP)

The Environmental assessment for this application was undertaken by EScience Associates (Pty) Ltd. (ESA), as independent Environmental Assessment Practitioners (EAP's) to Biotherm Energy (Pty) Ltd. The Environmental Impact Assessment study team was led by Mr Hanre Crous, senior environmental scientist with more than 13 years' experience in environmental management, with Roelof Letter in the EIA project management role (see Appendix 9 for relevant CVs).

Table 2-1: Details of the EAPs

Name	***Qualification***
Hanre Crous	MSc Zoology
Roelof Letter	BSc (Hons) Environmental Management

2.4.1. LIST OF SPECIALISTS AND SPECIALIST STUDIES UNDERTAKEN AS PART OF THIS EIA

A brief list of specialists and specialist studies which were undertaken are shown in Table 2-2 below:

Table 2-2: List of Specialists and Specialist Studies

	Specialist Study	***Specialists***
1	Environmental Legal Review	Hanre Crous and Roelof Letter (ESA)
2	Biodiversity / Ecological impact assessment	Simon Todd, Simon Todd Consultancy
3	Archaeology and Heritage Impact assessment	Mr Anton Pelser (Archaetnos Consultants)
4	Desktop Paleontological assessment	Bruce Rubidge; University of the Witwatersrand.
5	Visual Impact Assessment / GIS / 3-D visualizations	Emmanuel Tshuma (ESA) and Kotie Geldenhuys (Propaganda Studios)
6	Soil Impact Assessment	Bradley Thorpe and Roelof Letter (ESA) in consultation with Prof. A. Claassens (Soil science and plant nutrition consultant)
7	Cumulative impact assessment	Hanre Crous and Roelof Letter (ESA)
8	Environmental reporting, public participation, project management	Roelof Letter & Hanre Crous (ESA)

2.5. LAND, LANDOWNER DETAILS AND SURFACE RIGHTS

The EIA was undertaken on Portion 1 (remaining extent) of the farm Klein Zwart Bast 188 in the Northern Cape approximately 42 km south west from Kenhardt on the gravel road off the R27 main tar road between Kenhardt and Brandvlei. Figure 2-4 indicates the area within portion 1 (Remaining extent) of the farm Klein Zwart Bast 188 which was identified as a potential location of the solar facility and that was assessed in detail as part of the Environmental Impact Assessment process. The delineated study area is approximately 415 hectares (see Figure 2-3).

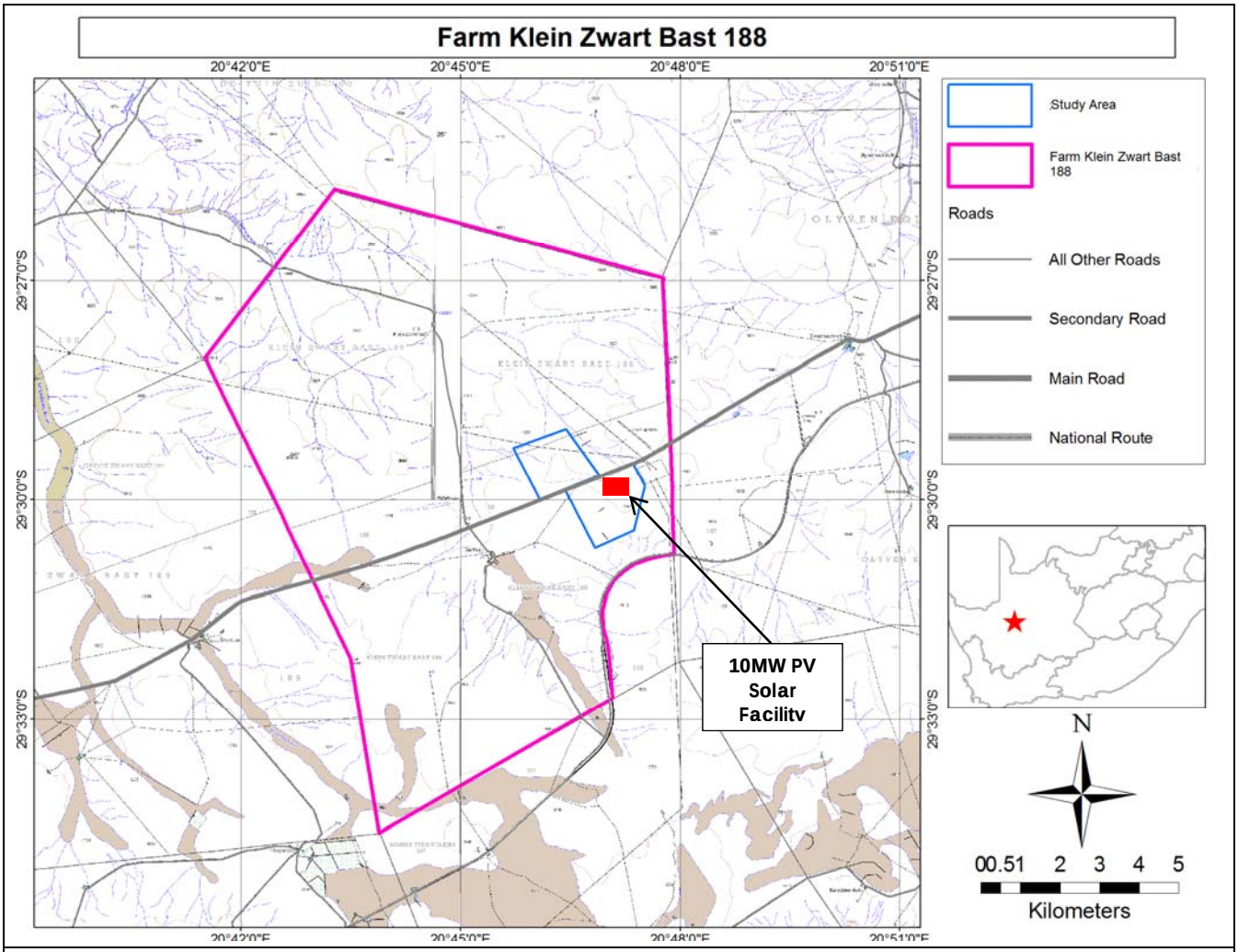


Figure 2-4: Topographical locality map of KleinZwart Bast farm

The Biotherm (Pty) Ltd is not the owner of the property, but they have entered into a lease agreement with the owners (Trustees of the Heytor Trust), together with an option to purchase the land in the future. It should also be noted that a portion of the study area has already received Environmental Authorisation from the Department of Environmental Affairs for the development of a 10 MW PV facility of less than 20 hectares (27 -06 -2012 & Appendix 2). The proposed solar facility will be developed adjacent to the currently authorised facility, increasing the generation capacity to approximately 100 MW.. Figure 2-4 indicates the study area as well as the area demarcated for the development of the 10 MW PV solar facility.

Table 2-3: Details of the farm KleinZwart Bast

Farm Portion	Owner/ contact person
KleinZwart Bast No. 188, portion 1 (Remaining extent) approximately 42 km south westerly of Kenhardt in Northern Cape.	Trustees for the time being of the Heytor Trust and Ohna de Bruin

Table 2-4: Surveyor General 21 digit codes for portion 1 (Remaining extent) of the farm Klein Zwart Bast 188 included in the EIA process:

C	O	3	6	0	0	0	0	0	0	0	0	0	1	8	8	0	0	0	0	0

Table 2-5: Municipality and regional details	
District Municipality:	Siyanda District Municipality
Local Municipality (LM):	Kai !Garib Local Municipality
Nearest town/city:	Kenhardt

2.6. THE PROPONENT (APPLICANT)

BioTherm Energy (Pty) Ltd (BioTherm) is one of South Africa's leading renewable energy developers. As one of South Africa's first Independent Power Producers (IPP), BioTherm has embarked on delivering clean, renewable energy to South Africa with a series of wind and solar farms in the Western and Northern Cape provinces and has received preferred bidder status for two round one projects.

BioTherm was founded in 2003 and its business was initially focused on developing waste gas and heat cogeneration projects. In October 2007, BioTherm commissioned a 4.2 megawatt biogas project at the PetroSA refinery in Mossel Bay, Western Cape, which was the first non-recourse project-financed independent power producer transaction completed in South Africa. Further, BioTherm is currently engaged in the commissioning of an anaerobic digester at Kanhym, the largest piggery in Africa.

As a proudly South African Company, BioTherm is a strong advocate for attaining the national goals of increasing the extent of renewable energy use in the country, not just as an energy source but as an integral part of the economic, environmental and social aims of the country. BioTherm has strong Broad Based Black Economic Empowerment (B-BBEE) partners, who are actively participating in the development of their projects.

BioTherm was one of the successful bidders in Round 1 of the IPP Programme and was selected as preferred bidder on two solar projects (one being the 10 MW plant located at the site under review in this report) and one wind project. These projects are being prepared for financial close with construction expected to start before the end of the year.

Renewable energy has enormous potential to meet the needs of South Africa's growing economy, creating employment opportunities and new industries. BioTherm has the unique ability to fully develop renewable energy projects in-house, with experts in site development, wind and solar resource measurement and analysis, turbine selection, carbon reduction, construction and maintenance.

2.7. PROJECT MOTIVATION, NEEDS AND DESIRABILITY

The proposed activity would entail the construction of a solar power (Photovoltaic) generation facility. With populations in South Africa growing rapidly, and the need for "green" energy (such as wind and solar power) becoming more prevalent, the project aims to provide a sustainable, renewable energy resource for present and future generations. The positive aspects of using solar power far outweigh the negative compared with conventional power generation utilising fossil fuels. The proposed site will aid the new renewable generation capacity of the national grid and contribute to the 42% share targeted by the Department of Energy for renewable energy (Integrated Resource Plan, 2010-2030). According to the strategy, 8.4 GW of new generation capacity in South Africa is proposed to be obtained from PV solar sources over the next twenty years.

A target of 10,000 GWh of renewable energy was set by the South African government for 2013, due to the high level of renewable energy potential in the country. In order to contribute towards achieving this target, to initiate the renewable energy industry in South Africa, and promote socio-economic and environmentally sustainable growth, a market mechanism needed to be established. The Independent Power Producer (IPP) Procurement Programme was introduced in 2011 for the procurement of renewable energy projects. A maximum tariff was set for each technology and developers would bid for projects and compete on a competitive price basis to obtain approval of projects from the Department of Energy.

The IPP Procurement Programme promotes the Government's 10,000 GWh 2013 Renewable Energy Target and also encourages competitive markets in long term sustained growth of renewables in comparison with conventional power generation. South African electricity generation from renewable energy offers various socio-economic and environmental benefits, including:

- Increased energy security: The current electricity crisis outlines the need for more sustainable sources of electricity generations as the number of consumers increases. A grid connection with renewable energy acts as an alternative source of electricity as traditional sources become strained and more expensive.
- Resource savings: Water and natural resources can be saved by using solar technologies as conventional coal-fired power plants are major consumers of valuable natural resources.
- Pollution reduction: Major by-products of fossil fuel burning such as nitrogen, oxides and sulphur have a detrimental impact on human health though the formation of smog and cause the spread of respiratory illnesses. PV solar generation transforms solar radiation directly into electrical energy and therefore no toxic pollutants are emitted.
- Employment creation: The development, scale, installation, management and maintenance of solar facilities have significant potential for job creation in South Africa.

The activity will provide local communities in the Kai !Garib Local Municipality area with several benefits including job creation, socio-economic development and infrastructural investment into the area Society in general will also benefit, as the proposed project will create electricity without any emissions to air, i.e. zero carbon emissions. This is in contrast to coal-fired power stations, for example, which have significant carbon emissions and require vast amounts of water for power generation. Society will be benefit as less carbon emissions means less global climate change, which means healthier and better functioning environmental ecosystems on the planet.

Further to this, according to De Jong 2011, *solar development has the "potential to create sustainable employment in the Northern Cape while addressing some of the fundamental drivers of Climate Change. Being one of the pioneers of solar power in South Africa the project has the inherent role of developing solar power technology for the region. The viability and success of this project is strategic to paving the way for sustainable power technologies in this region. This is a project of strategic and national importance and capable of enhancing South Africa's position in the global technology arena while aligning the commitments made by South Africa in Copenhagen."*

3. PROJECT DESCRIPTION

3.1. PROCESS DESCRIPTION AND PROPOSED ONSITE INFRASTRUCTURE

Photovoltaic power production has been doubling roughly every 2 years, increasing by an average of 48% each year since 2002, making it the world's fastest-growing energy technology. The volume of new grid-connected PV capacities world-wide rose from 16 GW in 2010 to 27 GW in 2011. This increased the total installed PV capacity world-wide to over 67 GW at the end of 2011. Roughly 90% of PV generating capacity consists of grid-tied electrical systems. Such installations may be ground-mounted (and sometimes integrated with farming and grazing) or built into the roof or walls of a building, known as Building Integrated Photovoltaics. Due to the growing demand for renewable energy sources, the manufacturing of solar cells and photo-voltaic modules has advanced dramatically in recent years.

Photovoltaics (PVs) are materials that convert solar radiation directly into electricity. Photovoltaic solar cells are divided into two distinct groups: Traditional crystalline silicon solar cells and thin film solar cells. The absorbed solar radiation excites the electrons inside the cells and produces what is referred to as a / the photovoltaic effect. The crystalline silicon solar cells are made from monocrystalline or polycrystalline silicon. The thin film technologies are comprised of thinner layers of semiconductor material which are produced using a splutter process. Photovoltaic solar power plants comprise of solar modules connected together to form solar arrays for the production of electricity. Direct current electricity is produced from the solar array which in turn is connected to inverters for conversion to alternating current. Power from the inverters is then stepped up via transformers to voltages suitable for injection into the national grid for distribution to consumers.

Solar power plants can either have fixed tilt systems or tracking systems as shown in the diagrams below. Modules in a fixed tilt system are mounted at an optimised angle facing the sun. With tracking systems, the surface of the arrays is moved to follow the sun resulting in large radiation gains. Systems can be set to track the sun's daily path and/or its annual path. Figure 3-1 below shows a typical example of a fixed tilt PV array and Figure 3-2 shows a typical example of a tracking PV array. (these are illustrative examples of the technology only).

The proposed project may potentially also use Concentrated Photovoltaic (CPV) panels. CPV systems are very unique because they concentrate sunlight though a lens onto high performance solar cells and by doing so, increase the electricity generated. These CPV panels are mounted on tracking systems as to maximise the collection of energy from the sun. The concentrated light improves the efficiency of the cells and reduces the amount of expensive solar cell material needed to produce a specific amount of electricity. Some of these CPV panels can generate twice as much power per hectare in comparison with conventional solar panel technology. Certain designs of CPV use 23.5 meter wide panels with more than 1000 pairs of lenses and solar cells on each (See Figure 4-1). CPV panels are mounted on a dual axis system and installed with tracking systems to maintain 0.8 degree angles with the sun throughout the day (Bullis, 2011).

Figure 3-1: Fixed tilt PV array (sourced http://explow.com/solar_panel)

Figure 3-2: Tracking PV array (sourced http://solarblog.ca)

Photovoltaic (PV) arrays can be up to several hundred hectares in spatial extent. The panels are mounted on metal structures that are fixed into the ground, either through a concrete foundation or a deep seated screw. Central inverters are wired to sections of the PV field, which can have a rated power of 500 kW-1250 kW each. The inverter is a pulse width mode inverter that converts DC current to AC current at grid frequency. A typical central inverter rated at 500 kW has a size of approximately 3 m x 2.5 m x 1 m and an output voltage of 480 V Alternating Current (AC).

The grid connection requires transformation of the voltage from 480 V up to between 22,000 V and 400 000 V depending on the existing infrastructure. The normal components and size of a distribution rated electrical substation is also required. Tracking Arrays (Figure 3-2) comprise of one (single axis) or two (dual –axis) motors and a sun sensor used to track the sun. The motors usually contain gears and moving parts that need greasing from time to time.

The solar power generation facility is proposed to accommodate an array of photovoltaic (PV) panels with a generation capacity of approximately 100 MW, depending on the specific technology, covering the entire feasible area of the site (194 hectares). The study area was assessed in detail and the entire feasible area for development has been determined based on the assessment (refer to Sections 9 & 10). Approximately 1.5 – 2 hectares are required per MW of installed PV panels. The following infrastructure is required for the establishment of PV solar facilities:

- Foundations to support the PV panels.
- The plant consists of arrays of photovoltaic (PV) panels: The panels are placed in number rows with a buffer from the boundary fence and access roads in between the each row. Panels will have a junction box located below the rows where all connections between rows meet up. Underground cables run from this box to the inverter/transformer house at 400 V-1000 V Direct Current (DC).
- Panels will be placed on a fixed rotating structure, which is done to ensure up and down movement to ensure maximum absorption of solar radiation. Each of these arrays of panels is expected to be approximately 3 m in height for fixed arrays to 9m for tracking systems.
- Access and inside roads/paths – An access road to the site as well as internal roads between the PV arrays would need to be constructed.
- Trenching – all DC and AC wiring within the PV plant must be buried underground. Trenches will have a river sand base, space for pipes, backfill of sifted soil and soft sand and concrete layer where vehicles will pass. Cable trenches will be approximately 600 mm (0.6 m) deep and 400 mm (0.4 m) wide and backfilled with sand. Manhole covers will be placed every 40 m or at each direction change. A concrete slab will be placed where vehicles pass over cable trenches.
- Inverter/transformer building-- 6 m X 3 m brick buildings located within the PV array each containing an inverter and a step up transformer will be constructed in the plant. The number of buildings will be dependent on the size of plant and inverters chosen. Alternatively a pre-packaged inverter/transformer housed in a concrete substation for outdoors can be utilised.
- Combined guard house/ control room – One (1) brick building of approximately 100m^2 on the perimeter of the plant. Guardhouse will include a small kitchen and toilet. Building will include a storeroom for spare parts kept onsite. The control room will contain switchgear and monitoring equipment for the PV plant. The buildings will be a standard height of approximately 3 m.
- Connection to grid: The grid connection requires transformation of the voltage from 480 V to between 22,000 V and 400,000 V depending on the available

infrastructure. The normal components and size of a distribution rated electrical substation will be required.

- A small switching station for the plant will be located on the outside of the control room.

3.2. ACTIVITIES PROPOSED DURING DEVELOPMENT STAGES OF THE PROJECT

3.2.1. CONSTRUCTION PHASE

The physical construction (footprint) of the PV facility will cover the entire feasible area of the site identified through this EIA. An approved solar facility of 10 MW capacity currently in the process of being developed is located within the study (DEA Ref: 12/12/20/2098/2) (see Figure 2-4) and received preferred bidder status from the DoE as part of the IPP Procurement Program. Subsequent allocations will be determined by the DoE via the REIPP procurement programme, but will result in a facility covering the entire feasible area. This feasible area was only determined after all relevant specialist work and other environmental factors have been considered (see Figure 10-1)

There will be approximately 100-200 construction workers on site. Majority of the construction workers will be sourced from local communities and will be transported to the site during construction. Please refer to Section 9.3.8 for a detailed discussion regarding socio-economic issues. The typical procedures for the construction phase of the PV facility are as follows:

- Establishment of access roads: During the construction period internal roads need to be established; however these roads will only be temporary. There are a number of permanent roads that need to be established for operation and will be gravel based. Existing roads will be used where possible.
- Preparation of the site: Vegetation would need to be cleared for the footprint of the infrastructure as well as for the access roads to the site/internal roads and the laydown of the yard, etc. Topsoil stripping from the construction of access roads and infrastructure would need to be stockpiled and used to rehabilitated areas of the construction footprint.
- Transportation of equipment and components to the site: The main component of the proposed facility would be transported by road to the site. Excavators, graders, trucks and compacting equipment will need to be brought to the site.
- Establishment of workshops, temporary laydown areas and construction camps: Once all the equipment has been brought to the site a dedicated laydown and equipment camps will be established. Fuel will be stored on site during construction; appropriate mitigation measures must be employed to ensure no pollution occurs as a result.
- Construction of the PV array: The foundations for the PV panel array will be excavated. Another option would be to use a ramming system for the support structure which does not require excavation but is dependent on the geotechnical condition of the ground. Concrete and aggregates would need to be brought to the site. Trenches would also need to be excavated for underground connection of the panels to the inverters and subsequently to the plant substation.
- Site rehabilitation: Removal of all construction equipment from the site and rehabilitation of areas where reasonable and practical.

3.2.2. OPERATIONAL PHASE

The PV solar facility operational lifespan is estimated at approximately 20-25 years. The facility would create approximately sixty (60) permanent employment opportunities ranging from for skilled to unskilled individuals. The typical activities during the operational phase would be as follows:

- Operation of the electrical infrastructure and PV panels: Incoming solar radiation will be converted by the PV panels into electrical energy; associated inverters will convert this electrical energy into alternating current. This alternating current will be stepped up via transformers to grid voltage and transmitted via overhead cables to the Aries substation. Electrical and mechanical routine maintenance will also be carried out. Regular cleaning of the panels is also required and very labour intensive.
- Cleaning of PV panels using water: The major maintenance of the PV plant is that it requires quarterly cleaning with water to remove dust from the panels. It is proposed that the groundwater will be abstracted on site for these purposes. This water will temporarily be stored in tanks on site. The option of sourcing water from a water services provider in the area is also available. The panels would need to be cleaned of dust quarterly. The water requirements for the facility would be approximately 2500m³ per annum.
- Site security: Security will be stationed 24 hours a day on the site. The entire development area would have to be fenced off and security cameras installed.

3.2.3. DECOMMISSIONING PHASE

The proposed PV facility is expected to be decommissioned after 20 -25 years, but the operational time could be extended if economically viable. If the economic life is extended, this would mostly involve disassembling of components and installing more appropriate technologies of the time, however, if it is decided to close the facility, the site would need to be prepared to accommodate the relevant decommissioning activities. This would most likely be followed by disassembling of all the individual components of the entire plant. All materials that can be recycled/reused would be identified and implemented. All foundation materials and associated infrastructures would need to be removed and disposed of at an appropriate landfill. Once the entire facility has been removed the area should be reshaped and re-vegetated as to ensure that the environment is rehabilitated to a similar degree as before. A decommissioning and closure plan would therefore be required at end of life of the facility and approved by the DEA before commencement.

3.2.4. SERVICE AVAILABILITY

Due to the distance from the town of Kenhardt, municipal services are not directly available for the site. As around 100-200 construction workers will be stationed temporary on site during working hours and 2 security personnel will be stationed on the site during the operational lifespan, sanitation, water, refuse and electricity facilities will be required to supplement service requirements during construction and operation. The site will be serviced as follows:

- Electricity: During the construction and operational period the electrical requirement would be supplied through auxilliary power from Eskom and diesel generators where necessary.
- Water: The construction period would be characterised with the largest consumption of water for construction, machinery and domestic use. During operation/construction water allocation will be requested by the municipality to the project company. The site also has an existing water use licence (Appendix 2)

for the abstraction of groundwater during operation (Licence No: 14/D54D/A/1854,). If more water is required than authorised for the phase 1 project, an application for amendment will be made to the Department of Water Affairs.

- Sewage: Mobile chemical toilets will be used as far as possible for the construction/operational phase. However various alternative methods do exist some which require limited amount of water such as waterless toilet systems and bio digester systems which have been investigated by the proponent. The method chosen should be done in line with the EMPr of the site, to ensure that the method employed does not cause a significant impact.
- Waste Management: During the construction/operation phase all attempts will be made by the proponent to implement the general principles of integrated waste management through the waste hierarchy. This hierarchy includes: waste minimisation, waste reduction, waste recycling and finally disposal to an approved municipal facility. The waste generated during the construction phase will be mainly packaging, general construction and domestic waste; however the majority of waste produced during operation is of domestic nature.

4. ALTERNATIVES

The requirement for consideration of development alternatives were introduced into South Africa's 'environmental' legislation to encourage developers, 'industry' and 'mining' to consider different ways of doing things that may ultimately yield more desirable environmental outcomes, whilst still achieving their stated development goal(s). Going through the process of identifying and comparing alternatives, through inter alia cost-benefit analysis, will likely yield improvements to the original concept proposal. The ultimate goal of consideration of alternatives is typically to reduce negative environmental impacts and to enhance, or introduce, positive environmental outcomes.

4.1. SITE ALTERNATIVES

At present there are no alternative sites being considered for this particular project, but the optimum location for placement of all components of the solar facility within the existing study area will be selected primarily on the basis of environmental considerations. Renewable energy facilities require certain natural elements to ensure proper functioning of the facility. This most often result in site alternatives not being possible. These elements include the following:

- **Topography and site slope:** The placement of the panels require mainly flat topology with no mountains or hills in the immediate vicinity that would need excessive earthworks or cause shading issues.
- **Grid connectivity:** The site selection was restricted to areas where electrical grid connection is available. The current site was selected based on its close proximity to Aries Substation.
- **Site Access:** The site is directly accessible from a divisional road – P2936. It is a desolated gravel road which extends from the R27 (approximately 8 km south of Kenhardt) to the R358 (approximately 26 km south of Pofadder)

4.2. TECHNOLOGY ALTERNATIVES

In terms of technology alternatives, it should be noted that both the proposed technology and its alternative can be implemented on site separately or in combination. The alternative technology that should be considered is Concentrated Photo-voltaic (CPV). CPV systems are very unique because they concentrate sunlight though a lens onto high performance solar cells and by doing so, increase the electricity generated. These CPV

panels are mounted on tracking systems as to maximise the collection of energy from the sun.

The concentrated light improves the efficiency of the cells and reduces the amount of expensive solar cell materials required to produce an equivalent amount of power in a comparable PV array. In comparison to normal PV panels, certain designs of CPV use 23.5 meter wide panels with more than 1000 pairs of lenses and solar cells on each (See Figure 4-1). These panels are all mounted on a dual axis tracking systems to maintain an optimal alignment with the sun throughout the day. The CPV technology is more expensive, larger (8 meters high), has a higher maintenance cost and requires more resources for installation compared to normal PV.

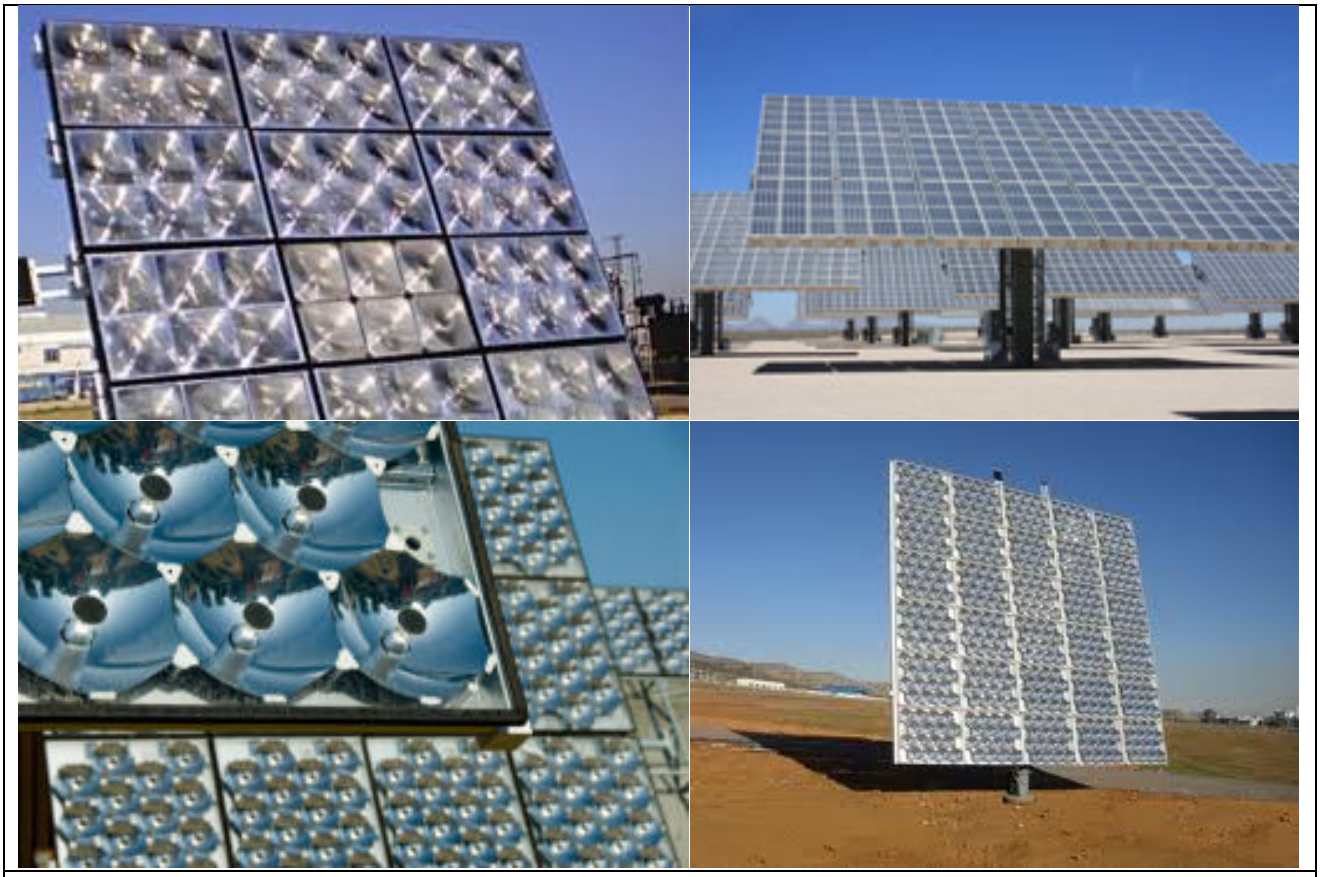


Figure 4-1: Example of Concentrated Photo-voltaic technologies (Bullis, 2011).

The materials used to construct these CPV panels are 95% recyclable due to the fact that the two main materials used are glass and aluminium (Lozanova, 2009).

Table 4-1: Comparison between PV and CPV

CPV vs. PV	
CPV	PV
Higher Efficiency	Lower Efficiency
Tracking Systems	Fixed and Tracking
Lenses/Mirrors/Panels	Panels
More Electricity	Less Electricity
Utility (Commercial)	All Markets
Higher Maintenance Cost	Lower Maintenance Cost
More Expensive than PV	Less expensive than CPV

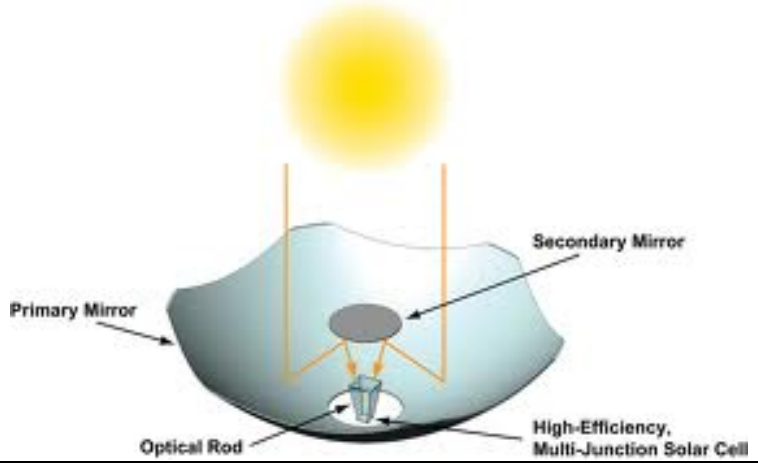


Figure 4-2: Diagram showing how Concentrated Photo-voltaic (CPV) works (Lozanova, 2009).

4.3. ALTERNATIVE GRID CONNECTIONS

Connection to the electrical grid is regulated by Eskom. The option currently being considered for connection to the Eskom substation is

- Through construction of an onsite switching station and the building of a 132 kV line from the switching station to the Aries substation.

4.4. NO-GO ALTERNATIVE

The no-go option refers to the alternative of the proposed development not going ahead at all. This alternative will avoid potentially positive and negative impacts on the environment, and the *status quo* of the area would remain. The implications of the no-go option will be evaluated as part of the EIA, focusing on comparing potential impacts from the proposed project with the *status quo*, and will be particularly relevant should it be found that detrimental impacts cannot be managed to an acceptable level.

Should this alternative be exercised the socio-economic and environmental benefits of renewable energy will not be realised. These benefits would include the following:

- Increased energy security
- Resource savings
- Exploitation of our valuable renewable energy resources
- Climate-friendly development
- Pollution reduction
- Support for international agreements
- Acceptability to society
- Employment creation

5. LEGAL AND POLICY FRAMEWORK

The following section is intended to provide an overview of all environmentally applicable legislation and associated regulatory requirements that need to be considered and addressed during the greater EIA process. The consideration of all relevant legislation will lead to improved decision making and the legally compliant commissioning of the proposed project.

5.1. CONSTITUTION OF SOUTH AFRICA

The Constitution of the Republic of South Africa (Act No. 108 of 1996) has significant implications for environmental management. The main effects are the protection of environmental and property rights, the drastic change brought about by the sections dealing with administrative law such as access to information, just administrative action and broadening of the locus standi of litigants.

These aspects provide general and overarching support and are of major assistance in the effective implementation of the environmental management principles and structures of the NEMA. Section 24 in the Bill of Rights of the Constitution specifically states:

- "Everyone has the right - to an environment that is not harmful to their health or well-being";
- "To have the environment protected, for the benefit of present and future generations, through reasonable legislative 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."

5.2. EIA & ENVIRONMENTAL AUTHORISATION

NEMA is South Africa's overarching environmental legislation, and contains a comprehensive legal framework to give effect to the environmental rights contained in Section 24 of The Constitution. Section 2 of NEMA contains environmental principles that form the legal foundation for sustainable environmental management in South Africa. NEMA introduces the principle of integrated environmental management that is achieved through the environmental assessment process in Section 24, which stipulates that certain identified activities may not commence without an Environmental Authorisation from the competent authority, in this case DEA. Section 24(1) of NEMA requires applicants to consider, investigate, assess and report the potential environmental impact of these activities. The requirements for the investigation, assessment and communication of potential environmental impacts are contained in the so-called 2010 amendment EIA Regulations (GN R.543, R.544, R.545 and R.546; 18 June 2010).

Based on the potential significance of impacts, the Regulations identify specific activities that are either subject to a Basic Assessment process, or more comprehensive Scoping and EIA process. The proposed solar facility includes activities that require a Scoping and EIA. All activities are however included in the Scoping and EIA assessments, i.e., they are combined into a single application procedure. The activities that would be (or are likely to be) associated with the proposed solar facility are listed in Table 5-1 below. It should be noted that the two lists below are comprehensive, but some of the activities may eventually not proceed. The activities ultimately undertaken by BioTherm will be based on the findings and recommendations of the EIA investigation and final project infrastructure design, including certain capacity thresholds and the feasibility of identified alternatives.

Table 5-1: Listed activities applied for in terms of the NEMA 2010 EIA regulations		
Listing	Activity number	Description of each listed activity
Government Notice no 545 of 18 June 2010. "Listing Notice 2"	Activity 1	The construction of facilities or infrastructure for the generation of electricity where the electricity output is 20 megawatts or more. *Reason: The proposed solar facility will have a power generation capacity of more than 20 MW.*
Government Notice no 545 of 18 June 2010. "Listing Notice 2"	Activity 8	The construction of facilities or infrastructure for the transmission and distribution of electricity with a capacity of 275 kilovolts or more, outside an urban area or industrial complex. *Reason: The proposed solar facility may transmit and distribute more than 275 kilovolts as they propose to connect to the national energy grid via the Aries substation.*
Government Notice no 545 of 18 June 2010. "Listing Notice 2"	Activity 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; except where such physical alteration takes place for: (i) linear development activities; or (ii) agriculture or afforestation where activity 16 in this Schedule will apply. *REASON: The proposed solar facility will be developed in phases and on completion the facility will be more than 20 hectares in spatial extent.*
Gnr 546	Activity 4	Road wider than 4 m with reserve less than 13.5 m *REASON: An access road to the facility is required, although the site has exiting access roads a small road would need to be constructed to the entrance of the facility.*
Gnr 546	Activity 14	The clearance of an area of 5 ha or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation *REASON: The study area consists mostly of undisturbed Bushmanland Arid Grassland, more than 5 hectares of this vegetation would therefore be removed.*

The process of applying for Environmental Authorisation includes a requirement to conduct an initial Scoping phase, followed by a detailed EIA as part of the application process. The assessment process (Figure 2-3), aimed at identifying potential positive and negative impacts on the environment (biophysical, socio-economic, and cultural), is comprehensive and detailed in order to:

- Examine alternatives/management measures to minimise negative and optimise positive consequences;
- Prevent substantial detrimental impact to the environment;
- Improve the environmental design of the proposal;
- Ensure that resources are used efficiently; and
- Identify appropriate management measures for mitigation and the monitoring thereof.

5.3. DUTY OF CARE

The National Environmental Management Act, Act 107 of 1998, (NEMA) places a duty to care on all persons who may cause significant pollution or degradation of the environment. Specifically, Section 28 of the act states:

"28 (1) Every person who causes, has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environment is authorised by law or cannot reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment.

(2) Without limiting the generality of the duty in subsection (1), the persons on whom subsection (1) imposes an obligation to take reasonable measures, include an owner of land or premises, a person in control of land or premises or a person who has a right to use the land or premises on which or in which-

(a) any activity or process is or was performed or undertaken; or
(b) any other situation exists, which causes, has caused or is likely to cause significant pollution or degradation of the environment.

(3) The measures required in terms of subsection (1) may include measures to-

(a) investigate, assess and evaluate the impact on the environment;
(b) inform and educate employees about the environmental risks of their work and the manner in which their tasks must be performed in order to avoid causing significant pollution or degradation of the environment;
(c) cease, modify or control any act, activity or process causing the pollution or degradation;
(d) contain or prevent the movement of pollutants or the causant of degradation;
(e) eliminate any source of the pollution or degradation; or
(f) remedy the effects of the pollution or degradation."

Consequently, in the context of this assessment, the owner/operator of the PV facility must take "reasonable steps" to prevent pollution or degradation of the environment that may result from the proposed facility and related activities. These reasonable steps include the investigation and evaluation of the potential impact and identification of means to prevent any unacceptable impact on the environment, and to contain or minimise potential impacts where they cannot be eliminated.

5.4. BIODIVERSITY

5.4.1. NATIONAL FORESTS ACT (ACT NO. 84 OF 1998)

There are a number of tree species that are protected according to Government Notice no. 1012 under Section 12(l)(d) of the National Forests Act, 1998 (Act No. 84 of 1998). In terms of Section 1 5(1) of the National Forests Act, 1998 "*no person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell donate or in any other manner acquire or dispose of any protected tree or any forest product derived from a protected tree, except under a license granted by the Minister to an (applicant and subject to such period and conditions as may be stipulated)*".

Two protected tree species were observed within or in close proximity to the site, *Aloe dichotoma* and *Acacia erioloba*. A permit obtainable from DAFF is required for any activities involving protected tree species. Any affected individuals of *Aloe dichotoma* should be trans-located outside of the development footprint prior to construction.

5.4.1. CONSERVATION OF AGRICULTURAL RESOURCES ACT (ACT 43 OF 1983)

As defined by the Conservation of Agricultural Resources Act (CARA) (Act 43 of 1983), **conservation** is defined as: "in relation to the natural agricultural resources, includes the protection, recovery and reclamation of those resources."

The objectives of the CARA, as stated in Section 2 of the Act, entitled "Objects of Act", are:

"The objects of this Act are to provide for the conservation of the natural agricultural resources of the Republic 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."

Furthermore, Regulation 5 of CARA entitled: "Prohibition of spreading weeds", states:
No person shall-

(a) sell, agree to sell or offer, advertise, keep, exhibit, transmit, send, convey or deliver for sale, or exchange for anything or dispose of to any person in any manner for a consideration, any weed; or

(b) in any other manner whatsoever disperse or cause or permit the dispersal of any weed from any place in the Republic to any other place in the Republic.

Regulation 5 is noted, and the solar facility will strive to meet this requirement of CARA, and the management and mitigation measure to achieve this will be defined in the EIA.

Furthermore, Government Notice Regulation (GNR) 1048 of 25 May 1984 has been promulgated under the Conservation of Agricultural Resources Act (CARA). Amongst others, GNR 1048 defines the following key aspects:

"flood area: in relation to a water course, means the area which in the opinion of the executive officer is flooded by the flood water of that water course during a 1-in-10 years flood";

Utilisation and protection of vlei, marshes, water sponges and water courses
7. (1) Subject to the provisions of the Water Act, 1956 (Act 54 of 1956), and sub regulation (2) of this regulation, no land user shall utilise the vegetation in a vlei, marsh or water sponge or within the flood area of a water course or within 10 metres horizontally outside flood area in a manner that causes or may cause the deterioration of or damage to the natural agricultural resources.
9
(2) Every land user shall remove the vegetation in a water course on his farm unit to such an extent that it will not constitute an obstruction during a flood that could cause excessive soil loss as a result of erosion through the action of water.

(3) Except on authority of a written permission by the executive officer, no land user shall-

(a) drain or cultivate any vlei, marsh or water sponge or a portion thereof on his farm unit; or
(b) cultivate any land on his farm unit within the flood area of a water course or within 10 metres horizontally outside the flood area of a water course.

(4) The prohibition contained in subregulation (3) shall not apply in respect of-

(a) a vlei, marsh or water sponge or a portion thereof that has already been drained or is under cultivation on the date of commencement of these regulations provided it is not done at the expense of the conservation of the natural agricultural resources; and
(b) Land within the flood area of a water course or within 10 metres horizontally outside the flood area of a water course that is under cultivation on the date of commencement of these regulations, provided it is already protected effectively in terms of regulation 4 against excessive soil loss due to erosion through the action of water.

(5) The provisions of regulation 2 (2), (3) and (4) shall apply mutatis mutandis with regard to an application for a permission referred to in subregulation (3).

The subject project would not impact on any productive agricultural soils/ lands (see section 9.3.6; there is also no possibility that the facility would impact on any vleis, marshes, water sponges or water courses as none are present refer to section 9.3.4.

5.4.2. NATIONAL ENVIRONMENTAL MANAGEMENT: BIODIVERSITY ACT (ACT 10 OF 2004)

The National Environmental Management: Biodiversity Act (Act 10 Of 2004) (NEMBA) is the primary legislation governing biodiversity management in South Africa. Section 2: "Objectives of the Act," states the following:

Objectives of Act:

2. The objectives of this Act are-
    a. within the framework of the National Environmental Management Act, to provide for-
        i. the management and conservation of biological diversity within the Republic and of the components of such biological diversity.
        ii. the use of indigenous biological resources in a sustainable manner; and
        iii. the fair and equitable sharing among stakeholders of benefits arising from bioprospecting involving indigenous biological resources;

b. to give effect to ratified international agreements relating to biodiversity which are binding on the Republic;
c. to provide for co-operative governance in biodiversity management and conservation; and
d. to provide for a South African National Biodiversity Institute to assist in achieving the objectives of this Act.

The objectives of this act will be upheld and promoted during the development of the EIR and EMPr. The specialist who will be undertaking the biodiversity assessment will include this legislation in the development of their management and monitoring recommendations.

5.4.3. REQUIREMENTS FOR BIODIVERSITY ASSESSMENTS

It is acknowledged that there are no national guidelines for biodiversity assessments; however, in November 2009, the Department of Agriculture and Rural Development: Directorate of Nature Conservation published the "GDARD requirements for biodiversity assessments" (Version 2). Although these guidelines are specific to the Gauteng Province, the essence of reporting on biodiversity issues and the minimum requirements for biodiversity studies can be adapted and used in any situation.

These guidelines will act as reference documentation for the reporting of biodiversity aspects on the proposed PV solar project.

5.5. NORTHERN CAPE CONSERVATION ACT (ACT NO. 9 OF 2009)

The Northern Cape Nature Conservation Act provides inter alia for the sustainable utilisation of wild animals, aquatic biota and plants as well as permitting and trade regulations regarding wild fauna and flora within the province. In terms of this act the following section may be relevant with regards to any security fencing the development may require.

Manipulation of boundary fences
Section19. "No Person may –

a) erect, alter remove or partly remove or cause to be erected, altered removed or partly removed, any fence, whether on a common boundary or on such person's own property, in such a manner that any wild animal which as a result thereof gains access or may gain access to the property or a camp on the property, cannot escape or is likely not to be able to escape therefrom;"

The Act also lists protected fauna and flora under 3 schedules ranging from Endangered (Schedule 1), protected (schedule 2) to common (schedule 3). The majority of mammals, reptiles and amphibians are listed under Schedule 2, except for listed species which are under Schedule 1. A permit is required for any activities which involve species listed under schedule 1 or 2. Of relevance for the current development is the fact that several plant families and genera are listed in their entirety as protected, this includes, inter alia *Mesembryanthemaceae*, *Amaryllidaceae*, *Apocyanceae*, *Asphodeliaceae*, *Crassulaceae*, *Iridaceae* and *Euphorbia*. Although there are few species of conservation concern within these families and genera at the site, the species present within the development footprint will need to be listed with the permit application. A permit obtainable from the DENC permit office in Kimberly would be required for the site clearing. A permit would also be required to destroy or translocated any nationally or provincially listed species from the site. A single permit, which covers all of these permitting requirements as well as meets TOPS regulations, is used.

5.6. WATER

5.6.1. NATIONAL WATER ACT (NWA), 1998 (ACT 36 OF 1998)

The National Water Act (NWA), 1998 (Act 36 of 1998), aims to manage national water resources in order to achieve sustainable use of water for the benefit of all water users. This requires that the quality of water resources is protected, and integrated management of water resources takes place.

In terms of Section 21 of the National Water Act, Act No. 36 of 1998 (NWA) a water use licence is required for:

a) taking water from a water resource;
b) storing water;
c) impeding or diverting the flow of water in a watercourse;
d) engaging in a stream flow reduction activity contemplated in Section 36;
e) engaging in a controlled activity identified as such in Section 37 (1) or declared under Section 38 (1);
f) discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit;
g) disposing of waste in a manner which may detrimentally impact on a water resource;
h) disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generation process;
i) altering the bed, banks, course or characteristics of a watercourse;
j) removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people; and
k) using water for recreational purposes.

Other provisions of the NWA have been taken into account, specifically relating to Part 4 (Section 19), which deals with pollution prevention, in particular situations where pollution of a water resource occurs or might occur as a result of activities on land. A person who owns controls, occupies or uses the land in question is responsible for taking measures to prevent pollution of water resources. If these measures are not taken, the catchment management agency concerned may itself do whatever is necessary to prevent the pollution or to remedy its effects, and to recover all reasonable costs from the persons responsible for the pollution.

If more water is required than authorised under the existing water use licence for the site a amendment application will be submitted to the provincial DWA. Section 19 of the NWA also places a general duty to care in so far as the pollution of water resources is concerned. This will need to be taken into consideration during the WUL application.

5.7. HERITAGE

Aspects concerning the conservation of cultural resources are dealt with mainly in two acts. These are the National Heritage Resources Act (Act 25 of 1999) and to a lesser extent, the National Environmental Management Act (Act 107 of 1998). A similar study was done on the farm for BioTherm /APS during January 2011, during which a number of archaeological sites were recorded. Based on the results of the earlier work Biotherm has positioned their plant in order not to impact negatively on these sites. The 2012 assessment was necessitated by the fact that a second area on KleinZwart Bast, for the expansion of the solar plant, has been selected for development.

5.7.1. NATIONAL HERITAGE RESOURCES ACT (NHRA) (ACT 25 OF 1999)

According to the above-mentioned act the following are protected as cultural heritage resources:

a. Archaeological artefacts, structures and sites older than 100 years
b. Ethnographic art objects (e.g. prehistoric rock art) and ethnography
c. Objects of decorative and visual arts
d. Military objects, structures and sites older than 75 years
e. Historical objects, structures and sites older than 60 years
f. Proclaimed heritage sites
g. Grave yards and graves older than 60 years
h. Meteorites and fossils
i. Objects, structures and sites or scientific or technological value.

A Heritage Impact Assessment (HIA) is the process to determine whether any heritage resources are located within the area to be developed as well as the possible impact of the proposed development thereon. An Archaeological Impact Assessment (AIA) only looks at archaeological resources. An HIA must be done under the following circumstances:

i. The construction of a linear development (road, wall, power line, canal etc.) exceeding 300 m in length
ii. The construction of a bridge or similar structure exceeding 50 m in length
iii. Any development or other activity that will change the character of a site and exceed 5 000 m^2 or involve three or more existing erven or subdivisions thereof
iv. Re-zoning of a site exceeding 10 000 m^2
v. Any other category provided for in the regulations of SAHRA or a provincial heritage authority

Structures

Section 34 (1) of the NHRA states that no person may demolish any structure or part thereof which is older than 60 years without a permit issued by the relevant provincial heritage resources authority. A 'structure' refers to any building, works, device or other facility made by people and which is fixed to land, and includes any fixtures, fittings and equipment associated therewith. 'Alter' means any action affecting the structure, appearance or physical properties of a place or object, whether by way of structural or other works, by painting, plastering or the decoration or any other means.

Archaeology, palaeontology and meteorites

Section 35(4) of this act deals with archaeology, palaeontology and meteorites. The act states that no person may, without a permit issued by the responsible heritage resources authority (national or provincial):

a) destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or paleontological site or any meteorite;
b) destroy, damage, excavate, remove from its original position, collect or own any archaeological or paleontological material or object or any meteorite;
c) trade in, sell for private gain, export or attempt to export from the Republic any category of archaeological or paleontological material or object, or any meteorite; or
d) bring onto or use at an archaeological or paleontological site any excavation equipment or any equipment that assists in the detection or recovery of metals or

archaeological and paleontological material or objects, or use such equipment for the recovery of meteorites.

e) alter or demolish any structure or part of a structure which is older than 60 years as protected.

The above mentioned may only be disturbed or moved by an archaeologist after receiving a permit from the South African Heritage Resources Agency (SAHRA). In order to demolish such a site or structure, a destruction permit from SAHRA will also be needed.

Human remains

Graves and burial grounds are divided into the following:

A. ancestral graves
B. royal graves and graves of traditional leaders
C. graves of victims of conflict
D. graves designated by the Minister
E. historical graves and cemeteries
F. human remains

In terms of Section 36(3) of the National Heritage Resources Act, no person may, without a permit issued by the relevant heritage resources authority:

a) destroy, damage, alter, exhume or remove from its original position or otherwise disturb the grave of a victim of conflict, or any burial ground or part thereof which contains such graves;
b) 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; or
c) bring onto or use at a burial ground or grave referred to in paragraph (a) or (b) any excavation, or any equipment which assists in the detection or recovery of metals.

Human remains that are less than 60 years old are subject to provisions of the Human Tissue Act (Act 65 of 1983) and to local regulations. Exhumation of graves must conform to the standards set out in the Ordinance on Excavations (Ordinance no. 12 of 1980) (replacing the old Transvaal Ordinance no. 7 of 1925). Permission must also be gained from the descendants (where known), the National Department of Health, Provincial Department of Health, Premier of the Province and local police. Furthermore, permission must also be gained from the various landowners (i.e. where the graves are located and where they are to be relocated) before exhumation can take place. Human remains can only be handled by a registered undertaker or an institution declared under the Human Tissues Act (Act 65 of 1983 as amended). Unidentified/unknown graves are also handled as older than 60 until proven otherwise.

Following the completion of the AIA and HIA the coordinates of the entities identified will be added to the location map. The entities will be classified in terms of the ranking afforded to each in the report, and the applicant will aim to minimise the impact on any identified entities throughout the detail design phase, and prior to finalising permits for destruction and/or exhumation, which will only be considered in circumstances when mitigation is impossible.

5.8. VISUAL

5.8.1. WESTERN CAPE DEPARTMENT OF AND DEVELOPMENT PLANNING: GUIDELINE FOR INVOLVING VISUAL AND AESTHETIC SPECIALISTS IN EIA PROCESSES

A guideline document was developed by the Provincial Government of the Western Cape: Department Of Environmental Affairs and Development Planning (WCDEADP), which is entitled: "Guideline for Involving Visual and Aesthetic Specialists in EIA Processes".

This guideline document, which deals with specialist visual input into the EIA process, has been organised into a sequence of sections, following a logical order covering the following:'

- the background and context for specialist visual input;
- the triggers and issues that determine the need for visual input;
- the type of skills and scope of visual inputs required in the EIA process;
- the methodology, information and steps required for visual input;
- Finally, the review or evaluation of the visual assessment process.

PRINCIPLES AND CONCEPTS UNDERPINNING VISUAL INPUT

The following key principles and concepts will be considered during visual input into the EIA process (WCDEADP, 2005):

- An awareness that 'visual' implies the full range of visual, aesthetic, cultural and spiritual aspects of the environment that contribute to the area's sense of place.
- The consideration of both the natural and the cultural landscape, and their inter-relatedness.
- The identification of all scenic resources, protected areas and sites of special interest, together with their relative importance in the region.
- An understanding of the landscape processes, including geological, vegetation and settlement patterns, which give the landscape its particular character or scenic attributes.
- The need to include both quantitative criteria, such as 'visibility', and qualitative criteria, such as landscape or townscape 'character'.
- The need to include visual input as an integral part of the project planning and design process, so that the findings and recommended mitigation measures can inform the final design, and hopefully the quality of the project.

5.9. NATIONAL PLANNING AND POLICY CONTEXT ON ENERGY

5.9.1. WHITE PAPER ON THE ENERGY POLICY OF SOUTH AFRICA, 1998

The white paper on South African energy policy governs the development of the South Africa energy sector (DME, 1998). This document identifies key objectives for energy supply such as managing energy related environmental impacts, access to affordable energy services and securing energy supply though diversity.

5.9.2. RENEWABLE ENERGY POLICY IN SOUTH AFRICA, 2003

The white paper on renewable energy (DME, 2003) supplements the energy policy and sets out the government's strategic goals, vision, policy principles and objectives implementing and promoting renewable energy in South Africa. South Africa has various sources of renewable resources, particularly solar and wind, and therefore this policy supports the rationale that from a fuel resource perspective, renewable application is proven to be the least costly, especially from an environmental and social perspective.

Meeting technical and economic as well other constraints is one of the major concerns of the government policy on renewable energy.

South Africa has set a 10 year 10 000 GWH target for renewable energies by 2013 to be produced mainly from solar, wind and biomass as well small scale hydro. This amounts to approximately 4% of the country's estimated demand by 2013.

5.9.3. FINAL INTEGRATED RESOURCE PLAN, 2010 -2030

The Ministry of Energy is obligated as per the Energy Act of 2008 to publish and develop an integrated resource plan for energy. The Department of Energy (DOE) in partnership with the National Energy Regulator of South Africa (NERSA) has published the Integrated Resource Plan (IRP) for the time period 2010 to 2030. The main objective of the IRP develops an electricity investment strategy that is sustainable for the transmission infrastructure and generation capacity of South Africa for the next 20 years.

The white paper on renewable energies states that it is of global/national importance to supplement existing energy demand with renewable forms of energy in order to combat climate change. The outcome of this IRP acknowledged that coal fired power generation facilities will still be required over the next 20 years. The DOE released the final IRP in March 2011and parliament accepted it at the end of March. In addition to all existing and committed power plants the IRP includes 6.3 GW of coal, 9.6 GW for Nuclear, 17.8 GW for renewables (including 8.4 GW for solar) and 8.9 GW from other sources.

5.10. Astronomy Geographic Advantage Act, 2007

The objectives of the Astronomy Geographic Advantage Act are as follows:

a) to provide measures to advance astronomy and related scientific endeavours in the Republic;
b) to develop the skills, capabilities and expertise of those engaged in astronomy and related scientific endeavours in Southern Africa;
c) to identify and protect areas in which astronomy projects of national strategic importance can be undertaken;
d) to provide a framework for the establishment of a national system of astronomy advantage areas in the Republic, to ensure that the geographic areas in the Republic which are highly suitable for astronomy and related scientific endeavours due to, for example, high atmospheric transparency, low levels of light pollution, low population density or minimal radio frequency interference are protected, preserved and properly maintained;
e) to regulate activities which cause or could cause light pollution or radio frequency interference or interfere in any other way with astronomy and related scientific endeavours in those areas;
f) pursuant to Section 5, to provide for the declaration and management of astronomy advantage areas; and
g) to enable the Minister to participate in efforts to preserve the astronomy advantage of Southern Africa and to coordinate astronomy within this area.

In line with the above the MEC may declare astronomy advantage areas (AAA). The provisions provide for the minister within the act to declare any area in the Northern Cape Province as an AAA; however no such declaration may be made in respect to any area demarcated in terms of the Municipal Demarcation Act and falling within the Sol Plaatje Municipality. The entire Northern Cape province excluding Sol Plaatji Municipality was declared an astronomy advantage area within GN: 31855 (No. 82 of 2009) in terms of Astronomy Geographic Act, 2007 (Act No. 21 of 2007).

Notice of intention to declare the Karoo astronomy advantage area was published for public comment in General Notice 115 of 2009 within GN. 31855 of 2009. This general notice describes the boundaries of radio Astronomy Advantage Areas, including Karoo core radio AAA, Karoo Central radio AAA 1, Karoo Central radio AAA 2 and Karoo Central radio AAA 3

The purpose of declaring areas as astronomy advantage areas is mainly to ensure that areas suitable for astronomy and related scientific endeavours in South Africa are preserved and maintained. These areas consist of, among other things, atmospheric transparency, low levels of light pollution, low population density or minimal radio frequency interference. The AAAs also enhance and provide management to existing geographic advantage areas.

In terms of this act no person without prior permission from the delegated management authority in terms of the act, may:

1. "Enter any core astronomy advantage area
2. Reside in a core astronomy advantage area
3. Have in their possession, within a core astronomy advantage area designated by the Minister in terms of Section 7(1)(c) for radio astronomy, any interference source, mobile radio frequency interference source or short range device, unless the source or device has been turned off and, when in that state, is incapable of causing any form of radio frequency interference; and
4. Perform any other activity in a core astronomy advantage area that might be harmful to astronomy and related scientific endeavours or to the preservation of the area's astronomical advantage."

In terms of this act restrictions can also be placed on the use of radio frequency spectrums in astronomy advantage areas. Draft regulations regarding radio astronomy protection levels in astronomy advantage areas were published in GN .539 of 2011 in terms of the Astronomy Geographic Advantage Act, 2007 (Act No. 21 of 2007).

5.11. OTHER RELEVANT LEGISLATION AND GUIDELINES CONSULTED

5.11.1. SIYANDA DISTRICT MUNICIPALITY INTEGRATED DEVELOPMENT PLAN (2011/12) / SPATIAL DEVELOPMENT FRAMEWORK

A synopsis report on the 2011/12 District Municipality IDP was considered in the development of this EIA Report. In terms of the national special development perspective, the Siyanda district area is classified as a medium important area which means no significant investment is concentrated in the region. The potential growth in the area lies mainly in tourism development. The IDP strongly outlines the need to create employment opportunities in the District. The IDP identifies priority issues such as insufficient infrastructure development, insufficient stimulation and enhancement of the local economic development (LED), it clearly represents the need for economic development as to alleviate poverty in the area. One of the strategic goals of the municipality is that it must deliver a positive contribution to the sustainable growth and development. A key objective of the district is to enhance provision of infrastructural development such as electricity, water, road, sanitation and telecommunications

5.11.2. KAI! GARIB LOCAL MUNICIPALITY: INTEGRATED DEVELOPMENT PLAN, 2007 – 2012.

The main aim of the municipality is to create a municipality that enhances the communities' and inhabitants' standards of living. This would be mainly done through

providing communities in the area with excellent services and good governance. Various priority issues have been identified by the municipality:

- Lack of economic development
- Lack of access to electricity
- Lack of training and skills development
- Lack of job opportunities

The proposed project would therefore be in line with the issues identified within the IDP. In order to help alleviate local unemployment, employment, mostly during construction, will be sourced from the local population, and training programmes will be implemented for these individuals as to allow them the opportunity to become eligible for permanent positions. The production of electricity by the project will ensure a reliable local electricity supply and reduce the demand for importing electricity from areas outside the Northern Cape.

5.11.3. NATIONAL VELD AND FOREST FIRE ACT (ACT 101 OF 1998)

The purpose of this Act is to prevent and combat veld, forest and mountain fires. The Act provides for a variety of institutions, methods and practices for achieving the purpose such as the formation of fire protection associations. It also places responsibility on landowners to develop and maintain firebreaks as well as be sufficiently prepared to combat veld fires in terms of equipment as well as suitably trained personnel.

The site is however arid and given the sparse vegetation cover, it is highly unlikely that fires are a normal occurrence in the area. Fires at the site are not currently considered to be a significant risk. However, if site is not grazed occasionally, there is a danger that sufficient biomass to carry a fire would build up. Given the risk that this would pose to the development, it would be in the operators' interests to manage plant cover at an acceptable level through grazing or alternative management practice.

5.11.4. EQUATOR PRINCIPLES

Project financing would require the development proposal to comply with the Equator Principles. These principles are a set of international standards that are voluntarily implemented to identify, assess and manage environmental and social risks. The Equator Principles are based on the guidelines of the World Bank group of social policies of the International Finance Corporation (IFC). Once financial institutions adopt the Equator Principles they place a commitment onto themselves not to finance projects that do not comply with these principles.

The Equator Principles would be considered in monitoring and managing the project in line with these requirements. The following table represents the principles that have been considered in compiling this report.

Table 5-2: Equator Principles considered	
Principle 1: Review and Categorisation	"Category C – Projects with minimal or no social or environmental impacts."
Principle 2: Social and Environmental Assessment	This subject report is compiled to assess the environmental and social impact of the proposed development. The mitigation measures are prescribed in this report as well as in the EMPr (Appendix 8)
Principle 3: Applicable Social and environmental Standards	The following IFC performance standards are applicable to the proposed project:

Table 5-2: Equator Principles considered	
	1. Social and environmental Sustainability 2. Labour and Working conditions 3. Pollution prevention and abatement 4. Community health, Safety and Security 5. Land Acquisition and Involuntary Resettlement 6. Biodiversity Conservation and Sustainable Natural resource Management 7. Cultural Heritage
Principles 4: Action Plan and Management system	The EMPr should be used as the management plant to develop a site-specific Action Plan that would need to be implemented as part of the site's Environmental Management System (EMS) and implemented by the site Environmental Control Offices
Principles 5: Consultation and Disclosure	The public participation process has been and will be undertaken in line with South African legislation in terms of NEMA: EIA regulation R543.
Principles 6: Grievance Mechanism	A grievance process will be implemented by the project development company to ensure disclosure, consultation and public engagements during all phases of development of the facility.
Principles 7: Independent Review	Independent review of all environmentally related aspects/documents of the proposed project lender must be undertaken.
Principle 8: Covenants	All South African legislation must be complied with by the proponent.
Principle 9: Independent Monitoring and Reporting	ECO must monitor the site to ensure independent verification of monitoring results.
Principle 10: EPFI Reporting	Annual report must be submitted to the relevant lender.

5.11.5. OCCUPATIONAL HEALTH AND SAFETY

The EIA process assesses impacts on the environment, and does not specifically focus on issues of internal health and safety, as these are regulated by other legislation such as the Occupational Health and Safety Amendment Act, Act No. 181 of 1993, (OHSA). However there are instances in which the application of health and safety regulation is relevant within the domain of impact on the environment. The Occupational Health and Safety Act (OHSA) regulations include Regulation 1179 (Hazardous Chemical Substances) and Regulation 7122 (Major Hazard Installations). A "hazardous chemical substance" is defined in Government Notice R.1179 Hazardous Chemical Substances Regulations (1995) as any toxic, harmful, corrosive, irritant or asphyxiant substance, or a mixture of such substances for which (a) an occupational exposure limit is prescribed, or (b) an occupational exposure limit is not prescribed; but which creates a hazard to health.

In terms of Section 8(2d) of the Occupational Health and Safety Act, 1993, the employer has to establish, as far as is reasonably practicable, what hazards to the health or safety of persons are attached to any work which is performed, any article or substance which is produced, processed, used, handled, stored or transported and any plant or machinery which is used in his business; and he shall, as far as is reasonably practicable, further establish what precautionary measures should be taken with respect to such work, article, substance, plant or machinery in order to protect the health and safety of persons. The employer shall, furthermore, provide the necessary means to apply such precautionary measures.

A Major Hazardous Installation is defined in terms of the Occupational Health and Safety Act as an installation:

- "where more than the prescribed quantity of any substance is or may be kept, whether permanently or temporarily; or
- where any substance is produced, used, handled or stored in such a form and quantity that it has the potential to cause a major incident".

A major incident as referred to above is defined as "*an occurrence of catastrophic proportions, resulting from the use of plant or machinery, or from activities at a workplace*". It is impossible to put a specific value to "catastrophic" because it will always differ from person to person and from place to place. However, when the outcome of a risk assessment indicates that there is a possibility that the public will be involved in an incident, then the incident can be seen as catastrophic (Department of Labour 2005). Certain substances listed in Schedule A of the General Machinery Regulations may possibly be used or stored in quantities exceeding the stated thresholds. However due to previous experience with such this would not necessarily be the case.

5.11.6. GUIDELINES PUBLISHED IN TERMS OF NEMA EIA REGULATIONS:

- Guideline 3: General Guide to Environmental Impact Assessment Regulations, 2006 (DEAT, June 2066).
- Guideline 4: Public Participation in support of the Environmental Impact Assessment Regulations, 2006 (DEAT, June 2006)
- Guideline 5: Assessment of alternatives and impact in support of the Environmental Impacts Assessment Regulations, 2006 (DEAT, June 2006)
- Integrated Environmental Management Information series
- South African national Biodiversity Institute (SANBI) published guidelines.

5.11.7. GUIDELINES ON THE INVOLVEMENT OF SPECIALISTS IN THE EIA PROCESS

The Western Cape Department of Environmental Affairs and Development Planning (WC DEADP) have developed policy guidelines around specialist involvement in EIA processes. The guidelines aim to improve the quality of specialist input and facilitate informed decision-making. The guidelines clarify the roles and responsibilities of all role players with regard to specialist input in the EIA process. These guidelines have been derived to help practitioners draft appropriate terms of reference for specialist input and assist role players to evaluate the appropriateness of specialist input in individual cases. Although these guidelines have been developed by the Western Cape, they can be adopted for use anywhere in the country.

Hence, the EIA process will endeavour to adhere to these set of guidelines, in order to be in line with provincial guidelines relevant to EIA's.

These guidelines include:

- Guideline for Determining the Scope of Specialist involvement in EIA processes (June 2005)
- Guideline for the Review of Specialist input in EIA processes (June 2005)
- Guideline for involving Biodiversity specialists in EIA processes (June 2005)
- Guideline for involving Heritage specialists in EIA processes (June 2005)
- Guideline for involving Visual and Aesthetic specialists in EIA processes (June 2005)
- Guideline for Environmental Management Plans
- Guideline for involving Social Assessment Specialists in EIA processes

The full versions of these reports can be downloaded from: http://www.capegateway.gov.za/eng/pubs/guides/G/103381

6. PUBLIC PARTICIPATION

6.1. INTRODUCTION

Public participation provides the opportunity for Interested and Affected Parties (IAPs) to participate on an informed basis, and to ensure that their needs and concerns are considered during the impact assessment process. In so doing, a sense of ownership of the project is vested in both the project proponent and interested or affected parties. The public participation process is aimed at achieving the following:

- Provide opportunities for IAPs and the authorities to obtain clear, accurate and understandable information about the expected environmental and socio-economic impacts of the proposed development;
- Establish a formal platform for the public with the opportunity to voice their concerns and to raise questions regarding the project;
- Utilise the opportunity to formulate ways for reducing or mitigating any negative impacts of the project, and for enhancing its benefits;
- Enable project proponent to consider the needs, preferences and values of IAPs in their decisions;
- Clear up any misunderstandings about technical issues, resolving disputes and reconciling conflicting interests;
- Provide a proactive indication of issues which may inhibit project progress resulting in delays, or which may result in enhanced and shared benefits; and
- Ensure transparency and accountability in decision-making.

The public participation process to date is discussed below. Refer to Appendix 5 for further detail, which includes:

- The project Background Information Document (BID);
- Proof of notifications to IAPs of the application to DEA for Environmental Authorisation;
- Proof of press advertisements and site notices;
- List of IAPs;
- Issues and Responses Report (I&RR);
- Minutes of public meetings; and
- 30 day commenting period for registered IAPs and 40 days commenting period for key stakeholders (DAFF, DEA, DWA etc.) on draft scoping report
- 30 day commenting period was given on the final scoping report to registered IAPs as well key stakeholders.
- Proof of distribution of draft and final reports to relevant key commenting authorities

6.2. IAP NOTIFICATION & CONSULTATION TO DATE

The first step in the public participation process was to advertise the project as required by the 2010 EIA Regulations, in order to inform potential IAP's of the proposed project and EIA process. This was done by means of the following:

- A Background Information Document (BID) was compiled giving details on the applicant, the Environmental Assessment Practitioner (EAP), the scope and locality of the proposed project, the EIA process, purpose and process of public participation, and included an invitation to register as an IAP and provide comment.

- Pre-identification of interested and affected parties (IAPs), including adjacent landowners, using existing databases, and distributing the BID to these stakeholders. The BID was also sent to any other IAPs who responded to site or press notifications.
- Advertising the proposed project and associated EIA process in "Die Gemsbok" on 16 March 2012. The advertisements indicated where written comments may be directed to and were placed in English.
- A2-size site notices were erected on the site
- The draft Scoping report was distributed to all registered IAPs and important commenting stakeholders/authorities for a 30 day commenting period from the 23 April 2012 to the 23 May 2012.
- The final scoping report was also distributed to IAPs and commenting stakeholders/authorities for a 30 day commenting period from the 14 June 2012 to the 12 July 2012. All parties were instructed to send their comment directly to the DEA.

Proof of these advertisements, sending of the BID, proof of site notices, communications with IAP's, availability of scoping reports and others are contained in the public participation report attached as Appendix 5 to this report.

6.3. IAP NOTIFICATION & CONSULTATION FOR THE REMAINDER OF THE ASSESSMENT

- The availability of the draft EIR will be advertised in one local newspapers (Gemsbok or Ons Kontrei) as well the particular amendment required to the application form.
- A copy of the draft EIR will be place in the local Kenhardt Library for review by interested stakeholders. This will be communicated to all registered I&Ap and also included in the advert.
- The draft EIR will be distributed to all registered IAPs for a 40 day commenting period from the 28 September 2012 to the 7 November 2012.
- The draft EIR will also be distributed all important commenting stakeholders/authorities and given 40 days commenting period from the 28 September 2012 to the 7 November 2012.
- The final EIR will also be distributed to IAPs and commenting stakeholders/authorities for a 21 day commenting period. All parties will be instructed to send their comment directly to the DEA.

6.4. EIA PUBLIC MEETING PHASE

To date, no public meeting has been held regarding the proposed project. The public interest in the proposed project has been very low. If the need arises once the draft EIR has been distributed a public meeting will be held. However, to date, interest in the project has been limited.

6.5. AUTHORITIES CONSULTATION

The National Department of Environmental Affairs is the assigned competent authority for the environmental authorisation of power generation application. All official correspondence from the DEA regarding this specific application is contained within

Appendix 2 of this report. Consultation with the regulating authority as well as key commenting authorities have continued throughout the EIA process thus far. These include the following:

- Submission of application form for Environmental Authorisation to the Department of Environmental affairs.
- Submission of draft Scoping Report to the DEA as well key commenting authorities for a 40 day commenting period as well 30 day period to IAP
- Submission of final Scoping report to DEA for review as well key commenting authorities for 30 day period to IAP/key commenting authorities
- Submission of draft Environmental Impact Report (EIR) for comment to DEA as well key commenting authorities for 30 day period to IAP/key commenting authorities

For the remaining EIA process, the final EIR will be submitted to the DEA after a 40 day commenting period for key commenting authorities as well as a 30 day commenting period for IAP. The following key stakeholders/ authorities have been requested to provide their comment on the draft and subsequent final report.

Table 6-1: Key commenting authorities.			
Northern Cape Department Agriculture, Forestry and Fisheries (DAFF)	Mrs. Jacoline Mans	054 338 5909	JacolineMa@nda.agric.za
Northern Cape Department of Environment and Nature Conservation	Mr. Tshlo Makaundi	053 807 7464	tmakaudi@ncpg.gov.za
Department of Water Affairs (DWA)	Mr. A Abrahams & SR Cloete	053 830 8802 & 054 33 8500	AbrahamsA@dwa.gov.za & cloetes@dwa.gov.za
Khai Ma Local Municipality	Mr. A Vosloo	054 4316328	avosloo@kaigarib.co.za
Siyanda District Municipality	Mr. D. Ngxanga	054 377 2800	b.ngxanga@vodamail.co.za

Table 6-2: Other important IAPs who received electronic copies of the reports	
National Department of Agriculture, Forestry and fisheries (DAFF)	Ms Mashudu Marubini & Ms Thoko Buthelezi
South African Heritage resource Agency (SAHRA).	Kathryn Smuts
Eskom	John Geeringh (Pr Sci Nat), KevinLeask & RonaldMarais
SKA	Dr. Adrian Tiplady

Table 6-3: Other Important IAp
National Department of Agriculture, Forestry and fisheries (DAFF)
South African Heritage resource Agency (SAHRA).
Eskom
SKA

Please also refer to the public participation report (Appendix 5)

6.6. COMMENTS & ISSUES

To date very few comments or issues has risen by any IAPs. The report will be distributed to all IAP and comment received will be updated below. Additionally the availability of the draft EIR will be advertised in the Gemsbok, as to ensure that any additional stakeholders not identified during the initial advert and notifications are not excluded from the process.

Table 6-4: Comments from IAPs to date	
IAP & Comment	***EAP Response***
Kevin Anderson: Please can you inform me when the next PPP meeting is to be held?	Thank you for your interest in the project. Due to the fact that public interest in the project has been very low to date, no public meeting has been scheduled; however we would be more than happy to meet with you to address any particular concerns which you may have. Please also give us an initial indication of your potential concerns. You will also be given the opportunity to comment on the draft EIR report scheduled to be released for comment mid-September. Presently there is not a need for a public meeting, however if the need arises this will be held after the draft EIR report has been made available.
Kevin Anderson: Am I correct to assume that no public meetings will be held as part of this EIA process?	The assumption that there will be no public meeting will depend on need thereof. As stated previously we would be more than happy to meet to raise your particular concern and interest in the project.
J Mans (Chief Forester NC(DAFF) commented on final SR: • DAFF mainly concerned about potential impact on protected tree species. Please ensure that the anticipated impact (if any) on protected trees and plants are properly assessed during the EIA phase.	Your comments were noted. As part of the assessment contained in this report was the initiation of a biodiversity impact assessment by a specialist in the field. His report outlines the potential impact the proposed facility will have on the receiving environment specifically related to biodiversity (incl. trees and plants). Your concerns have been implemented as required and contained within this report and the relevant appendices attached.
SAHRA comments received on 29 June 2012	Please refer to Appendix 5

7. DESCRIPTION OF THE RECEIVING ENVIRONMENT

7.1. REGIONAL LOCATION

The property on which the proposed development is to take place belongs to local farmers, and not to BioTherm Energy. The land will be leased from the land-owners for the development with an option to purchase. The site for the proposed facility lies within the Siyanda District Municipality and within the Kai !Garib Local Municipality. The remaining extent of portion 1 of the farm Klein Zwart Bast 188 is located on the gravel road to Pofadder off the R27 from Kenhart in the Northern Cape. Siyanda District Municipality covers an area of approximately 100 000 square kilometres (30% of the entire Northern Cape Province). The current EIA study is being undertaken to assess the potential feasible area within the demarcated study area below.

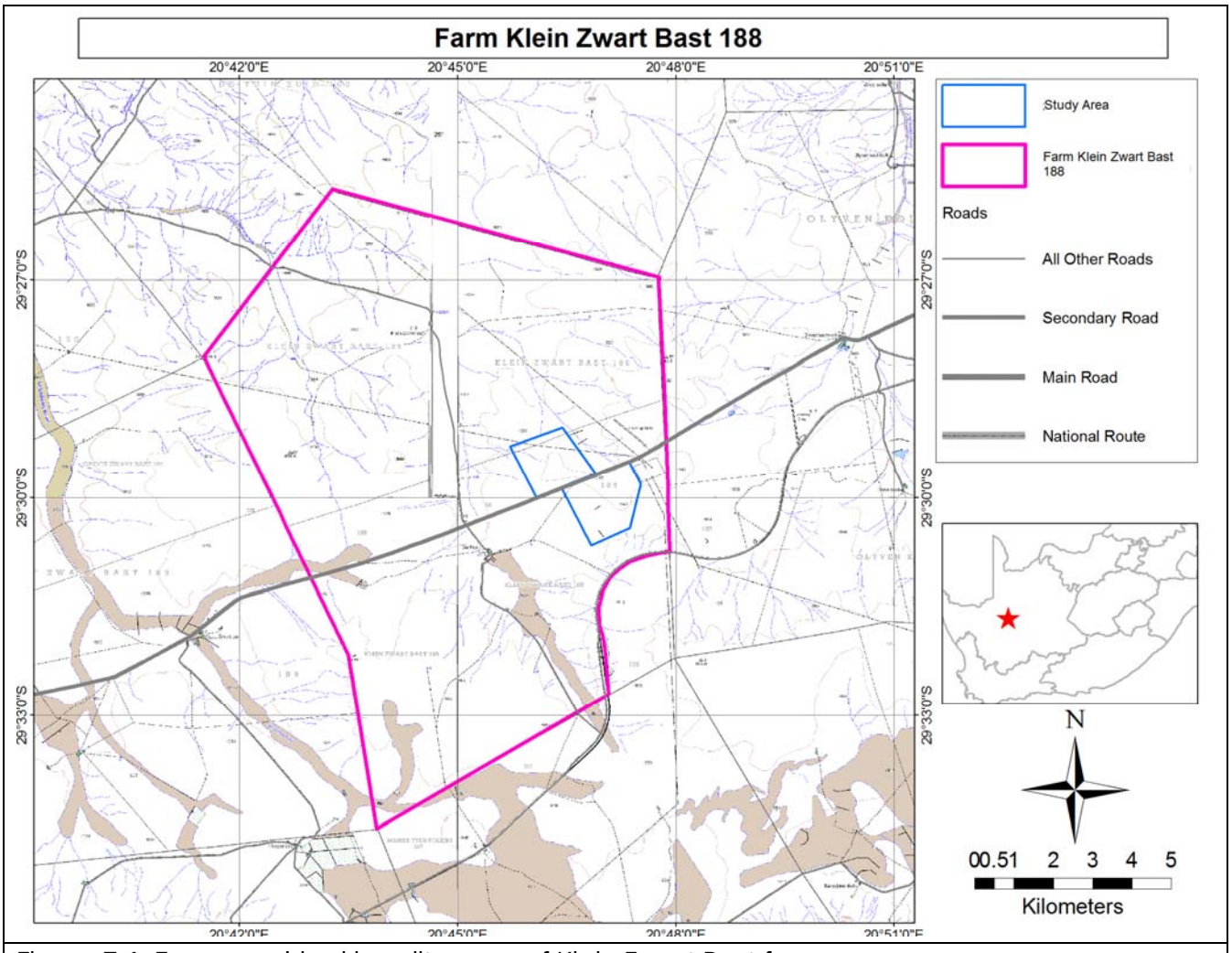


Figure 7-1: Topographical locality map of Klein Zwart Bast farm

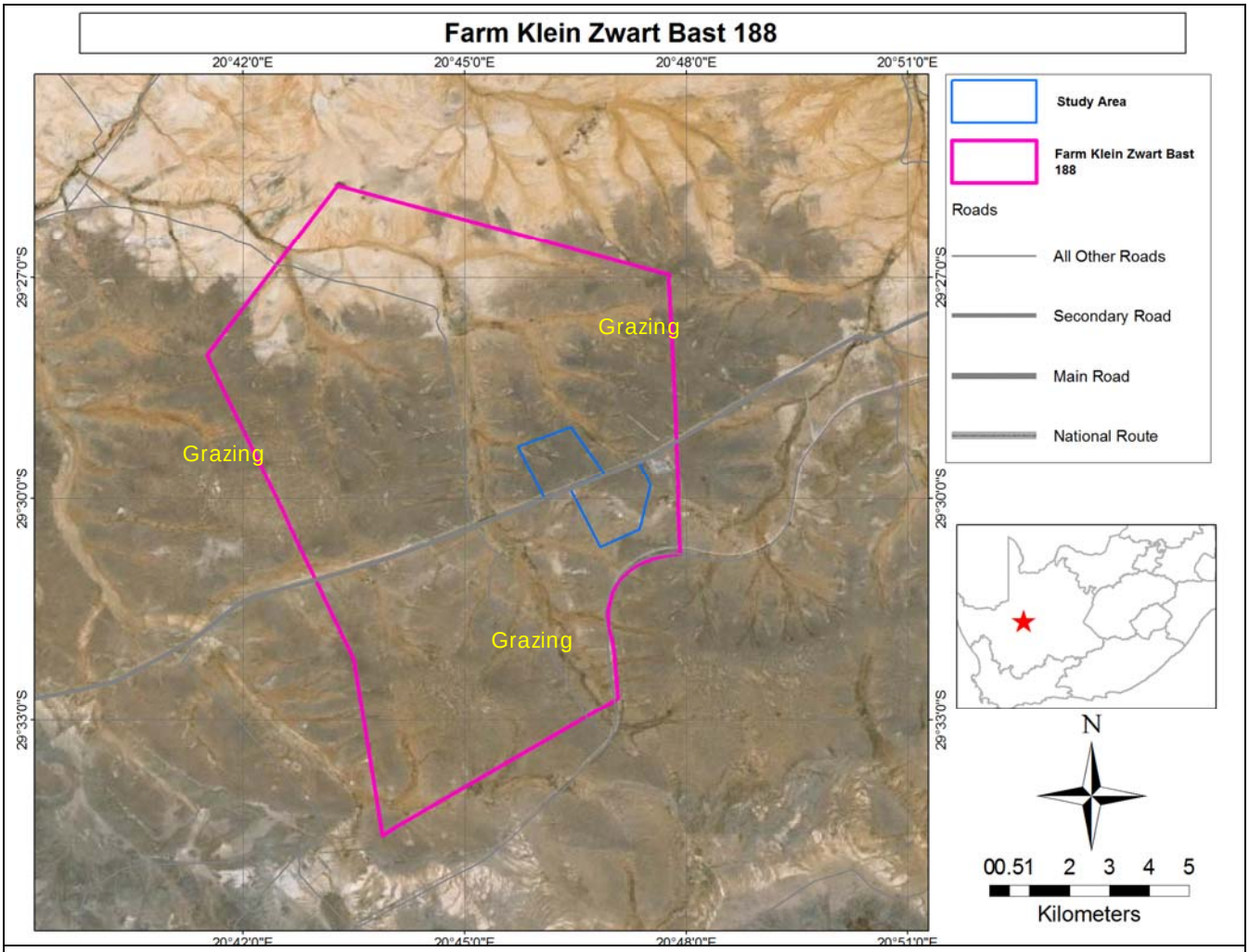


Figure 7-2: Google Earth locality map of Klein Zwart Bast

7.2. LAND-USE AND LAND COVER OF THE STUDY AREA

The predominant land use activities within the Northern Cape are mining and goat, sheep, cattle and game farming (Figure 7-2). The site is characterised by mostly cattle and game farming, with limited agricultural activity/potential in the area. The surrounding land cover is mostly grassland and scrubland. The main issues identified, as issues relating to land resources in the Northern Cape Province, are desertification, land degradation, land ownership and land use. The province is classified to be 30% moderately degraded and 20% of the land is classified as extremely degraded, resulting in approximately 50% of the province land falling into the above categories and therefore measures must be put in place to ensure that this situation does not worsen. The Northern Cape Province is very susceptible to desertification and measures should be put in place to ensure sustainable land management.

7.3. CLIMATE

7.3.1. TEMPERATURE

The daily average maximum temperatures in the town of Kenhardt range from 37 °C in January and February to 24 °C in July. Temperatures during the winter months of June and July are considered the coldest with an average night time temperature of 4 °C.

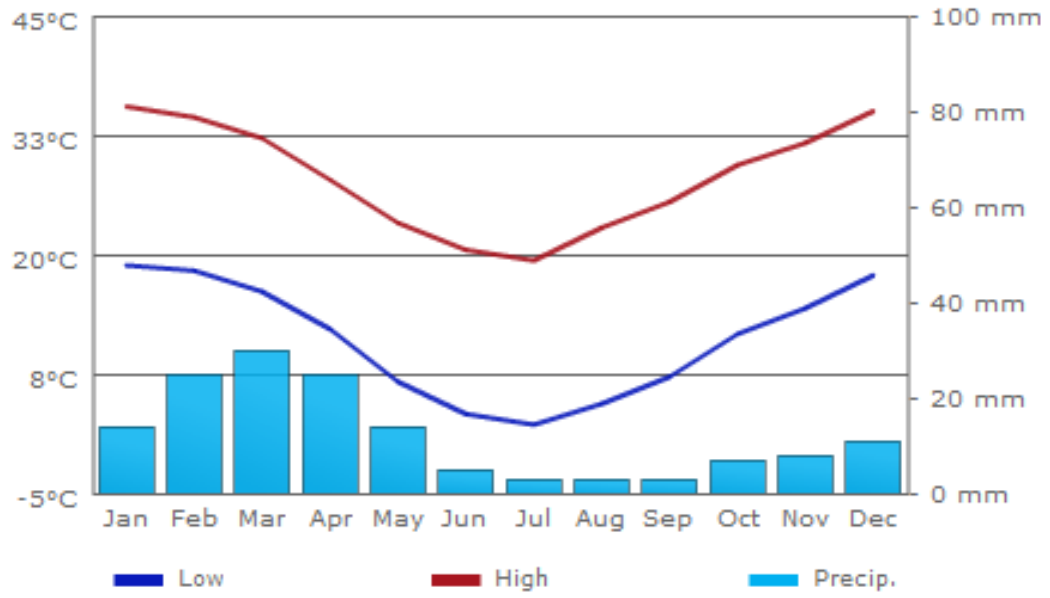


Figure 7-3: Average temperature graph for Augrabies region (http://www.worldweatheronline.com)

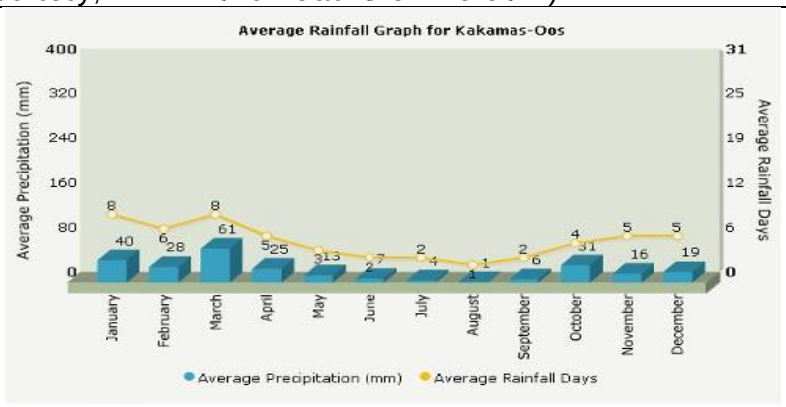
7.3.2. RAINFALL

The region is classified as semi-arid and receives an annual rainfall of 133 millimetres, with the majority of rain falling in the summer months between October and March. On average, the heaviest rains falls in mid to late summer, with February and March being the wettest months. The areas falling within the scope of the study are considered to be arid to very arid regions of South Africa, mainly because they receive less than 400 millimetres of rainfall per year.

There are no official rainfall stations in close proximity to the study area. It was subsequently necessary to use data from the nearest official rainfall station to the study area and derive the likely rainfall by using the trend of the nearby rainfall station. We acquired the following data from the website, www.worldweatheronline.com. The data is for Kakamas on the Orange River some 84 Km north-northwest of the study area. This town is located at the confluence of the Hartbees River with the Orange River.

The above weather station is located in quaternary catchment D53J to the north-northwest of the study area. The average rainfall within this catchment is slightly more than that of the study area, however it would have virtually the same monthly rainfall trends. Therefore we can derive average monthly rainfall of the study area by using the average monthly rainfall table. The Kakamas-oos weather station receives an average rainfall of 134 mm/a.

Table 7-1: The monthly average rainfall for Kakamas-Oos (closest station to Kenhardt). (Courtesy, www.worldweatheronline.com)



Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
40mm	28mm	61mm	25mm	13mm	7mm	4mm	1mm	6mm	31mm	16mm	19mm
8	6	8	5	3	2	2	1	2	4	5	5

7.3.3. WIND

Figure 7-4 represents a wind rose of the dominant wind direction in the Augrabies region (Augrabies is the closest area where reliable data could be retrieved) to be predominately south easterly. This is expected as Augrabies is in a part of the country where the mean flow is from the Anticlonic circulation from the South Atlantic High pressure.

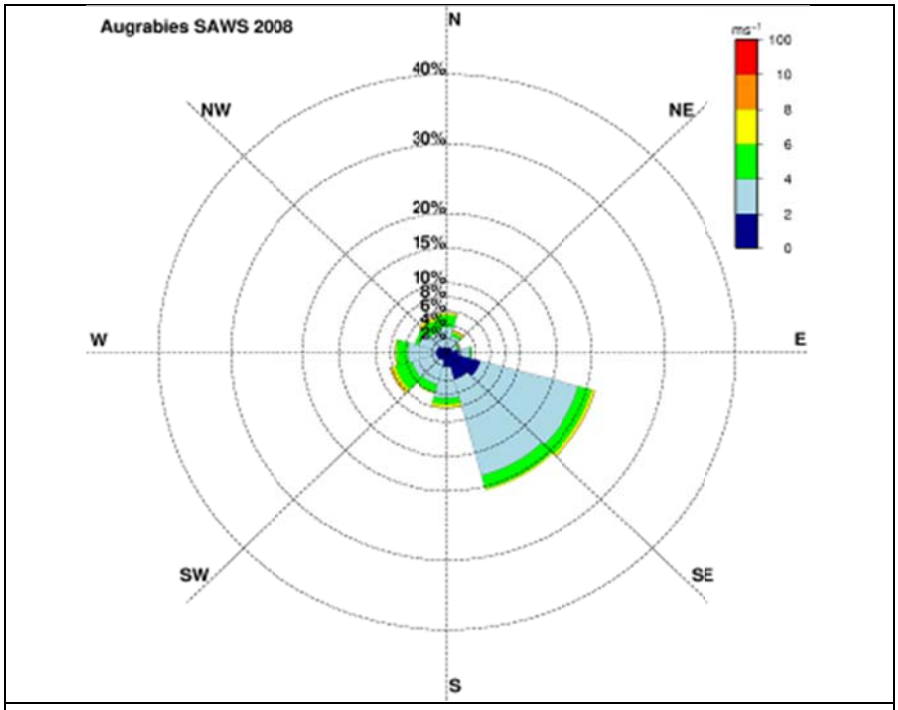


Figure 7-4: Augrabies wind rose

7.4. TOPOGRAPHY

The regional topography is generally flat, with the Kalahari plains intersected by a few dry river beds. Figure 7-5 below shows the regional topography of the study area as well the locations used to determine the north south and east west slope analysis. The study area is relatively flat with no major topological constraints to the proposed development. The

majority of the site is flat, with minimal change in elevation throughout with an average slope of 0.63 degrees (1.1%)(0.6˚East West) and 0.7˚ (North South) (Figure 7-6 & Figure 7-7). The study area has an average elevation 938 mamsl.

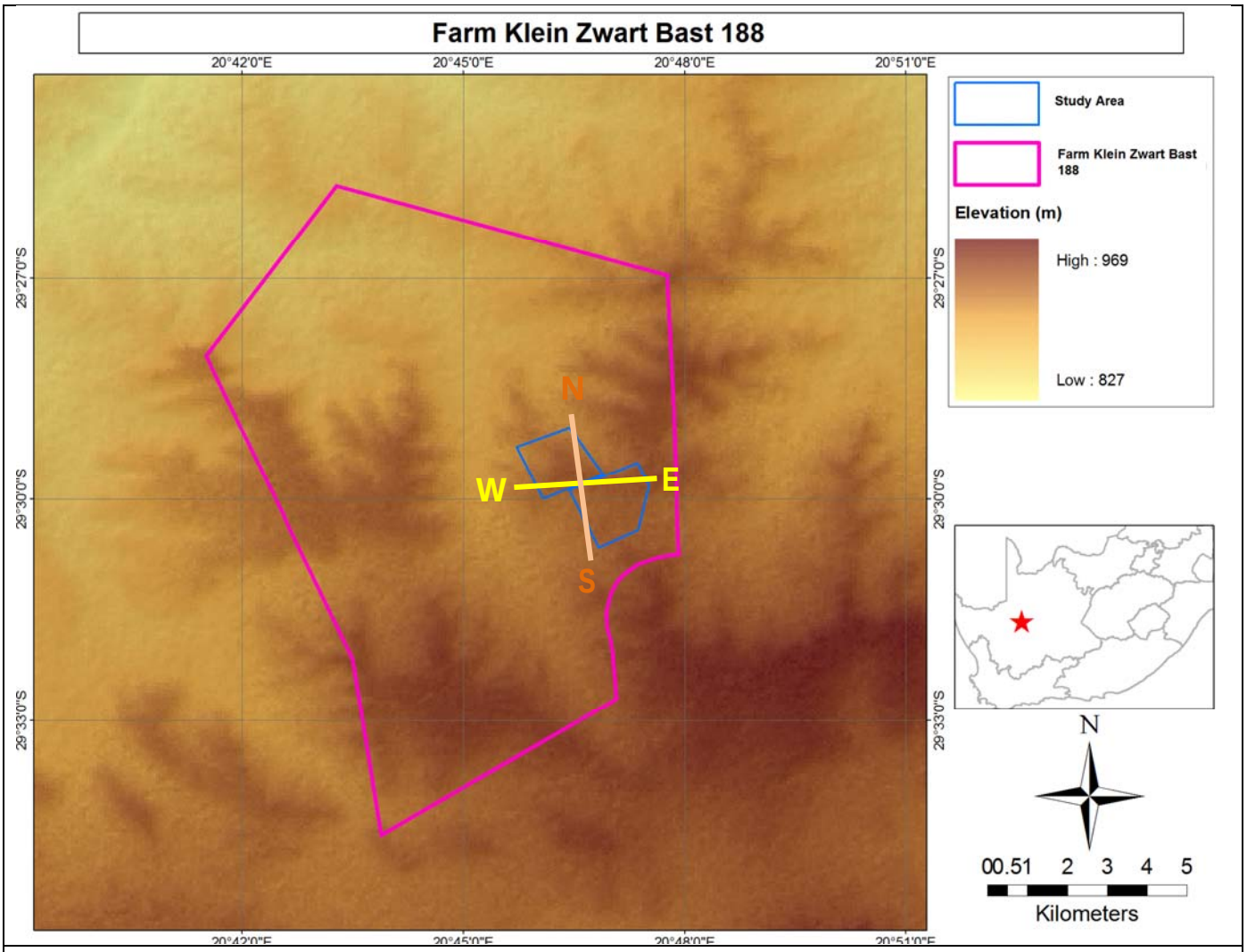


Figure 7-5: Regional topography map of the study area, indicating the relevant location of cross section represented in Figure 7.6

North South

Figure 7-6: North South Slope analysis of the study area.

East West

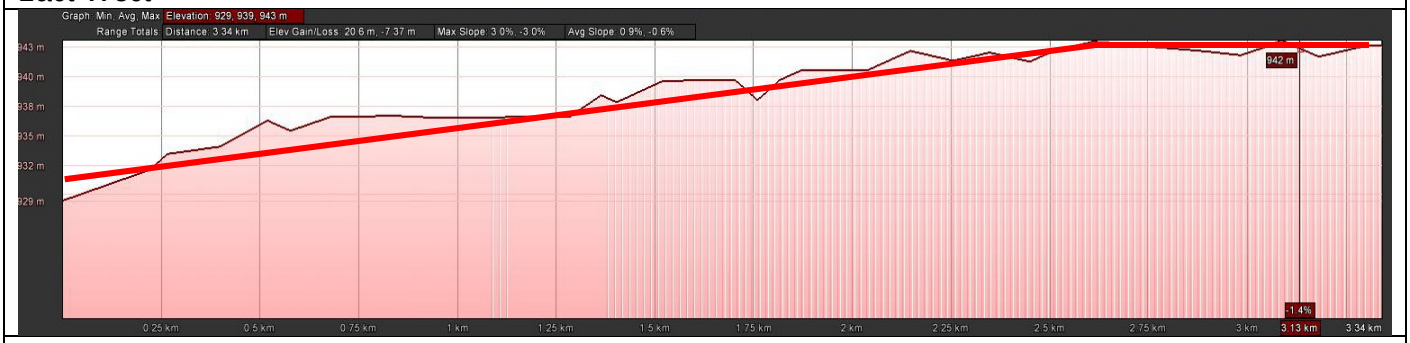


Figure 7-7: East West Slope analysis of the study area.

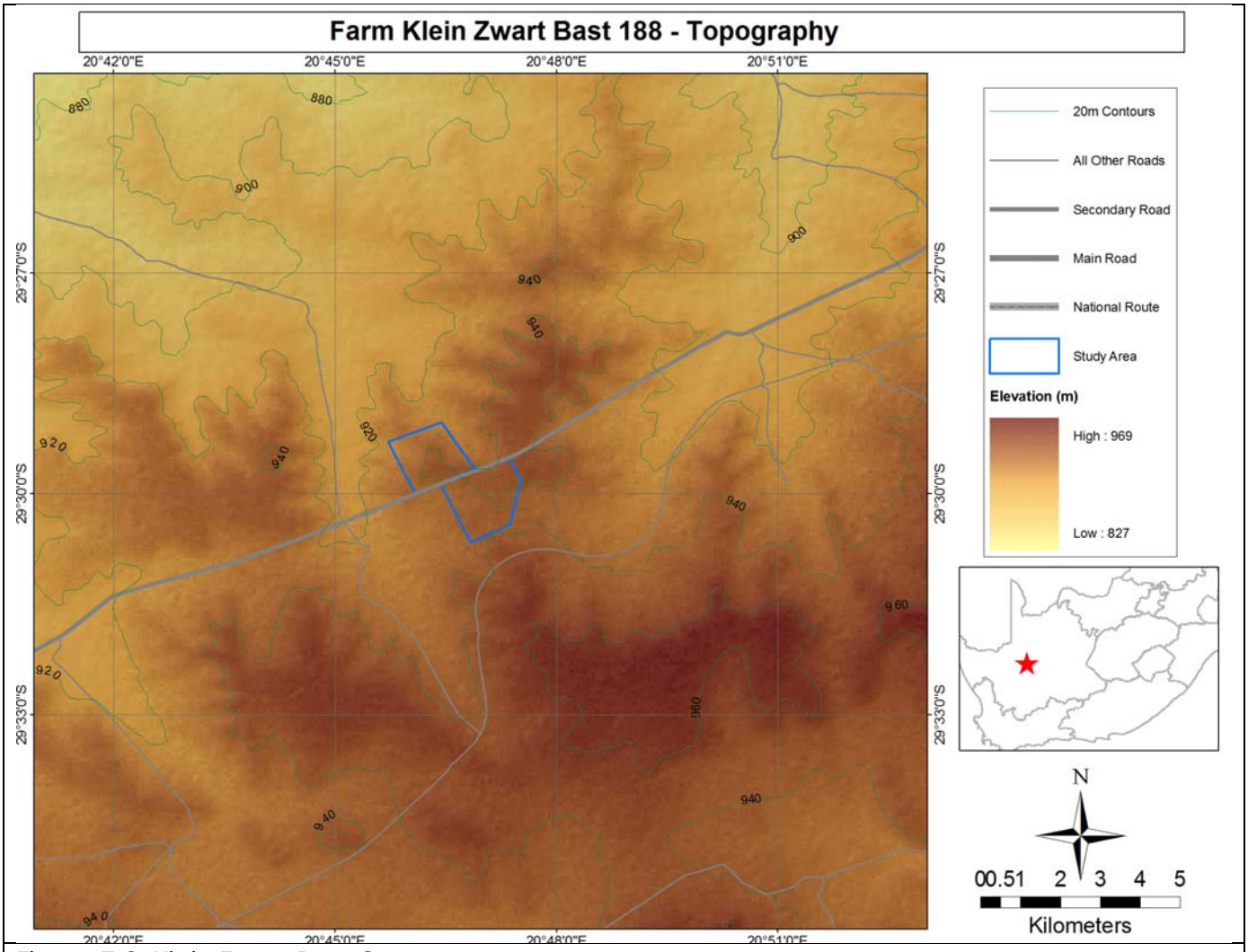


Figure 7-8: Klein Zwart Bast Contours

7.5. GEOLOGY

The study area is underlain by the Dwyka Formation of the Karoo Supergroup. To the north of the site there are extensive outcrops of undifferentiated granite and gneiss.

The regional geology consists of undifferentiated granite and gneiss to the north of the site and is situated directly on the Dwyka Formation (Figure 7-9). The available information indicates that the Karoo Supergroup was formed when sediments filled an intracratonic, foreland basin on Gondwanaland, during the Carboniferous, Permian, Triassic and early Jurassic ages, 300 to 160 million years ago (Truswell, 1970). Since Gondwanaland drifted from polar to tropical latitudes during this period, the sedimentation occurred under

different depositional environments (Tankard et al., 1982). The result is that one can clearly distinguish between different groups of sediments, each with its own physical properties within the Supergroup today (Botha, et. al., 1998).

The most relevant stratigraphic unit to this study area is the Dwyka Formation of the Karoo Supergroup. In its continued drift northwards, Gondwanaland entered a more temperate region during the Permian Age (286-248 Ma). The Dwyka ice cap thus began to melt, leaving a deep basin in the south and incised glacial valleys in the north (Van Bart, 2012).

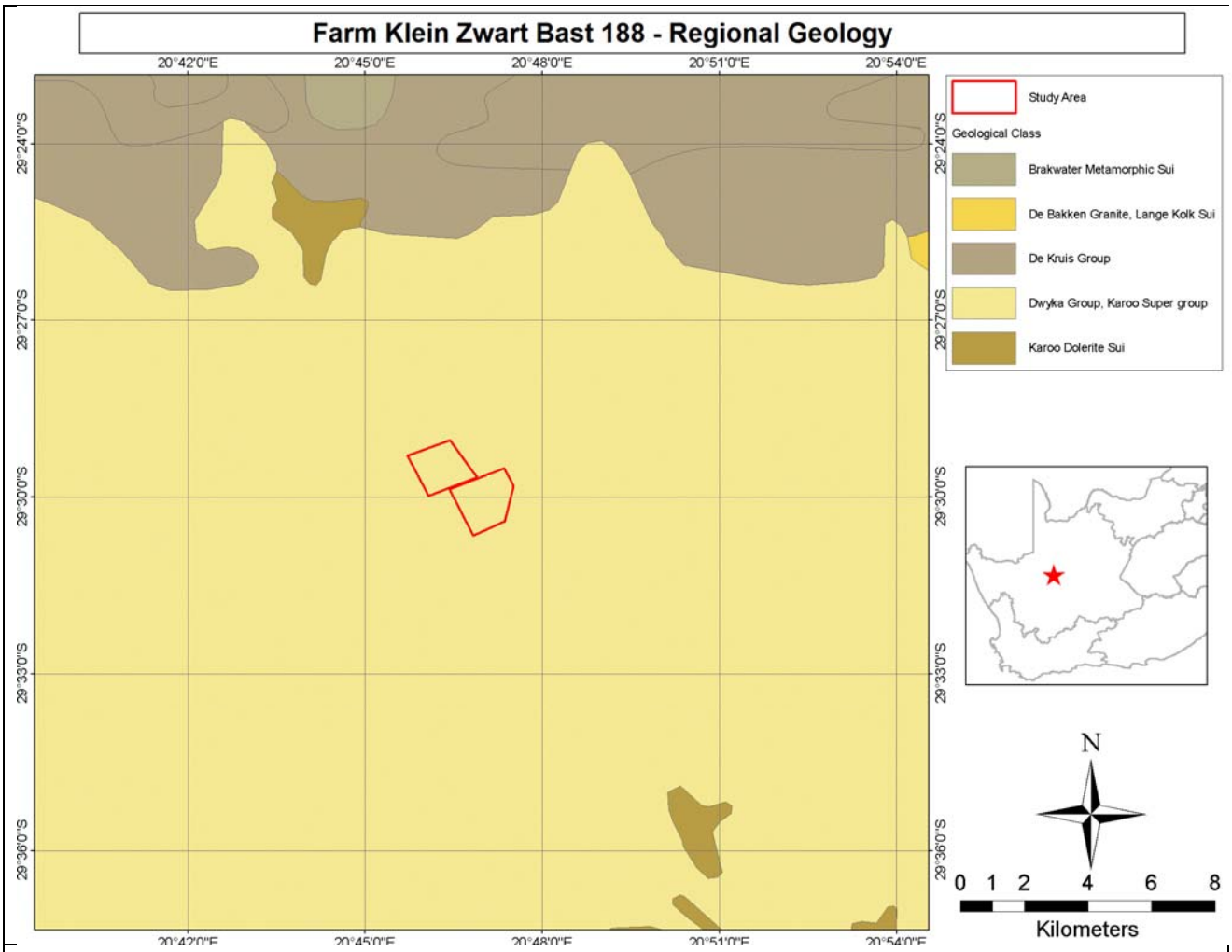


Figure 7-9: General surface geology surrounding the study area.

7.6. SOIL

7.6.1. LAND TYPE DATA

The majority of Portion 1 (remaining extent) of the farm Klein Zwart Bast No. 188 falls within the land type Ah11. A small part of the northern border of the farm falls within land type Ag2, as indicated in Figure 7-11. The area presented by land type Ah11 has a terrain type A2. This indicates that more than 80% of the slopes are less than 8% with a height difference between 30 and 90 metres. The terrain is undulating with a distribution of the terrain units 1 to 5; approximately 45% of this land type is presented by terrain unit 3 with slopes less than 5%. Figure 7-10 represents the elevation of on Portion 1 (remaining extent) of the farm Klein Zwart Bast No. 188

The area presented by land type Ag2 on the northern part of the farm has a terrain type A3 which means more than 80% of the area has long slopes less than 8%. The largest part of this land type has terrain units 3 or 4.

Land type Ah11:

1) Clovelly form soil covers approximately 50% of the farm mainly on terrain unit 3. Soil texture varies from sandy loam to sandy clay loam and depth varies from 150 to 500 mm.
2) Hutton soil form covers approximately 12% of the area mainly on terrain unit 3. Soil depth varies from 150 – 600 mm. In certain area these soils are deeper. Soils are sandy loam to sandy clay loam
3) Glenrosa form covers 10% of the area mainly on terrain units 1 and 3. Soil depth varies from 75 to 300 mm. Soil texture ranges from sandy loam to sandy clay loam.
4) Mispah form covers 10% of the area mainly on terrain units 1 and 3. Soil texture varies from sandy loam to sandy clay loam.
5) Solid rock covers approximately 5% of the area, mainly on terrain unit 5, and is also the main soil depth restriction.

According to the 'Environmental Potential atlas for the Northern Cape- Generalised Soil Description' (Figure 7-11), the soils within the study area are considered to be soils with minimal development, usually shallow on hard or weathered rock, with or without intermittent diverse soils. Lime is indicated as being generally present in part, or most, of the landscape. The general soil depth in the area is <450 mm, with <15% clay content within the topsoil (DEA, et al., 2000).

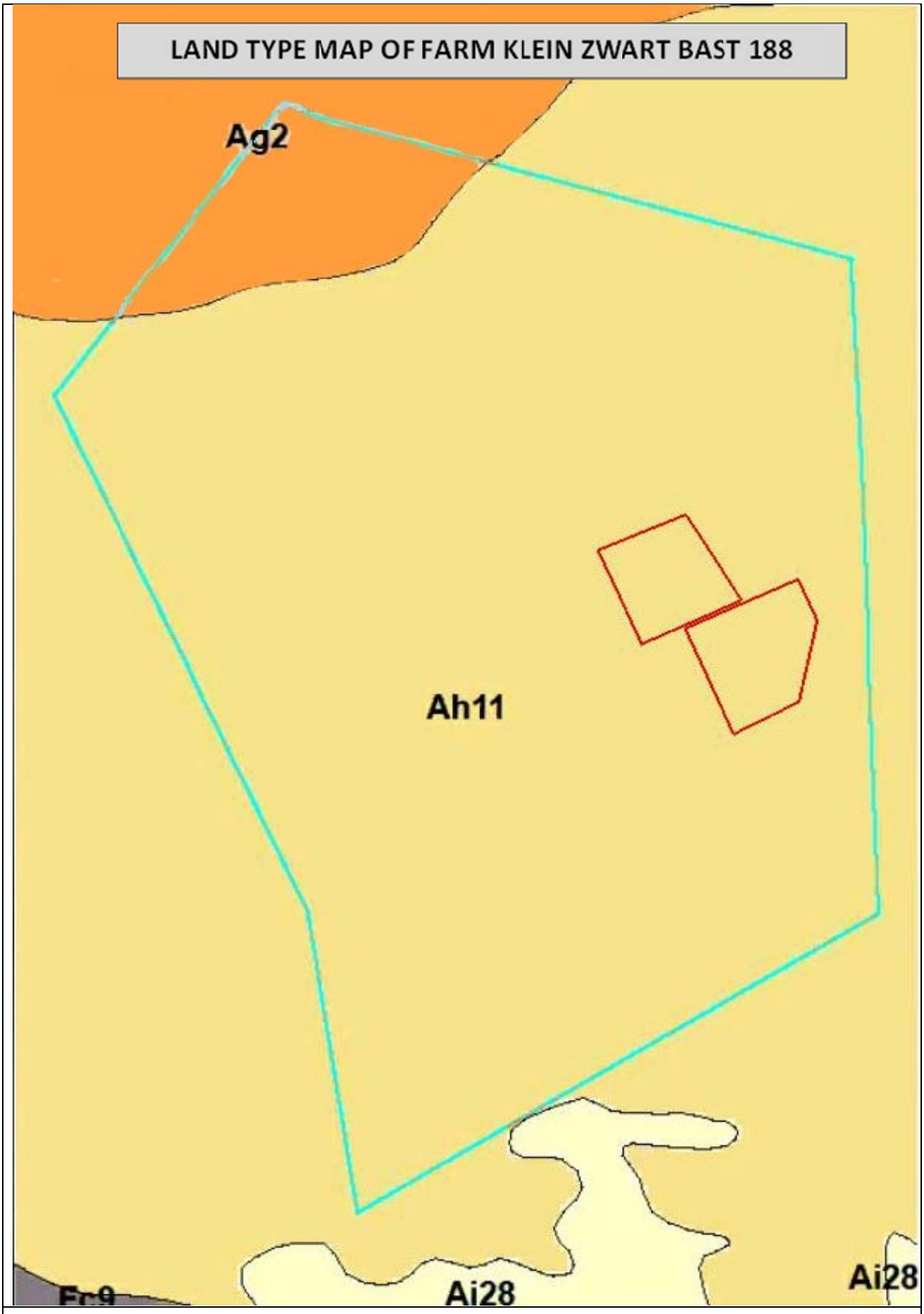


Figure 7-10: Land type map for the farm Klein Zwart Bast

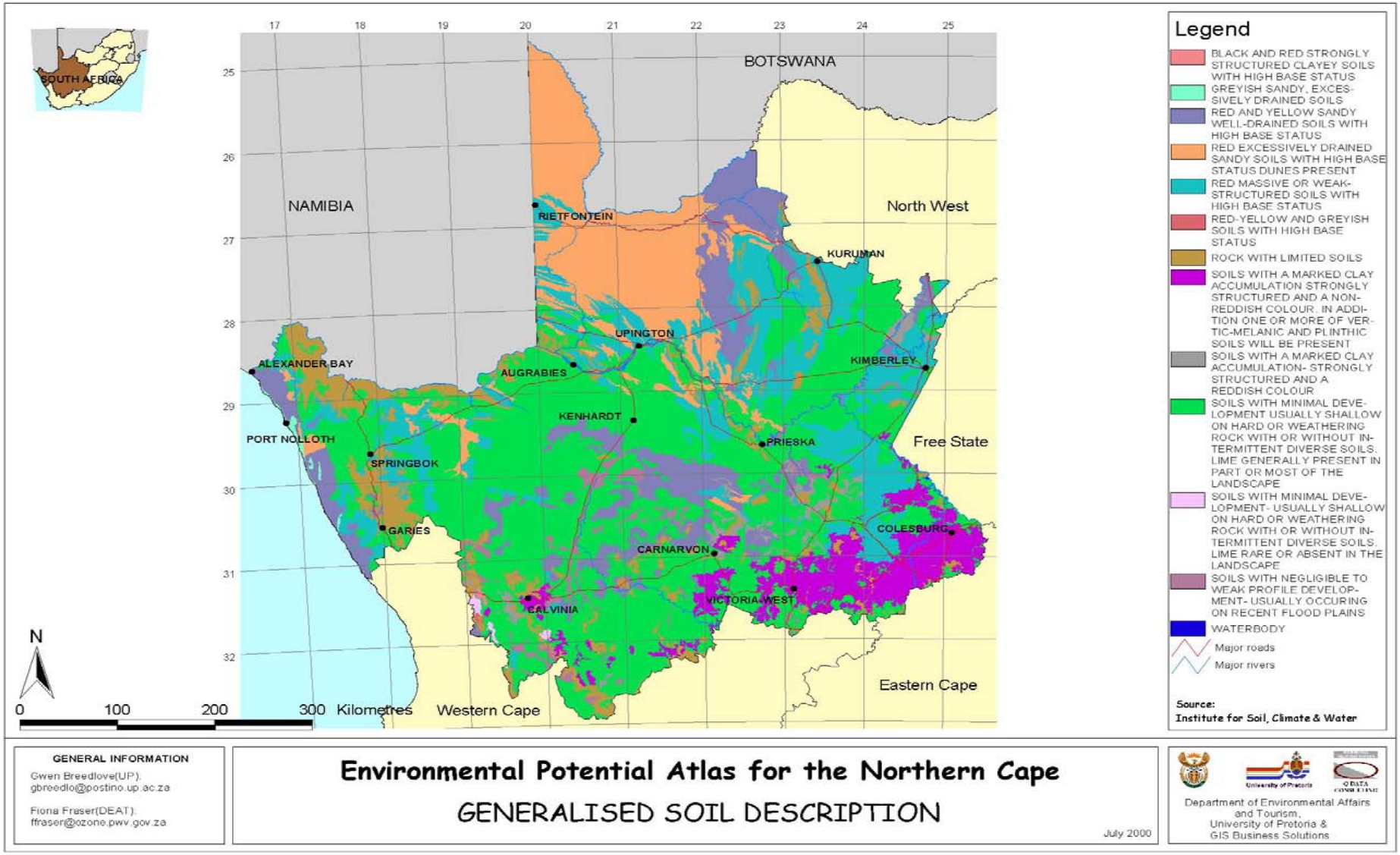


Figure 7-11: General soil description map of the Northern Cape province (http://www.environment.gov.za)

7.7. BIODIVERSITY

Willem de Frey (EcoInfo) was appointed to conduct a baseline biodiversity assessment (refer appendix 7.2). Following recommendations made in his report, Simon Todd (Simon Todd Consultancy) was appointed by ESA to expedite a detailed site faunal and floral assessment (refer to Appendix 7.1) of the site. A concise overview of the findings thereof is presented in the sections that follow.

7.8. BIOME AND BIO REGION

The proposed study area is situated within the Bushmanland Basin Shrubland vegetation type. Approximately 34 000 km^2 of the northern Cape is covered by this vegetation type, which is also the second most extensive vegetation type in South Africa. The site is located on Dwyka tillites and Ecca group consisting of shale's and mudstone. There are also occasional dolerite intrusions and dykes. Soils are largely shallow Mispah and Glenrosa forms with calcrete usually present (Fc land type).

7.8.1. VEGETATION TYPE

The vegetation type contains the Bushmanland endemic *Tridentea dwequensis*, as well as the endemic forb *Cromidon minutum* and the geophytes *Ornithogalum bucornutum* and *O.ovatum* subsp. *oliverorum*. The vegetation type classified as least threatened with approximately 99% still regarded intact. The presence of extensive intermittent river channels as well a large number of endohetic pans is a characteristic of the vegetation type (Todd, 2012).

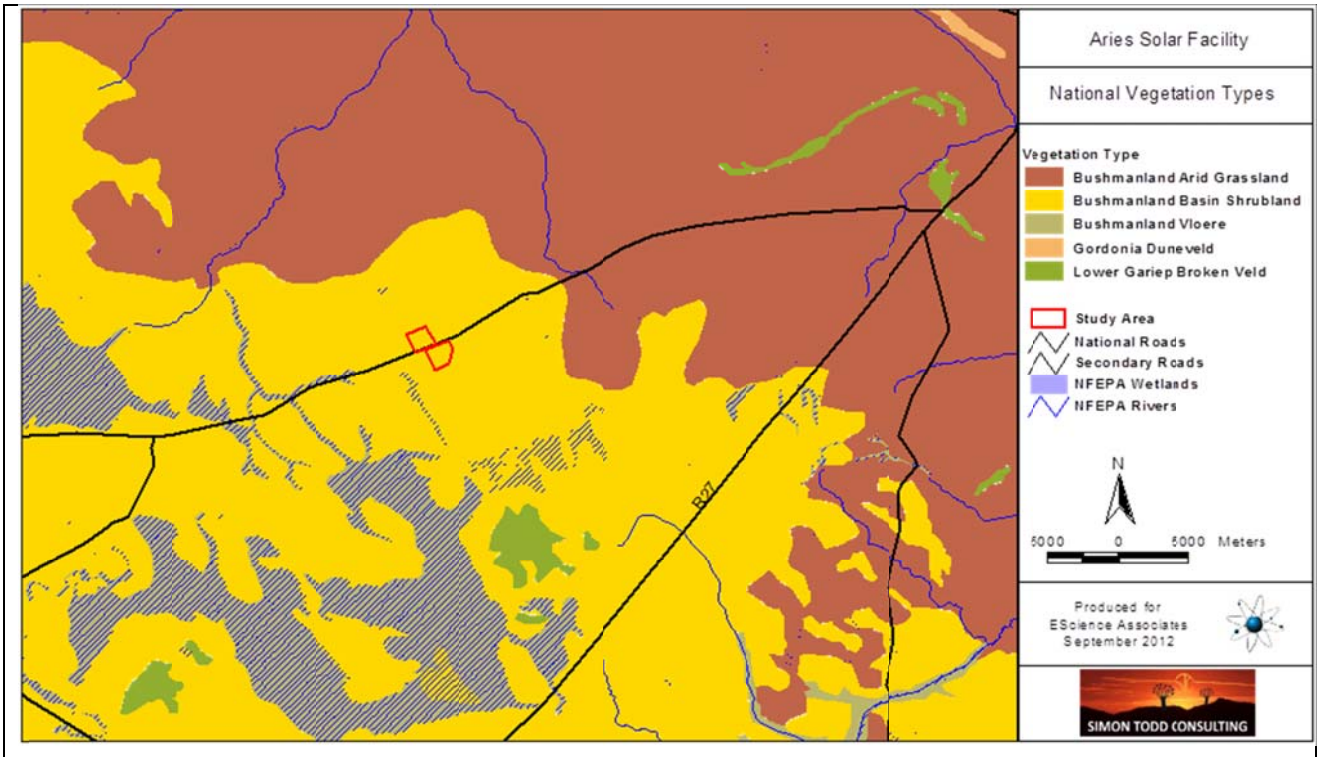


Figure 7-12: Broad-scale overview of the vegetation in and around the proposed Aries Solar Energy Facility.

7.8.1. FLORA

Three different plant communities were identified within the study area; each representing different habitats. The most predominate plant community within the study area is

associated with stony plains (stony grassy, shrubland). This plant community is mainly dominated by low shrubs such as: *Osteospermum armatum, Eriocephalus pauperrimus, Rosenia glandulosa, Pteronia sordida, Salsola tuberculata, Sarcocaulon patersonii, Hermannia spinosa, Lycium cinereum and Zygophyllum chrysopteron.*

Grass species are also located in this vegetation type mainly in areas which receive some run off and include the following species: *Stipagrostis ciliata, Stipagrostis obtusa, Stipagrostis uniplumisi, Fingerhuthia africana, Enneapogon scaber and Aristida adscensionis (Todd, 2012).*

Figure 7-13: Examples of the stony plains plant community type at the Kein Zwart Bast site

The second most dominated plant community present on site is calcrete grassland which mainly occur were calcrete is exposed near the surface, mainly dominated by Stipagrostis species. The diversity of the community is low mainly dominated by grasses: *Stipagrostis ciliata* and *Stipagrostis obtusa* and occasional shrubs such as *Phaeoptilum spinosum* and *Osteospermum armatum.* Animal activity was higher in this community mainly due to diggings by Aardwolf and Aardvark, possibly on account of higher abundance of termites within the area (Todd, 2012).

Figure 7-14: Example of the calcrete grassland plant community

The third most dominated plant community is mainly associated with drainage lines. These areas are dominated by *Rhigozum trichotomum* with occasional clumps of Parkinsonia Africana; other species observed to be common within the drainage areas include Phaeoptilum spinosum, Osteospermum armatum and Berkheya pinnatifida.

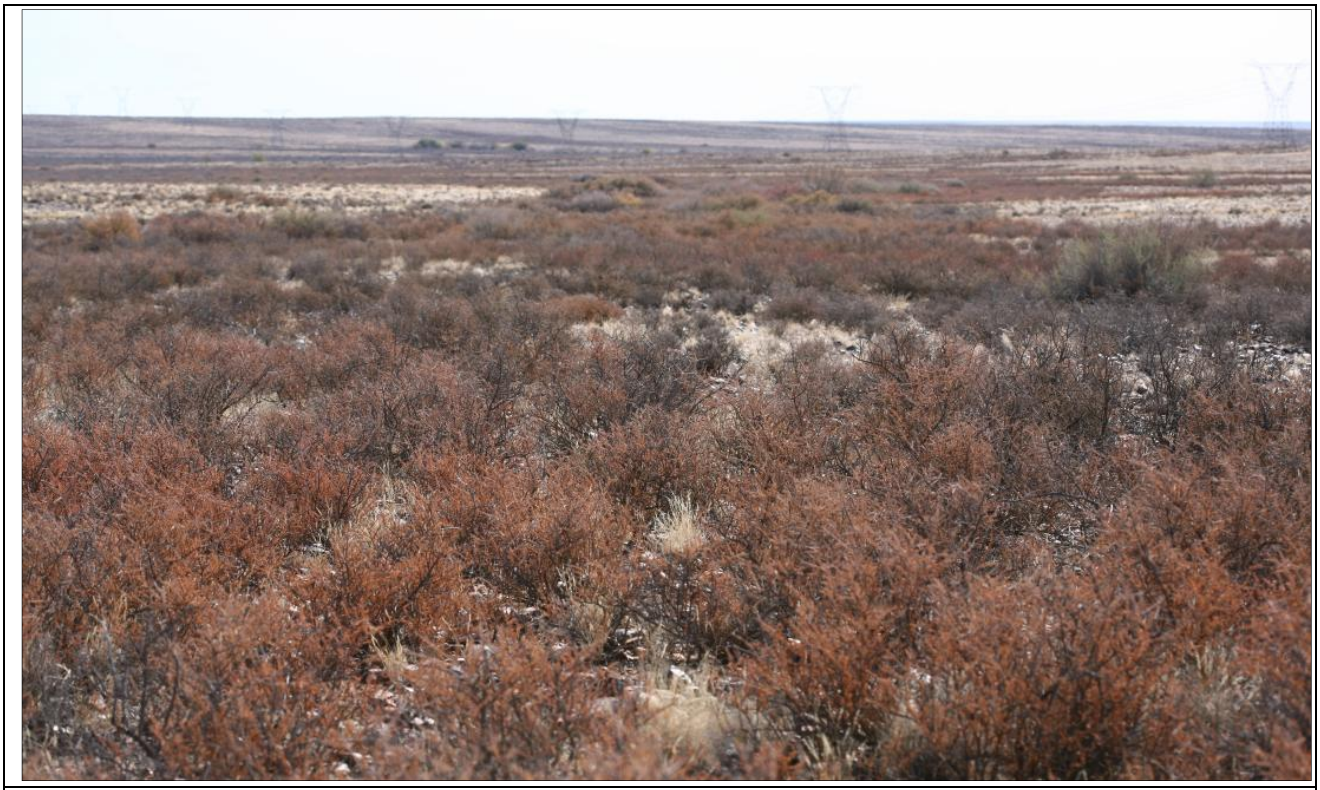


Figure 7-15: Example of drainage line communities.

7.8.1. LISTED FLORAL SPECIES

A total of 135 species have been recorded within the quarter degree squares. The area is considered to have low species richness; the numbers of species identified within the quaternary grids are particularly low indicating that the area has not been well sampled. Only *Hoodia gordonii* (Classified as DDD – Data deficient – insufficient information) and *Aloinopsis luckhoffii* (Classified as DDT – Data deficient – Taxonomically Problematic) are known from the area. Only *Hoodia gordonii* was observed on the site, an individual of which located near the substation.

It should be noted that the site does not fall within a National Protected Areas Expansion Strategy focus area, indicating that it has not been recognized as a potentially important area for future conservation efforts.

The open generic, flat landscape of the study area on a broad scale; means that there is limited ecological gradient and processes likely to operate across the site. The habitat of the study area is widely available and similar (Todd, 2012). The specialist indicated that the potential for broad scale fragmentation or loss of connectivity due to the proposed project is low.

7.8.2. FAUNA

Mammals

The site falls within the distribution range of just over 40 terrestrial mammals and therefore the site is not considered to have a rich faunal community. The site doesn't consist of required habitat and therefore the number of species on site would be considerable less than indicated above. There are no rocky outcrops within the assessment area and therefore the present of species mostly associated within these areas are unlikely to occur on site. The following species are likely to occur within the broader area, but very unlikely to occur at the site: Klipspringer, Rock Hyrax, Dassie Rat, Western Rock Elephant Shrew and Smith's Red Rock Rabbit.

The only antelope which occur on the site are Steenbok (*Raphicerus campestris)* and Common Duiker (*Sylvicapra grimmia)*. Other mammals which can be confirmed as being present at the site based on observations include; Aardvark (*Orycteropus afer)*, Aardwolf (*Proteles cristatus)*, Cape Porcupine (*Hystrix africaeaustralis)*, Bat-Eared Fox (*Otocyon megalotis)* and Stiped Polecat (*Ictonyx striatus)*.

The following species although not observed on the site is likely to occur on site: Caracal *Caracal caracal*, Black-backed Jackal and Cape Fox.

Two listed mammals species could occur, although not observed on site: Black-footed cat(*Felis nigripes*) which is listed as Vulnerable and the Honey Badger *(Mellivora capensis)* which is listed as Endangered in the South African Red Data Book for Mammals, but Least Concern globally, according to the IUCN.

The black footed cat and Honey badger is likely to occur; as it favours a mix of open and densely vegetated areas. These species is largely distributed across the arid and semi-arid areas of South Africa. The development size would not result in a significant amount of habitat loss to the species.

A small mammal community is likely to be dominated by the following species: Four Striped Grass Mouse (*Rhabdomys pumilio),* Namaqua Rock Mouse (*Micaelamys namaquensis),* Cape Short-tailed Gerbil (*Desmodillus auricularis)* and Round-eared Elephant Shrew (*Macroscelides proboscideus)*. Species associated with sandy substrates such as Brants's Whistling Rat *Parotomys brantsii* and *Gerbillurus paeba* will be largely restricted to areas with deeper soils such as along the drainage lines. The overall abundance of small mammals at the site is likely to fluctuate widely from year to year depending on rainfall which regulates small mammal abundance through its effects on plant cover and food availability.

The following bats species are likely to occur on the site: Cape Serotine Bat, Egyptian Free-tailed Bat and Egyptian Slit-faced Bat. All of these bat species is classified as being of least concern in terms on the IUCN red list categories for fauna and flora. The likelihood of them occurring in the area is reduced due to the lack of suitable habitat on site as well directly availability of water. The proposed facility would therefore not directly affect bat communities likely to occur in the area. Please note the potential impact on bats is not considered applicable to the study area. As there are no suitable habitat located within the study area for bat communities the impact is not considered significant and not considered further in this assessment. Recommendation has also been made in section Fauna and Flora regaring installing low UV emitting lighting at the facility as to red

The proposed development apart from direct habitat loss would also potentially disrupt the connectivity of the landscape for mammals, due to erection of fences around the facility. The open landscape and underdevelopment of the area would not significantly reduce the movement of mammals as they would be able to circle past the facility with relevant ease.

Reptiles

The site has a known distribution range of just over 40 reptile species and therefore the site is not considered to have a rich reptile community. The site does not consist of required habitat and therefore the number of species on site would be considerable less. The reptile specialist composition at the site would most likely be as follows:

- Tortoise 1x

- Snakes 14x
- Lizards and skinks16
- Geckos 8x
- Chameleon 1x

This would suggest a reptile fauna composition low in tortoises and snakes species, but rich in lizards, skinks and geckos. This composition of reptile fauna reflect the lack of vegetation cover and structure as the site favours nocturnal and fast moving species adapted to open ground. The following species are unlikely to occur on the site as they favour rocky outcrops Girdled Lizards (*Cordylus* spp). Reptile species that prefers areas of sandy, stony and open ground and more likely to occur on the site. The following species were confirmed on site: Namaqua Sand Lizard *Pedioplanis namaquensis*, Ground Agama *Agama aculeata* and Schinz's Beaked Blind Snake *Rhinotyphlops schinzi*. No species which may occur in the area are listed as endangered, but the Bushmanland Tent Tortoise is protected under provincial ordinance and is also listed under Appendix II of the act of Cites which regulates trade in these species.

The following bats species are likely to occur on the site: Cape Serotine Bat, Egyptian Free-tailed Bat and Egyptian Slit-faced Bat. All of these bat species is classified as being of least concern in terms on the IUCN red list categories for fauna and flora. The likelihood of them occurring in the area is reduced due to the lack of suitable habitat on site as well availability of water. The proposed facility would therefore not directly affect bat communities likely to occur in the area. Please note the potential impact on bats is not considered applicable to the study area. As there are no suitable habitat located within the study area for bat communities the impact is not considered significant and not considered further in this assessment.

The development is expected to impact the direct natural vegetative habitat of the site; some infrastructural components constructed by the development would attract species which utilize such structures such as tubercled geckos (*Chondrodactylus* spp) and agamas (*Agama* spp). Artificial lighting on site would attract insect which in turn attract geckos and other night feeding insectivores (such as bats) to the vicinity of the lights. This could however be easily mitigated by using low-UV emitting lights such as most LEDs.

Amphibians

Given the scarcity of water in the area amphibian species are extremely unlikely to occur on the site. The only species that would be able to tolerate extended dry periods are Karoo Toad *Vandijkophrynus gariepensis*. The only potential breeding habitats at the site appear to be man-made and include small earth dams or livestock watering troughs. The drainage lines represent the most important area for amphibians and provided that these are avoided by the development, the impact on amphibians is not likely to be significant. The greatest threat to amphibians associated with the development is probably chemical and fuel/oil spills related to the construction activities, rather than the presence of the development in the long-term.

Avifauna

Avifaunal studies undertaken around the site identified high number of bird species. The following species has been recorded by specialist and therefore very likely to occur within the study area. Rock Kestrei, Namaqua dove, Pale Chanting Goshawk, Southern black Korhaan, Pied Crow, Double Banded courser, Sociable Weaver, Namaqua Sandgrouse, Ant Eating Chat, White Browed Sparrow Weaver, Rosy Faced Lovebird, Ludwigs (*Neotis ludwigii*)) bustards and Kori (*Ardeotis kon*). Some other endemic bird species likely to occur in the larger Eco region are the Sclater's lank and furruginous lank (Vulnerable). The

Martial and Tawny eagles' species of the Nama Karoo is also likely to occur (De Klerk, et al., 2012).

7.8.1. EXOTIC AND INVASIVE SPECIES

Alien species abundance at the site was low and alien plant species observed at the site include scattered individuals of *Prosopis glandulosa* and occasional *Salsola kali* in disturbed locations.

7.9. SURFACE HYDROLOGY

The proposed study area is located within a very dry, warm climate mostly associated with deserts and receives very little annual rainfall. It is located within Kalahari Basin in the Northern Cape Province. No surface water whatsoever occurs within the vicinity of the site. There are no rivers or surface streams in close proximity to the study area. The drainage channels that do exist in the vicinity are almost perpetually dry, only conveying water during the odd occasion when it rains in the area. In most cases with the drainage channels around the study area, these streams also only flow for a limited distance before they merely disappear into the Kalahari Basin sand (Krige, 2012).

The study area is located in quaternary catchment D53D, within the Lower Orange River Water Management Area. The dry Tuins River drains quaternary catchment D53D. A second dry river, the Graafwaters River, drains the eastern parts of this quaternary catchment, but falls outside the drainage area of the Aries solar plant. The difference between a dry river and a non-perennial river is that a non-perennial river does not transport water during dry season, but often transports water during the rainy season. A dry river never has water for long periods of time (even decades) and only transports water for few days during exceptional rainfall events. It is considered that all watercourses in quaternary catchment D53D are dry streams (Krige, 2012).

A dry watercourse, the Klein Zwartbas River, originates immediately to the north of the study area on the farm KleinZwart Bast 188 and flows in a generally northwesterly direction. A second dry watercourse, the Groot Zwartbas River originates on the farm, Groot Zwart Bast 189 and flows in a generally northerly direction. The confluence of the Klein and Groot Zwartbas Rivers on the farm, De Tuin Zuid 163, marks the beginning of the Tuins River, also a dry watercourse (Krige, 2012).

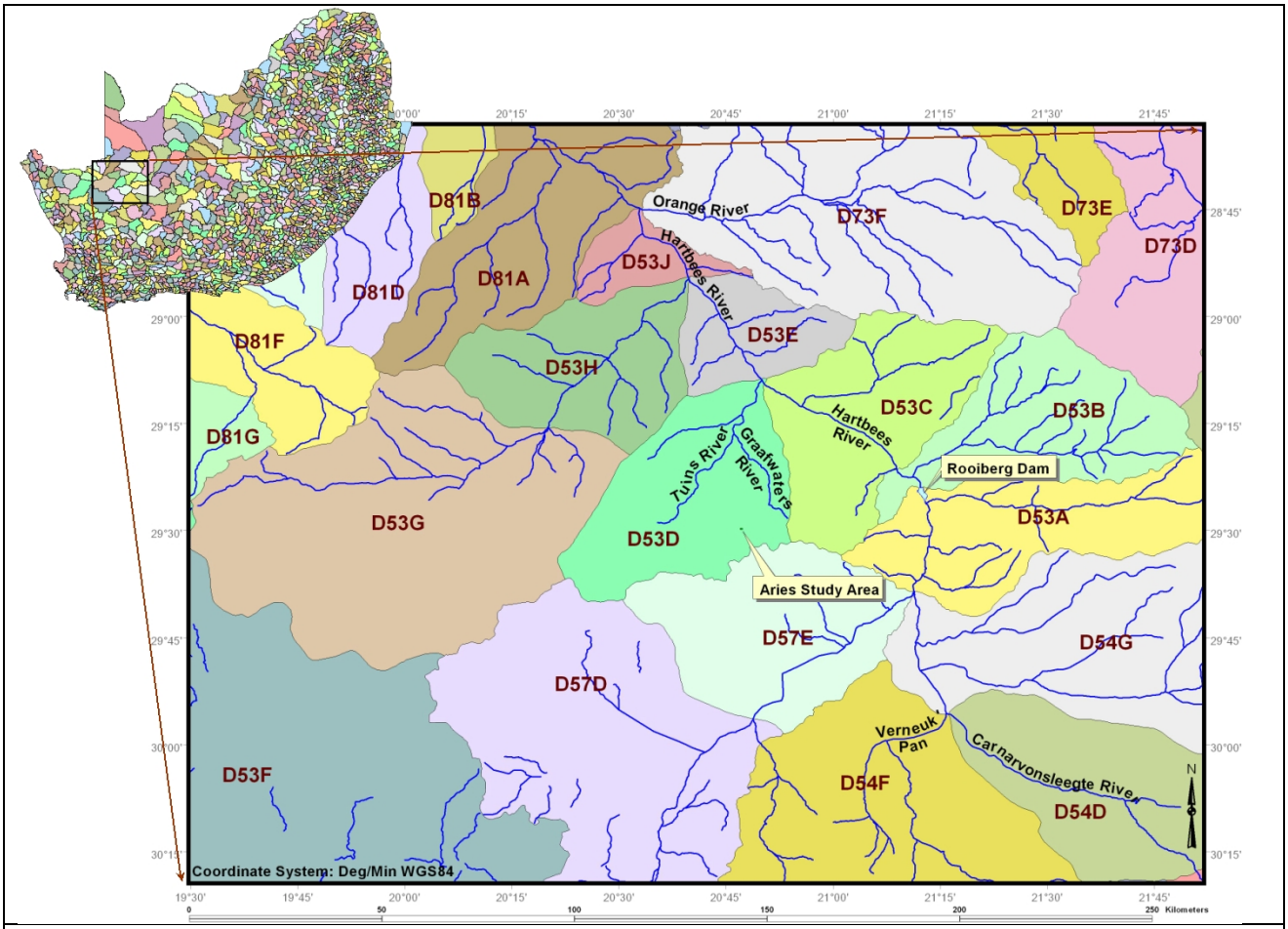


Figure 7-16: Map showing the quaternary catchments and major rivers

7.9.1. DRAINAGE DENSITY OF STUDY AREA

There are no perennial streams in the vicinity of the site. The nearest perennial river is the Orange River, some +/- 78 km north of the study area. The only source of water within the vicinity of the site is therefore groundwater. (Krige, 2012)

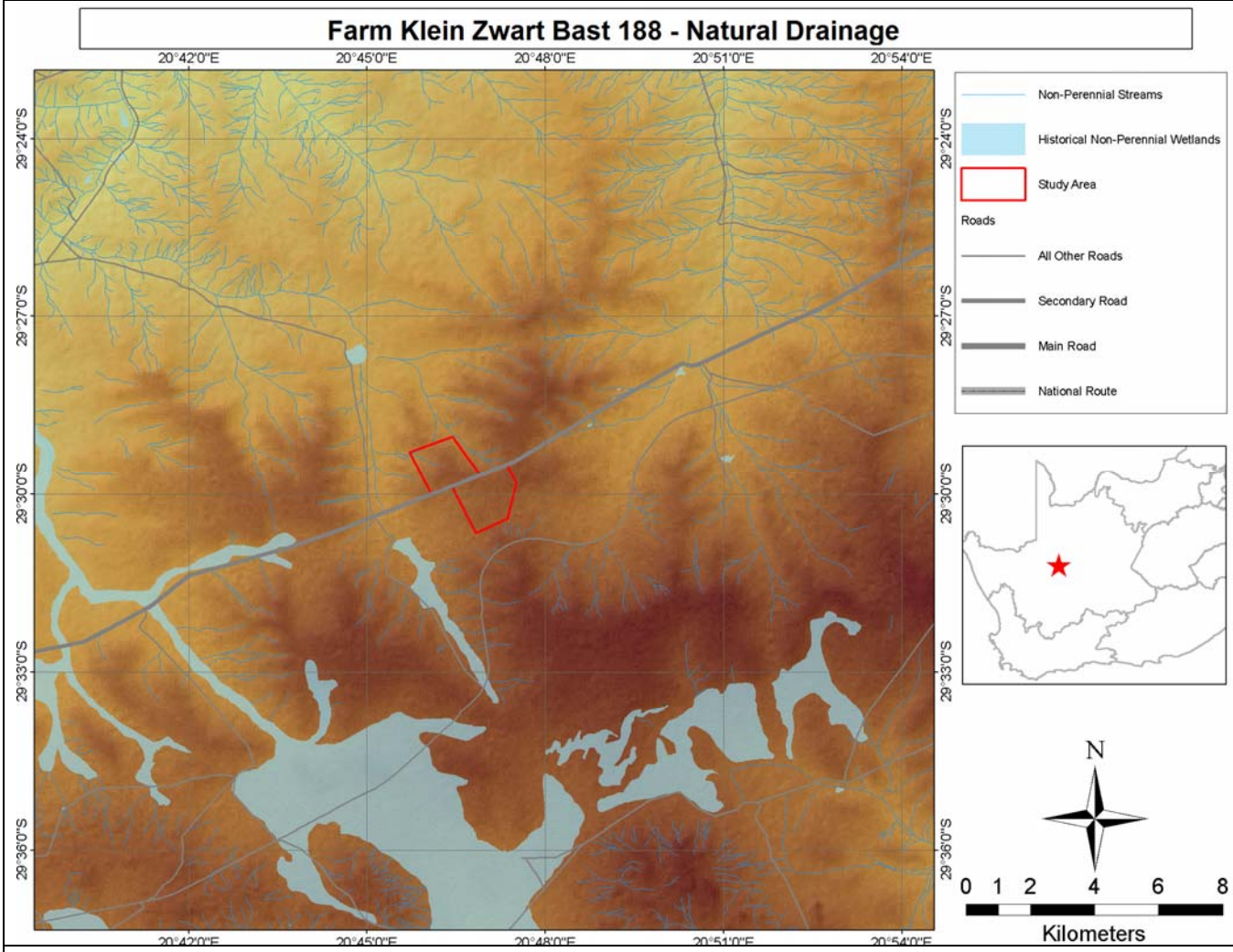


Figure 7-17: Non perennial drainage lines of the study area and surroundings

7.10. GROUNDWATER

Karoo rock types are generally dived into two distinct aquifers, namely a deeper fractured aquifer and shallow weathered. This is mainly based on the underlying geology.

Dwyka group is primarily characterised by porosity that does not allow significant groundwater flow into deeper fractured aquifers, except where porosity has been increased by subsequent secondary structures. Mostly dolerite sills, dykes and faults are associated with groundwater flow in fractured aquifers in the area. Generally aquifer yields in the region would be approximately 0.5 L/s, however occasionally high yielding aquifers may be intersected. The general quality of water in the fractured aquifers is of poorer quality than the weathered aquifer due mostly to the slower rate of recharge and higher concentrations of salts.

Therefore the main aquifer can only be developed as a result of geological structures such as fault zones, mainly through secondary porosity. The Department of Water Affairs and Forestry (1999) classified the underlying aquifer as type b2, meaning that the aquifer is fractured with average yields between 0.1 – 0.5 L/s (Van Bart, 2012).

Shallow weathered aquifers are mostly recharged by rainfall. More than often, these aquifers are perched mainly due to impermeable shale horizons that may be artesian in places. Recharge is estimated at 3% of the annual precipitation in the region. Downward filtration of rainwater into the aquifer is most often constricted by the numerous shale

layers. Between fresh and weathered bedrock is normally where water accumulates. Borehole yields are low due to low aquifer parameters of the aquifer material (Van Bart, 2012).

As the site falls within quaternary catchment D53D, it is estimated to have a 1.5% annual recharge of mean annual precipitation (154 mm per/annum). The quaternary catchment has a surface area of approximately 230 000 000 m^2, groundwater infiltration therefore equates to 529 000 m^3 per year (Van Bart, 2012).

Topographic elevation and groundwater elevation has strong relationship in Karoo aquifers. The predominant groundwater within the study area flows north easterly/easterly.

7.11. NOISE

The area is generally characterized by farming and the ambient noise levels are very low. Vehicular traffic on the gravel dirt road is the only source of increase in ambient noise levels in the area. There are therefore no major contributors to the static noise levels in the area.

7.12. VISUAL AESTHETICS

The general appearance of the farm KleinZwart Bast is dominated by largely unspoilt natural Bushmanland Basin Shrubland vegetation on relatively flat landscapes somewhat degraded by grazing. The general "sense of place" (Figure 7-19) of the area is a particular kind of openness and of generally unspoilt natural beauty. As the area is dominated by the open land of the Karoo, the visual and aesthetic feeling of the area is pleasant. There is however some cultural modification/visual intrusion existing around the proposed site: various power lines going into the substation as well the Aries substation itself (Figure 7-18)(Geldenhuys, 2012).

Figure 7-18: Cultural Modification & Adjacent Scenery (Geldenhuys, 2012)

Figure 7-19: Sense of place photos (Geldenhuys, 2012).

7.13. TRAFFIC

The road network around the subject Photovoltaic Power Plant is displayed in Figure 7-20 below and consists of the National Road (R27) and a Divisional Road (P2986). The National Road – R27, extends from N7 at Vredendal (in the South) to N14 at Keimoes (in the North), passing through a number of towns including Brandvlei and Kenhardt. The R27 road is approximately 6 m wide and is located within a 45 m wide road reserve. The speed limit of the road is 120 km/h. Since this is an important rural road, it will be classified as a Category B road, thus in accordance with TRH-4, the road would have been designed for a minimum daily traffic exceeding 1000 (equivalent vehicles units) (Schwartz, 2012).

The Divisional Road – P2936 is a desolated gravel road which extends from the R27 (approximately 8 km south of Kenhardt) to the R358 (approximately 26 km south of Pofadder). This is a single carriageway gravel road. The condition of this road is however considered good. The road is approximately 10 m wide and located within a road reserve that varies between 20 to 50 m wide. The design criterion for this road is not known. However, since this is a gravel rural road, it will be classified as a Category D road. Thus in accordance with TRH-4, the road would have been designed for a maximum daily traffic not exceeding 500 (equivalent vehicles units) (Schwartz, 2012).

Figure 7-20: Road network surrounding the site

7.14. ARCHAEOLOGY, HERITAGE & CULTURE

An assessment of the initial 20 hectare site was undertaken in 2011. This study recorded a number of sites, features and objects of archaeological nature. The assessment of the expansion of the facility resulted in an additional 2012 assessment to be undertaken. This study identified some sites located in similar areas. To identify possible archaeological objects, features and sites that could possibly be unearthed and disturbed during the proposed development, it is necessary to give a background regarding the different phases of human history and the history and archaeology of the area in general.

7.14.1. STONE AGE

The Stone Age is the period in human history when lithic (stone) material was mainly used to produce tools (Coertze & Coertze 1996: 293). In South Africa the Stone Age can be divided into three periods. It is however important to note that dates are relative and only provide a broad framework for interpretation. The division for the Stone Age according to Korsman & Meyer (1999: 93-94) is as follows:

Early Stone Age (ESA) 2 million – 150 000 years ago
Middle Stone Age (MSA) 150 000 – 30 000 years ago
Late Stone Age (LSA) 40 000 years ago – 1850 - A.D.

Morris indicates that in the vicinity of Olywen Kolk and Klein Zwart Bast, the farms at the southwestern-most end of the proposed line, the terrain is characterized by Dwyka tillite, known to be a favoured source of raw materials in Early Stone Age times. He does indicate that in the vicinity of the substation several artifacts were noted amidst the strewn stones that typify the surfaces here (Morris 2006: 6).

The Northern Cape is one of the regions in South Africa (and probably world-wide) with the richest Stone Age scatters on the landscape, yet it remains poorly recorded and understood because so few deep-time stratified sequences have been excavated and/or dated. Arguably, the most significant phase in the sequence is the Early to Middle Stone Age transitional phase that may include the Fauresmith Industry (Lombard 2012: 4).

7.14.2. IRON AGE

The Iron Age is the name given to the period of human history when metal was mainly used to produce artefacts (Coertze & Coertze 1996: 346). The expansion of early farmers, who, among other things, cultivated crops, raised livestock, made ceramic containers (pots), mined ore and smelted metals, occurred in this area between AD 400 and AD 1100 and brought the Early Iron Age to South Africa. They settled in semi-permanent villages (De Jong 2010: 35).

This later phase, termed the Late Iron Age (LIA), was accompanied by extensive stonewalled settlements, such as the Thlaping capital Dithakong, 40 km north of Kuruman (Pelser, 2012).

Sotho-Tswana and Nguni societies, the descendants of the LIA mixed farming communities, found the region already sparsely inhabited by the Late Stone Age (LSA) Khoisan groups, the so-called 'first people'. Most of them were eventually assimilated by LIA communities and only a few managed to survive, such as the Korana and Griqua. This period of contact is sometimes known as the Ceramic Late Stone Age and is represented by sites such as the Blinkklipkop specularite mine near Postmasburg and finds at the Kathu Pan (De Jong 2010: 36).

No known Iron Age archaeological sites are located in the area.

7.14.3. HISTORICAL AGE

Factors such as population expansion, increasing pressure on natural resources, the emergence of power blocs, attempts to control trade and penetration by Griquas, Korana and white communities from the south-west resulted in a period of instability in Southern Africa that began in the late 18th century and effectively ended with the settlement of white farmers in the interior. This period, known as the *difaqane* or *Mfecane*, also affected the Northern Cape Province, although at a relatively late stage compared to the rest of Southern Africa. Here, the period of instability, beginning in the mid-1820s, was triggered by the incursion of displaced refugees associated with the Tlokwa, Fokeng, Hlakwana and Phuting tribal groups (Pelser, 2012).

The Difaqane coincided with the penetration of the interior of South Africa by white traders, hunters, explorers and missionaries. The first was PJ Truter's and William Somerville's journey of 1801, which reached Dithakong at Kuruman. They were followed by Cowan, Donovan, Burchell and Campbell and their journey resulted in the establishment of a London Mission Society station near Kuruman in 1817 by James Read (Pelser, 2012).

The Great Trek of the Boers from the Cape in 1836 brought large numbers of Voortrekkers up to the borders of large regions known as Bechuanaland and Griqualand West, thereby coming into conflict with many Tswana groups and also the missionaries of the London Mission Society. The conflict between Boer and Tswana communities escalated in the 1860s and 1870s when the Korana and Griqua communities became involved and later also the British government. The conflict mainly centered on land claims by various communities. For decades the western border of the Transvaal Boer republic was not fixed. Only through arbitration (the Keate Arbitration), triggered by the discovery of gold

at Tati (1866) and diamonds at Hopetown (1867) was part of the western border finally determined in 1871. Ten years later, the Pretoria Convention fixed the entire western border, thereby finally excluding Bechuanaland and Griqualand West from Boer domination (De Jong 2010: 36).

7.15. PALEONTOLOGICAL RESEARCH

The site is underplayed by mostly Permo-Carboniferous diamictites of the Dwyka Group, Karoo Supergroup. Quaternary alluvial deposits cover diamictites along river drainage lines. It is very unlikely that fossils are contained within Dwyka diamictites; however there is small possibility that quaternary fossils could be found in unconsolidated alluvial deposits. It is therefore very unlikely that the proposed development would impact the paleontological heritage. If fossils are however uncovered, a professional palaeontologist must be brought to the site to investigate. Please refer to the paleontological assessment for the site (Appendix 7.5)

7.16. SOCIO-ECONOMIC BASELINE SUMMARY

The Northern Cape is the province with the smallest economy. It is situated towards the west of the country. The province shares international borders with Namibia and Botswana and provincial boundaries with the North West, Free State, Western Cape and Eastern Cape provinces. The Syanda District Municipality (SDM) is situated in the upper central Northern of South Africa.

7.16.1. ECONOMIC PROFILE

The Kai !Garib local Municipality population is considered to earn less than R1800 per month. About 22% of the local population is dependent completely on social grants and 24% of the population has no income whatsoever. This by itself has negative influences on the payment of services delivery. The service subsidy scheme subsidizes around 2706 households. Employment in the area is mostly in the agricultural sector. The high numbers of people not completing school is a major concern even though there has been a slight increase in people attending tertiary education. 12% of the labour force is currently unemployed in the local municipality.

The major factors contributing to negative economic condition in the area are:

- High teenage pregnancies rates
- HIV/AIDS (approximately 8.5% of the population known is HIV+)
- Increased alcohol and drug abuse
- High levels of unemployment
- Increase in crimes linked to drug and alcohol abuse

The Kai !Garib Local Municipality employment data indicates that 57.8% of the population between ages 15 and 56 are employed with a relative unemployment rate of 12%. Data obtained from the 2001 Census indicated that 48.8% of the population in the local municipality has no formal income and that 93.7% of the population earns less than R800 a month (Barbour & Rogatschnig, 2011).

7.16.2. DEMOGRAPHIC PROFILE

The Kai !Garib Municipality has a population of 55 501 people, and 17 389 households are serviced by the municipality. Remarkably, according to the integrated development plan, the population has +/-50% male and +/-50% female residence. The potential for economic growth exists as 56.5% of the local population falls within the youth category (IDP. 2011).

The population density in the Northern Cape region is generally low and is frequently congregated around towns. The surrounding residential population is largely limited to land owners and farm labours. The towns of Augrabies, Keimoes and Kakamas are the only centres of economic activity in the area, the reason for this being the proximity of the Orange River, which supports the agricultural economy by providing water for crop irrigation. The Augrabies National Park is also a famous tourist attraction in the area. The population of the Siyanda DM is approximately 200 000 people with a population density of 1.7 per square kilometre. The demographics of the area are approximately 52.2% male and 47.8% female; however the district is very scarcely populated due its predominantly agricultural characteristic. In the provincial context the Northern Cape only accommodates approximately 1.8% of the population of South Africa. The region's population is considered mostly young with 57.7% of inhabitants being younger than 30 years (Barbour & Rogatschnig, 2011).

The population in the local Management Area comprised approximately 56 501 in 2007, the general demographics in the area are as follows:

White	7.8%
Coloured	66.5%
Black	22.2%

7.16.3. WATER SUPPLY

All domestic water needs are sourced from the Pelladrift regional water scheme. This water scheme supplies most water to the Kai! Garib Local municipality as well the Black Mountain Mine.

7.16.4. POWER SUPPLY

The majority of electrical supply is sourced from Eskom in the area.

8. IMPACT ASSESSMENT METHODOLOGY

The following criteria and methodology are proposed to determine the significance of environmental impacts caused by the proposed project.

8.1. TYPE OF IMPACTS

Potential environmental impacts may either have a positive or negative effect on the environment, and can in general be categorised as follows:

a) Direct/Primary Impacts
Primary impacts are caused directly by the activity and generally occur at the same time and place as the activity.
b) Indirect/Secondary Impacts
Secondary impacts induce changes that may occur as a result of the activity. These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken.
c) Cumulative Impacts
Cumulative impacts are those that result from the incremental impacts of the proposed activity on common resources when added to the impacts of the other past, present or reasonably foreseeable future activities. Cumulative impacts can occur from the collective impacts of individual minor actions over a period of time, and can include both direct and indirect impacts.

8.2. DETERMINING SIGNIFICANCE

The following criteria will be used to determine the significance of an impact. The scores associated with each of the levels within each criterion are indicated in brackets after each description [like this].

Nature

Nature (N) considers whether the impact is:
- positive [- ¼]
- negative [+1].

Extent

- Extent (E) considers whether the impact will occur:
- on site [1]
- locally: within the vicinity of the site [2]
- regionally: within the local municipality [3]
- provincially: across the province [4]
- nationally or internationally [5].

Duration

Duration (D) considers whether the impact will be:
- very short term: a matter of days or less [1]
- short term: a matter of weeks to months [2]
- medium term: up to a year or two [3]
- long term: up to 10 years [4]
- very long term, or permanent: 10 years or longer [5].

Intensity

Intensity (I) considers whether the impact will be:

- negligible: there is an impact on the environment, but it is negligible, having no discernable effect [1]
- minor: the impact alters the environment in such a way that the natural processes or functions are hardly affected; the system does however, become more sensitive to other impacts [2]
- moderate: the environment is altered, but function and process continue, albeit in a modified way; the system is stressed but manages to continue, although not with the same strength as before [3]
- major: the disturbance to the environment is enough to disrupt functions or processes, resulting in reduced diversity; the system has been damaged and is no longer what it used to be, but there are still remaining functions; the system will probably decline further without positive intervention [4]
- severe: the disturbance to the environment destroys certain aspects and damages all others; the system is totally out of balance and will collapse without major intervention or rehabilitation [5].

Probability

Probability (P) considers whether the impact will be:

- unlikely: the possibility of the impact occurring is very low, due either to the circumstances, design or experience [1]
- likely: there is a possibility that the impact will occur, to the extent that provisions must be made for it [2]
- very likely: the impact will probably occur, but it is not certain [3]
- definite: the impact will occur regardless of any prevention plans, and only mitigation can be used to manage the impact [4].

Mitigation or Enhancement

Mitigation (M) is about eliminating, minimising or compensating for negative impacts, whereas enhancement (H) magnifies project benefits. This factor considers whether –

A negative impact can be mitigated:

- unmitigated: no mitigation is possible or planned [1]
- slightly mitigated: a small reduction in the impact is likely [2]
- moderately mitigated: the impact can be substantially mitigated, but the residual impact is still noticeable or significant (relative to the original impact) [3]
- well mitigated: the impact can be mostly mitigated and the residual impact is negligible or minor [4]

A positive impact can be enhanced:
un-enhanced: no enhancement is possible or planned [1]

- slightly enhanced: a small enhancement in the benefit is possible [2]
- moderately enhanced: a noticeable enhancement is possible, which will increase the quantity or quality of the benefit in a significant way [3]
- well enhanced: the benefit can be substantially enhanced to reach a far greater number of receptors or recipients and/or be of a much higher quality than the original benefit [4].

Reversibility

Reversibility (R) considers whether an impact is:

- irreversible: no amount of time or money will allow the impact to be substantially reversed [1]
- slightly reversible: the impact is not easy to reverse and will require much effort, taken immediately after the impact, and even then, the final result will not match the original environment prior to the impact [2]
- moderately reversible: much of the impact can be reversed, but action will have to be taken within a certain time and the amount of effort will be significant in order to achieve a fair degree of rehabilitation [3]
- mostly reversible: the impact can mostly be reversed, although if the duration of the impact is too long, it may make the rehabilitation less successful, but otherwise a satisfactory degree of rehabilitation can generally be achieved quite easily [4].

8.3. CALCULATING IMPACT SIGNIFICANCE

The table below summarises the scoring for all the criteria.

Table 8-1: Scoring for Significance Criteria

CRITERION	SCORES					
	- ¼	1	2	3	4	5
N-nature	positive	negative	-	-	-	-
E-extent	-	site	local	regional	provincial	national
D-duration	-	very short	short	moderate	long	very long
I-intensity	-	negligible	minor	moderate	major	severe
P-probability	-	very unlikely	unlikely	likely	very likely	-
M-mitigation	-	none	slight	moderate	good	-
H-enhancement	-	none	slight	moderate	good	-
R-reversibility	-	none	slight	moderate	good	-

Impact significance is a net result of all the above criteria. The formula proposed to calculate impact significance (S) is:

For a negative impact: $S = N \times (E+D) \times I \times P \div ½(M+R)$; and
For a positive impact: $S = N \times (E+D) \times I \times P \times (H)$.

Negative impacts score from 2 to 200. Positive impacts score from – ½ to -200.

8.4. UNDERSTANDING IMPACT SIGNIFICANCE

The following is a guide to interpreting the final scores of an impact (for negative impacts):

Table 8-2: Final Significance Scoring

Final score (S)	Impact significance	
0 – 10	Negligible	the impact should cause no real damage to the environment, except where it has the opportunity to contribute to cumulative impacts
10 – 20	Low	the impact will be noticeable but should be localized or occur over a limited time period and not cause permanent or unacceptable changes; it should be addressed in an EMP and managed appropriately

Table 8-2: Final Significance Scoring		
Final score (S)	**Impact significance**	
20 – 50	Moderate	the impact is significant and will affect the integrity of the environment; effort must be made to mitigate and reverse this impact; in addition the project benefits must be shown to outweigh the impact
50 – 100	High	the impact will affect the environment to such an extent that permanent damage is likely and recovery will be slow and difficult; the impact is unacceptable without real mitigation or reversal plans; project benefits must be proven to be very substantial; the approval of the project will be in jeopardy if this impact cannot be addressed
100 – 200	Severe	the impact will result in large, permanent and severe impacts, such as local species extinctions, minor human migrations or local economic collapses; even projects with major benefits may not go ahead with this level of impact; project alternatives that are substantially different should be looked at, otherwise the project should not be approved

Two examples will help illustrate this system:

SCENARIO 1 – An industrial facility proposes discharging effluent containing a high salt content into a nearby stream. These salts will cause temporary problems for the ecosystem, but are washed downstream, diluted and will have no long term effects. The short term damage to the stream can be reversed fairly easily, but only if the ecosystem has not been seriously damaged by the salts over a long time. A mitigation measure is also proposed whereby during low flow periods (dry season) a pulse of clean water is discharged into the stream after the saline effluent, diluting the salts and pushing them downstream faster, so that the salts become so dilute as to have little or no effect.

From this scenario, the criteria are:

- nature = negative = 1
- extent = local = 2
- duration = medium = 3
- intensity = moderate = 3
- probability = very likely = 4
- mitigation = moderate = 3
- reversibility = moderate = 3,

and therefore impact significance is:

S = N x (E+D) x I x P ÷ ½(M+R)
= 1 x (2+3) x 3 x 4 ÷ ½(3+3)
= 60 ÷ 3
= 20.

Note that the impact prior to mitigation is major, but that due to the mitigation and the fact that the ecosystem can recover easily from the effects of salt (high reversibility), the residual impact becomes minor/moderate.

SCENARIO 2 – The above scenario applies, except that the effluent contains metals. These metals become adsorbed onto clay and organic matter in the stream bed and are accumulative toxins within the ecosystem, getting into the food chain and concentrating

upwards into predator species. Fresh water flushing will only very slightly mitigate this and ecosystem recovery will not be easy or fast.

From this scenario, the criteria are:

- nature = negative = 1
- extent = local = 2
- duration = very long = 5
- intensity = moderate = 3
- probability = very likely = 4
- mitigation = slight = 2
- reversibility = slight = 2,

and therefore impact significance is:

S = N x (E+D) x I x P ÷ ½(M+R)
= 1 x (2+5) x 3 x 4 ÷ ½(2+2)
= 84 ÷ 2
= 42.

Note that in this case, the original impact (of the metals) is more serious than the salt, but it is the limited mitigation and reversibility that also act on the residual score and result in this score being moderate.

9. IMPACT SIGNIFICANCE ASSESSMENT/ANALYSIS

9.1. INTRODUCTION

Impact analysis is, in a sense, the core of the EIA process. It is the phase where all relevant project information that has been gathered is manipulated and distilled – *it is the Environmental Impact Assessment*. The impact analysis has two major goals, starting with listing and describing all possible environmental impacts and then proceeding to give some perspective on the relative significance of the various impacts. The predicted effects of mitigation measures also need to be factored into the impact analysis.

Environmental impact analysis needs to take cognisance of the following issues that all fall under the definition of the 'environment':

- Physical natural environment: water, land, air;
- Biological natural environment: flora, fauna, ecosystems;
- Resources: land/space, minerals, water, rights of use;
- Economic: cost, profit, distribution of income, jobs, skills, permanence;
- Human health: occupational, environmental health, pollution, safety; and
- Human cultural: religion, tradition, aesthetics, heritage, recreation.

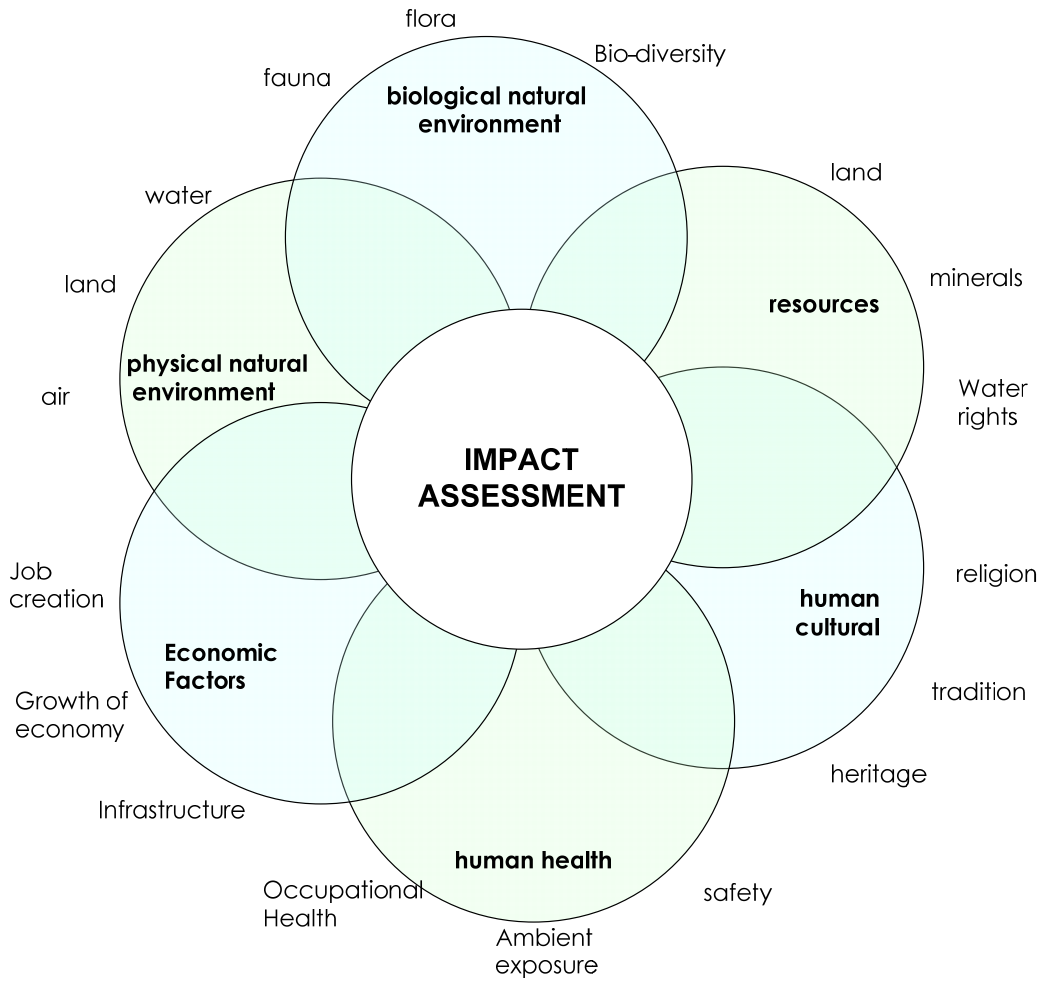


Figure 9-1: Widening environment and sustainability agenda

One needs to, however, bear in mind that the natural environment is the most threatened and irreplaceable resource upon which all the other human aspects depend.

Impact significance is semi-quantitatively assessed (Section 7.2) for relevant aspects (e.g. water, air, biodiversity, noise, visual character, heritage resources, etc.) for each respective phase of the project referred to above. In addition, a brief description of mitigation to be implemented in order to minimise the significance of the potential impacts is provided. The details of *inter alia* required mitigation, monitoring and reporting are put forward in the comprehensive Environmental Management Programme Report (EMPr) for the project, which is annexed to this report.

The analysis of impact significance assessment for potential project impacts furthermore needs to consider impacts that may be realised through all project phases:

1. Construction:
The significant activities associated with the construction period will be the establishment of the access road, site preparation, construction camp establishment, panel foundations and infrastructure, transportation of all materials/components to the site and finally site rehabilitation after construction has ended.

2. Operation:
The operational phase of the facility will generate clean renewable electricity to be inserted into the national grid. The site will need to have regular maintenance undertaken from time to time, such as washing the panels free of dust to ensure efficient operation of the facility.

3. Decommissioning:
The facility is expected to have a life cycle of approximate 25 years; however if the facility is deemed to be economically viable the facility will remain operational beyond this point. If the facility is closed down the decommissioning will include: disassembling of the components of the facility, site preparation and finally site rehabilitation to a degree depending on the final land use of the affected area. Decommissioning by itself is therefore not assessed in detail. The reason for this is that all activities associated with the decommissioning phase are similar in nature to construction impacts; however this is adequately addressed with the EMPr (Appendix 8). The REIPP Programme is designed to allow the proponent to operate the plant for a period of 20 years under a power purchase agreement. As the power plant can be operational for a longer period the economic conditions at that time will determine whether to continue with operation of the facility or decommission it. Any recyclable materials such as panels and steel structures will be sent to recycling facilities with other infrastructure disposed off in accordance with the EMPr.

9.2. ASSESSMENT APPROACH

The assessment area covers an area of 415 hectares (Figure 7-1); however only the most feasible area from an environmental and engineering point of view will be developed. The EIA has been conducted in a professional manner in line with principles of environmental management according to NEMA. To date no impacts have been identified that in the opinion of the environmental specialists result in the project being fatally flawed; however since sensitive areas exist within the study area these will be avoided by the development as to ensure that the impact associated by the development of the solar facility on Portion 1 of the farm Klein Zwart Bast 188 will be localised to the affected area only. These sensitive areas include:

- No non-perennial drainage line occurs within close proximity of the study area; due to the location and the arid nature of the area no permanent wetlands occur

within the area. There is however a number of non-perennial streams/drainage lines around the study area. These would be avoided as much as possible by the development.

- Ecologically sensitive areas include: The majority of the study area is considered "moderately sensitive", only the drainage networks within the boundary of the study area being considered "highly sensitive" from ecological perspective and should be avoided by the development (see Figure 9-2)

Taking the environmental sensitivities as well the technical preferences into consideration on the proposed site a facility layout can be developed and contained within Section 10. This layout has been produced taking all the impacts identified and assessed within this chapter into consideration to identify the area most suitable from an environmental and engineering perspective.

The feasible development area available is 194 hectares and could produce approximately 100 MW of electricity. Especially during the construction phase, the area will be disturbed due to the installation of the necessary infrastructure and foundation for the facility. The impact assessment below was mainly supplemented by specialist inputs from various fields of study and the project developer. Although large scale public notification was distributed, interest in the project was fairly limited.

In order to adequately assess the potential impact of the proposed development on the environment, it was required to quantify the temporarily and permanently affected areas (both linear and development areas). The construction and operation impact as a result of the facility is described below.

9.3. CONSTRUCTION AND OPERATIONAL PHASES

9.3.1. INTRODUCTION

This phase of the project involves all those activities related to preparation of the site and subsequent construction/establishment of the various project structures and associated infrastructure thereon once prepared (e.g. vegetation stripping, topsoil stripping, earthworks/levelling/excavations/foundations, building construction and engineering services installation, etc.). It is envisaged that the construction period will last for up to a year. The operational life span of the facility is expected to be 20-25 years with the option to extend this period. However most likely the facility will be disassembled and re-fitted with the appropriate technology of the time. Decommissioning is not assessed as part this section due to the similarity of activities related to construction. The decommissioning activities are regarded as similar to construction activities in this particular case.

9.3.2. FAUNA AND FLORA

Introduction

The loss of biodiversity brings significant costs through damage to the services that ecosystems provide. Biodiversity conservation efforts in South Africa are largely species, or area, based. In the former, legal protection is given to species by providing prohibitions or restrictions to listed threatened or protected species (Fuggle and Rabie, 2009). In support of the above, no person in South Africa may "*carry out a restricted activity (e.g. removes, destroy, transport or trade) involving a specimen of a listed threatened or protected species without a permit*".

Project implementation will require the stripping of large tracts of indigenous vegetation (within the 194 hectare site area) during the construction phase for subsequent earthworks

and the construction of structures and infrastructure; where the referenced structures and infrastructures relates to the proposed PV solar facility.

A specialist floral and faunal assessment was undertaken for the subject project and contained within Appendix 7.1. The specialists constructed a sensitivity map of the site (Figure 9-2) by integrated all existing literature and site observation of the fauna and flora communities. The sensitivity map indicates the majority of the site has a "medium sensitivity" and suitable for the location of the PV facility. The drainage system within the southern section adjacent to the substation and north-eastern corner of the northern section is considered sensitive and should be avoided by the development. Apart from these drainage networks on the site there are no other ecological sensitive habitats or features present on the site. The stony plains vegetation types mainly covering the site is regarded low in faunal and floral sensitivity and risk associated with the development areas is low.

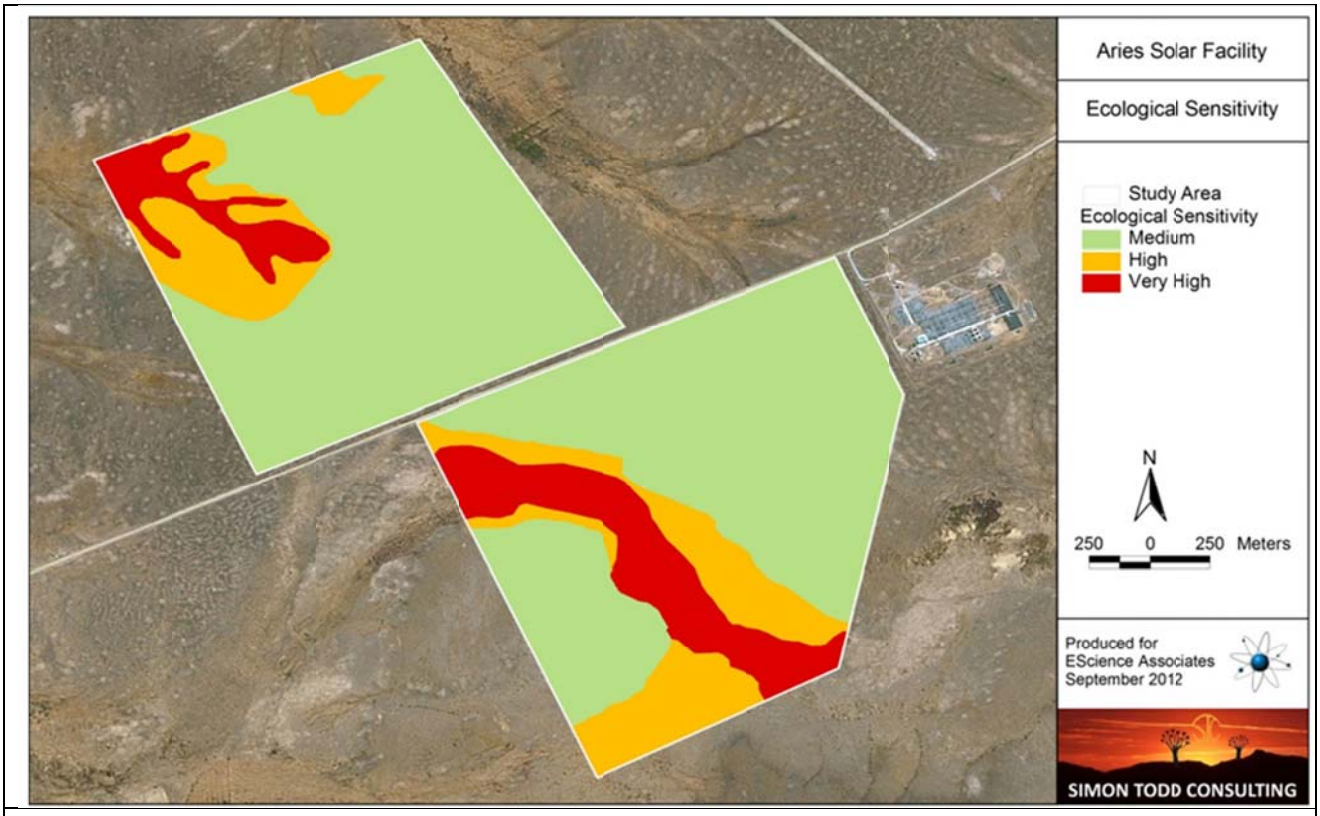


Figure 9-2: Ecological Sensitivity map of the proposed Aries II Solar Energy Facility site

The construction/operation phase of the project will have both direct and indirect impacts on indigenous site flora and fauna, as follows:

- Construction phase:
  - Vegetation clearing for PV panel supports, roads, buildings etc could impact listed plant species as well as high-biodiversity plant communities. Vegetation clearing will also lead to habitat loss for fauna and potentially the loss of sensitive faunal species, habitats and ecosystems.
  - Increased erosion risk would be highly likely to result due to the loss of plant cover and soil disturbance created during the construction phase. This may impact downstream riparian and wetland habitats if a lot of silt enters the drainage systems. Although the effects would probably only become apparent during the operational phase, the impact stems from the construction phase and suitable mitigation measures will also need to be applied at this stage.

  - Increased human presence can lead to poaching, illegal plant harvesting and other forms of disturbance such as fire.
  - Loss of connectivity & habitat fragmentation may result due to the presence of the generation infrastructure, roads, site fencing and other support infrastructure of the development.
  - Fire-related impacts (informal, unmanaged/indiscriminate, fires/burning regime by site contractors and construction personnel);
  - Soil and indigenous vegetation disturbances, leading to proliferation of alien vegetation; where such aliens would compete for space and available resources;
  - Removal/destruction of Red Data Listed (RDL) and protected floral species through site preparations (i.e. vegetation clearance);
- Operational Phase
  - The maintenance and operation activities of the facilities would generate some noise and disturbance which may deter some fauna from the area, amounting to a loss of connectivity & habitat fragmentation.
  - Maintenance activities such as vegetation clearing will impact the biodiversity of the site if not conducted in a sensitive manner.
  - Persistent avifaunal impacts would potentially result from the presence of power transmission infrastructure at the site
  - Fire related impacts (i.e. indiscriminate fires by contractors may lead to veld fires and the subsequent destruction of habitat to indigenous faunal species);

Flora Impact Discussion & Significance Assessment

The only significant feature identified by the specialist is the presence of a number of *Aloe claviflora* plants and a single individual of *Hoodia gordonii*, all of which were observed in the area adjacent to the substation. These species are not endangered, but are protected under national or provincial legislation and can be trans-located if necessary outside of the development footprint.

The proposed development will inevitably result in a loss of natural vegetation within the development footprint. This loss of localised vegetation has the potential to impact high number of listed plant species on the site. These impacts can to a large existence mitigated to acceptable levels and included as management recommendations. The potential cumulative impact is considered relatively low on account of the small development footprint in comparison with overwhelmingly intact nature surrounding the landscape. It should be noted that vegetation loss is inevitable and therefore cannot be avoided.

As the clearance of vegetation would result in soil disturbances would directly result in potential erosion risk. The impact would be more likely during operation as the constructed panels would increase runoff flows from the area. This impact can however be easily mitigated through regular monitoring and remedial action. The cumulative nature of the impact; without required mitigation has the potential to highly increase sedimentation in rivers and streams of the surrounding area. This would indirectly affect vegetation in these sensitive areas. Provided that the drainage features themselves are not directly impacted by the development, the major potential impact associated with the development of the site is likely to an increased risk of soil erosion. The construction of roads, panel foundations and the other infrastructure of the site will require a significant amount of vegetation clearing and will create a lot of disturbance at the site, leaving the soil exposed and vulnerable to erosion, particularly on the steeper slopes.

The loss of connectivity and potential for broad scape fragmentation is considered low as habitat occurring on site is widely available across an extensive area surrounding the site. The open and flat nature of the site suggests that limited ecological gradient and process is operating across the site in term of the broad scale processes. The potential disruption therefore of upland-lowland gradients in the area is very low and not considered a significant concern in the area. The reason being mainly as no topographic diversity or physical or climatic gradients exist in the area that might result in important broad scale ecological gradients in the area

The site is not considered to be very sensitive and provided that the development is restricted outside drainage lines (Considered to be highly sensitive) and access to these areas restricted by personnel and contractors the overall impact resulting from the proposed development is regarded as low after mitigation. Direct vegetation loss as result of the proposed development is unavoidable; however the significance of this impact is low. The specialist indicated that the area has a low biodiversity importance and a lack of significant impact on species of conservation concern. Due to the extensive nature of the vegetation type, habitat fragmentation due to the proposed development will not be heavily impacted upon. One of the major concerns identified by the specialist is erosion risks associated with the development. Erosion impacts can be easily and successfully monitored and managed to make the residual impact negligible.

Table 9-1: Cumulative floral Impacts during construction and operation – Significance Rating			
Nature (N)	Negative impacts on site biological diversity		1
Extent (E)	On Site: Impact to flora will most ne of a localised nature.		1
Duration (D)	Very long term: The impact will be largely reversed at the end of operation of the PV facility, but it may take several decades thereafter for floral species (particularly woody species) to re-establish.		5
Intensity (I)	Moderate: The disturbance to site flora will disrupt functions and processes at a localised level, thereby reducing diversity.		3
Probability (P)	Definite: Vegetation clearance is required for the establishment of site structures and supporting infrastructure.		4
Mitigation (M)	Well mitigated: The impact can be substantially localised though adequate monitoring and rehabilitation practices, but the residual impact will still be noticeable/ minor.		4
Enhancement (H)	N/A		-
Reversibility (R)	Mostly reversible: Rehabilitation efforts at closure will largely reverse the impact, although this may never entirely return the site to its 'natural', pre-development, condition.		4
Significance Rating with Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)	**Low**	28
Significance Rating without Mitigation -	N x (E+D) x I x P ÷ ½(M+R)	**Moderate**	28.8

Table 9-1: Cumulative floral Impacts during construction and operation – Significance Rating			
Negative Impact (S)			
Significance Rating -Positive Impact (S)	N x (E+D) x I x P x (H).		-

Management Actions

- Vegetation clearing to be kept to a minimum. No unnecessary vegetation to be cleared.
- Sensitive areas, as demarcated on the sensitivity map (Figure 9-2: Ecological Sensitivity map of the proposed Aries II Solar Energy Facility site (Figure 9-2), should be avoided as far as possible, and where these areas must be traversed by roads or infrastructure, specific precautions should be taken to ensure that impacts are minimized.
- The final development area should be surveyed for species suitable for search and rescue, which should be trans-located prior to the commencement of construction.
- Roads should run along the contour wherever possible and roads that do not should have diversion structures in place at regular intervals to ensure that water flow and movement is regulated in a manner which minimizes erosion risk.
- Roads which cross drainage lines should be constructed in manner which does not encourage erosion of the downstream channel and does not disrupt the natural flow of water down the channel.
- Regular monitoring for erosion after construction to ensure that no erosion problems have developed as result of the disturbance.
- All erosion problems observed should be rectified as soon as possible, using the appropriate erosion control structures and re-vegetation techniques.
- An environmental control officer (ECO) should oversee the rescue and relocation of all protected flora to be moved;
- All areas affected by construction should be rehabilitated upon completion of the construction phase of the development. Areas should be re-seeded with indigenous grasses/plant species as required;
- As much vegetation growth as possible should be promoted within the proposed development area in order to protect soils. In this regard special mention is made of the need to use indigenous vegetation species as the first choice during landscaping;
- In terms of the amendments to the regulations under the Conservation of Agricultural Resources Act, 1983 and Section 28 of the National Environmental Management Act, 1998, landowners are legally responsible for the control of invasive alien plants on their properties and it is therefore recommended that declared weed and invader species be removed from the subject property;
- Vehicles should be restricted to travelling only on designated roadways, in order to limit the ecological footprint of the proposed development activities;
- No fires whatsoever should be lit within the subject property;
- Impacts associated with the proposed development should not be allowed to impact on surrounding vegetation, outside the development footprint. Therefore the entire development footprint should be demarcated and no unauthorised access to these areas must be allowed.

Fauna Impact Discussion & Significance Assessment

Fauna in the direct affected area will be highly affected; mainly through noise, human activity, habitat destruction, pollution, noise and infrastructure establishment. Mainly due to human activities as well noise levels, the majority of shy and sensitive fauna will move away from the area during activities relating to construction. Slow moving species such as tortoises may not be able to avoid construction activities and may be killed. Some species may also be vulnerable to illegal collection or poaching during construction. This would be as a result of large amount of construction workers present on the site. It is expected that these impact discussed above can be mitigated to some extent. The direct faunal impact would largely be restricted to the small amount of habitat loss within the development area. The surrounding landscape would remain mostly intact although several renewable energy facilities are planned around the development. Sufficient remaining habitat; as well space will be available for most species to move around the development with relevant ease.

The proposed development could result in a disturbance of the broad scale ecological process. These processes include migration, dispersal or ability of fauna to respond to fluctuation in climate or other conditions. The major concern in terms of the above is the fencing off of the facility. This would ultimately disrupt connectivity of the landscape and restrict movement of animals. No fauna would be able to pass through the area and could also result in species being trapped inside the facility. This can be mitigated to some extent however it is considered more likely that faunal species would avoid the area regardless of management measures implemented.

Avifaunal impact associated with photovoltaic solar developments is generally considered to have minimal impact on birds. The main concern being loss of habitat especially to threatened species. Impact can be moderately mitigated as most significant impact associated with the development would be bird electrocution due to transmission line infrastructure. If these structure are located alongside existing lines this impact would be moderated mitigated. Impacts associated with avifaunal is not considered to be significant and mainly concentrated around habitat loss and electrocution by power lines.

Table 9-2: Impacts on Fauna during construction and operation – Significance Rating		
Nature (N)	Negative impacts on site faunal diversity	1
Extent (E)	On Site: Faunal species directly within the development site would be affected, mostly by habitat fragmentation and destruction	1
Duration (D)	Very long term: The impact will be largely reversed at the end of operation of the PV facility, but it may take several years to resemble present state.	5
Intensity (I)	Moderate: The disturbance to site fauna will disrupt functions and processes at a localised level, thereby reducing diversity and habitat loss.	3
Probability (P)	Definite: Vegetation clearance is required for the establishment of site structures and supporting infrastructure. This would result in direct habitat loss to local fauna.	5
Mitigation (M)	Well mitigated: The impact can be substantially localised though adequate monitoring, relocation and rehabilitation practices, but the residual impact will still be noticeable or significant, relative to the original	4

Table 9-2: Impacts on Fauna during construction and operation – Significance Rating			
	impact.		
Enhancement (H)	N/A		-
Reversibility (R)	Mostly reversible: Rehabilitation efforts at closure will largely reverse the impact, although this may never entirely return the site to its 'natural', pre-development, condition.		4
Significance Rating with Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)	**Low**	18
Significance Rating without Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)	**Moderate**	29
Significance Rating -Positive Impact (S)	N x (E+D) x I x P x (H).		-

Management Actions

- Any fauna directly threatened by the construction activities should be removed to a safe location by the ECO or other suitably qualified person.
- The collection, hunting or harvesting of any plants or animals at the site should be strictly forbidden. Personnel should not be allowed to wander off the demarcated construction site.
- Fires should only be allowed within fire-safe demarcated areas.
- No fuel/wood collection should be allowed on-site.
- No dogs should be allowed on site.
- If the site must be lit at night for security purposes, this should be done with low-UV type lights (such as most LEDs), which do not attract insects.
- All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill.
- No unauthorized persons should be allowed onto the site.
- Staff present during the operational phase should receive environmental education so as to ensure that that no hunting, killing or harvesting of plants and animals occurs.
- I recommend that any additional power lines needed at the facility be constructed immediately adjacent and running parallel to the existing power lines.

9.3.3. CONSTRUCTION AND INSTALLATION WASTE GENERATION (CONTRIBUTION TO LANDFILL, SEWAGE, WASTE HAZ & GEN ETC.)

Introduction

Waste will be generated during the construction of the proposed project structures/infrastructure and installation of equipment. The waste would predominantly comprise of building rubble, packaging and fabrication waste/s. Steel and electric cabling waste is also expected from installation. It is likely that most, if not all, of the waste generated would be non-hazardous/general waste. The generation of significant quantities of general waste could indirectly impact on the operational lifespan of the municipal landfill facility, through the permanent occupation of remaining available airspace at this facility.

Impact Discussion & Significance Assessment

The impacts will have regional extent where hazardous wastes are concerned (i.e. There is no suitably licensed hazardous landfill facility in the Northern Cape). The intensity of the impact will, however, be low relative to cumulative national and regional waste generation volumes (general and hazardous waste generation). As the waste will be taken off site weekly throughout the construction and operation phase, impacts associated with waste not expected to be significant. However, mitigation measures would need to be implemented to ensure proper handling and storage of the wastes. It is also recommended that the proponent implements the general waste management principals of in terms of waste hierarchy such as; waste reduction, reuse, recycling and finally disposal. However these aspects have been suitably addressed within the associated EMPr (Appendix 8) and would therefore ensure commitment from project developer to responsible waste management.

If dry sanitation systems or digester systems are used it would result in the production of dry sewage waste materials. This material has very low pathogenic composition and regarded as very manageable and can either be:

- Be used to make compost (Help in rehabilitation of vegetation or used as compost in landscaping)
- Used as source of fuel
- Dispose of it on a municipal waste facility.

Table 9-3: Impacts of Construction Waste Generation – Significance Rating			
Nature (N)	Indirect: Negative impact on landfill airspace availability		1
Extent (E)	National: Use of hazardous landfill beyond the provincial boundary		3
Duration (D)	Medium term: Construction phase (conservatively anticipated for up to a year, or possibly two)		3
Intensity (I)	Negligible: The anticipated impact will be negligible, with no discernible effect on relative airspace availability		1
Probability (P)	Definite: The generated of waste during the construction phase is largely unavoidable (the amount generated can, however, be managed)		4
Mitigation (M)	Slightly: A small reduction in the volumes of waste generated can likely be effected during construction		2
Enhancement (H)	N/A		-
Reversibility (R)	Moderately reversible through reuse, recovery and/or recycling initiatives: Where the impact relates to contribution to landfill, any measure implemented to reuse, recover, or recycle such waste would constitute the reversal of the impact		3
Significance Rating with Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)	Low	9.6
Significance Rating without Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)	Low	12

Table 9-3: Impacts of Construction Waste Generation – Significance Rating		
Significance Rating -Positive Impact (S)	N x (E+D) x I x P x (H).	-

Management Actions

Contractors will be required to provide a method statement specific to waste minimisation, reuse, recovery and recycling, as well as temporary storage and disposal; such plans would need to be signed off by competent site environmental personnel/environmental control officer (ECO), prior to the start of construction activities.

All construction and installation waste will be stored temporarily in a way that protects surface and groundwater, and appropriately disposed of at the permitted municipal disposal site (where the waste in question is classified as general waste). Temporary waste storage areas will be sited under the guidance of site environmental personnel prior to the start of construction activities. Construction personnel will be trained in their correct use and the sites will be regularly inspected to ensure that they are being appropriately managed.

During construction all sewage waste should be stored in a closed system. A schedule for servicing and disposal of the sewage waste will be set forth so as not to cause unpleasant or unhygienic conditions for the site personnel by an approved service provider specializing in the maintenance and treatment/disposal of sewage waste.

9.3.4. SURFACE- AND GROUNDWATER QUALITY & QUANTITY

Introduction

The inappropriate storage, management and handling of fuel, oil and other potentially hazardous chemicals and substances during the construction period could result in potentially negative impacts on surface and ground water quality; where spillages of such could enter the groundwater environment in particular, through the ready infiltration of contaminated surface run-off into the groundwater environment. Poorly managed vehicles too will impact negatively on ground water quality (where no surface water is located in close proximity to the site). Contamination of this nature, associated with the construction phase of such project would typically be hydrocarbon based (i.e. petrol, diesel and oil leaks and spillages to bare soil surfaces). Temporary concrete batching plants can also impact negatively on groundwater.

Poor placement and maintenance of temporary sanitary arrangements (i.e. portable toilets) can also result in detrimental impacts on water resources in one or another of the following ways (Fuggle and Rabie, 2009), depending on the nature and extent of potentially affected water resources:

- Eutrophication – referring to "*the enrichment of water with nutrients, such as nitrates and phosphates, which give rise to excessive growth of aquatic algae and cyanobacteria in surface water resources in particular*";
- Nitrification – referring to "*the contamination of drinking water supplies with elevated levels of nitrates;* and
- Microbial contamination – referring to the contamination of drinking water supplies with harmful pathogenic agents, such as *E. coli* bacteria and other faecal coliforms.

Groundwater contamination as above would generally be restricted to the confines of the site. This impact can further be mitigated through the use of dry or digester toilet systems on the market such as EcoSan.

In addition, during construction, temporary stockpiles of building material, excavated sand and rock, as well as waste, will be produced. It is important that these stockpiles are located in a centralised area where temporary measures such as berms will prevent sediment run-off, specifically during heavy rainfall episodes. Therefore it would be particularly important to update the storm water management plan created for the site. These particular waste streams are, however, not expected to be hazardous, or pose a contamination risk to groundwater.

Impact Discussion & Significance Assessment

The anticipated extent of surface water run-off will be negligible. This is as a result of the sandy nature of the underlying soils; surface water will readily infiltrate soil surfaces, as opposed to travelling any significant distance at the surface. The study area is located in the arid Kalahari area and no surface water exists in close proximity to the site, except within the Orange River some 80 Km north of the study area. There are no identifiable wetlands in the study area.

The proposed site is located within quaternary catchments D53D. The slope of the study area is relatively flat. The site is also located in a very arid region of South Africa, with vegetation cover considered to be sparsely distributed and soil characterised as being very sandy in nature; surface water runoff from the area is negligible. Most drainage lines in the area are considered dry river beds and most rainfall within the area infiltrates into the groundwater environment. A small amount of water actually ends up as runoff. The major concern regarding surface water runoff is potential erosion caused by an increase in runoff from the constructed PV panels; however through implementing appropriate measures this could be appropriately mitigated.

The groundwater flow within the area flows from a topographic high on the south-eastern side in a northerly, north-westerly and westerly direction. The project uses photovoltaic solar panels, i.e. energy from the sun will be converted into electricity by the solid panels directly. As this process does not involve the generation of steam, heating of liquids or other heated fluids to convert solar radiation into electricity there are no direct impacts due to the physical technological operation of the facility. Therefore spillages of hazardous/harmful substances would not occur that could have negative impacts on the surface/groundwater water environment. Rainwater running off these panels is classified as clean water and no water contamination is expected. The major concerns regarding groundwater/surface water quality is potential groundwater contamination due to mainly hydrocarbon (during construction) and microbial (during construction and operation) contamination mainly by: inadequate storage, spillages and microbial contamination (as a result of inadequate sewage management).

Table 9-4: Impact on Ground/Surface water Quality (During construction) -Significance rating		
Nature (N)	Negative impacts of construction related Hazardous substance contamination	1
Extent (E)	Site: Within the vicinity of the development area of the study area.	2
Duration (D)	Long term: Treatment of groundwater contamination (i.e. once occurred) is a long and arduous process	4
Intensity (I)	Major: Adjacent farmers/farming communities reliant on groundwater for their livelihood	4
Probability (P)	Likely: Impact likely to occur, to the extent that	2

Table 9-4: Impact on Ground/Surface water Quality (During construction) -Significance rating			
	provisions must be made for it.		
Mitigation (M)	Well mitigated: A comprehensive range of effective mitigation measures is readily available		4
Enhancement (H)	N/A		
Reversibility (R)	Irreversible: No amount of time or money will sustainably reverse the impact		1
Significance Rating with Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)	**Low**	19.2
Significance Rating without Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)	**Moderate**	48
Significance Rating -Positive Impact (S)	N x (E+D) x I x P x (H).		-

Table 9-5: Impacts due to Surface Water Runoff (During construction & Operation) - Significance rating			
Nature (N)	Negative impacts of construction/operation related Surface water runoff		1
Extent (E)	Site: Within the vicinity of the development area of the study area and surroundings.		1
Duration (D)	Very short terms: Only occurring during heavy rainfall periods.		5
Intensity (I)	Negligible: There's an impact on the environment, but it is negligible, having no discernable effect.		2
Probability (P)	Likely: Impact likely to occur, to the extent that provisions must be made for it.		1
Mitigation (M)	Well mitigated: The impact can be mostly mitigated and the residual impact is negligible or minor.		4
Enhancement (H)	N/A		
Reversibility (R)	Mostly Reversible: The impact can mostly be reversed, although if the duration of the impact is too long, it may make the rehabilitation less successful, but otherwise a satisfactory degree of rehabilitation can generally be achieved quite easily.		1
Significance Rating with Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)	**Negligible**	4.8
Significance Rating without Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)	**Low**	12
Significance Rating -Positive Impact (S)	N x (E+D) x I x P x (H).		-

Management Actions

A comprehensive range of effective, proven mitigation measures will be implemented to ensure groundwater contamination is mitigated, which are in principle as follows:

- All hazardous substances to be stored within appropriately sized, impermeable, and roofed surfaces;
- Drip trays to be appropriately placed under vehicles that park over-night on bare soil surfaces.
- No cement mixing must be allowed to occur on bare surfaces.
- Erosion sensitive areas must be identified and regular monitoring undertaken to ensure once the impact occurs it is stabilised and rehabilitated immediately.

The various components of the power station are considered to be mostly environmentally friendly and do not necessarily pose a risk to groundwater environment. The solar facility could potentially increase the amount of aquifer recharge locally.

9.3.5. HERITAGE

Introduction

The Archaeological assessment initiated as part of this assessment is regarded as an extension of the initial assessment undertaken on the farm KleinZwart Bast in 2011 and February 2012 2nd Phase archaeological work conducted (please refer to appendix 7.4).

The general study area consists of fairly flat and open landscapes, with sections of shrubs, grass and small trees the main vegetation cover. The area consists largely of stone such as river pebbles and is considered to be one of the places where most of the Stone Age material identified in the area is found. It was identified that the whole landscape was covered with archaeological materials consisting mostly of stone tools.

As part of the initial study undertaken on the site, the 2011 assessment identified mostly archaeological materials dating to the Stone Age, although some historical features and materials were also identified. The study initiated as part of this assessment revealed more stone artefacts on the expanded portion of the study area. The phase 2 mitigation work conducted on the initial study area characterised the area by scatters of stone tools varying in density/concentrations. The main purpose of the second phase mitigation undertaken in the initial area was to identify the possible density of materials in the larger area and it was concluded that it could be in the millions. Stone tool materials mentioned above include: cores, formal tools and flakes.

The mitigation work concluded that the area clearly indicated the presence of humans at the site and/or its directly associated areas for the last two million years. No known Iron Age archaeological sites were identified within the area.

Impact Discussion & Significance Assessment

The following section describes the artefacts found by the specialist and the significance of the finds. During the initial study conducted on the site a total of 11 sites were recorded, most dating to the Stone Age, although some historical sites were also recorded. Of these 11 sites only four would be disturbed by the currently approved solar development. The specialist indicated that studies undertaken on the initial assessment and the mitigation work on the site have shown that the whole area is characterised by the dwaka tillite rocks and in fact be seen as a single Stone Tool Landscape. The need to mark individual sites was determined not possible and accordingly not done in the current study.

In conclusion the Archaeological Impact Assessment of the area was conducted successfully. A number of archaeological sites feature and objects were also identified and recorded in the area, dating from the Early to Later Stone Ages, as well as the Historical period during the January 2011 assessment for the original Solar Plant development. Some of these sites (Stone Age) were mitigated during February 2012 and a final report has been submitted to SAHRA for comments and the issuing of a destruction permit received.

Due to the fact that the site had successfully undertaken mitigation work in February 2012 it was determined by the specialist that there is no need to conduct additional mitigation on the expanded section for the solar development. The area is considered to be very homogenous in terms of geographical, topographical and archaeological environment and it is envisaged that similar Stone Age material found during the mitigation work would be found on the extended portion of the study area.

The chance of fossils being damaged by the proposed facility is fairly limited due to the fact that the foundations of the PV infrastructure will be mounted approximately 1 m into the ground. If fossils (fossilised remains of animals or plants) are encountered due to proposed development a professional palaeontologist must be consulted immediately. The appropriate action will then be recommended accordingly by the professional. It should be noted that all sedimentary deposits have the potential to preserve fossilised materials. The major concern regarding potential impacts on the heritage resource are that construction activities might result in disturbance of surfaces/underground materials containing significant artefacts and therefore resulting in the damage, alternation, destruction, collection and removal from its original position.

Table 9-6: Impacts of archaeology during construction/operation (above and below ground) – Significance Rating			
Nature (N)	Negative impacts of construction/operation related heritage on sensitive receptors		1
Extent (E)	Site: Within the vicinity of the development area of the study area.		1
Duration (D)	Permanent: Loss of archaeological material due to excavation and land clearing associated mainly with construction period.		5
Intensity (I)	Minor: Relatively significant archaeological materials found, mainly concentrated on the outcrop/ridges, however the development will avoid these areas. Therefore there will be a minor to negligible impact on archaeology of the area.		2
Probability (P)	Unlikely: The possibility of the impact occurring is very low, mainly due to the circumstances of the expansion project and experience of the appointed specialist.		1
Mitigation (M)	Well mitigated: The development has already undertaken mitigation work and it was determined that no additional mitigation would be required.		4
Enhancement (H)	N/A		
Reversibility (R)	Irreversible: Once archaeological material is lost it cannot be restored.		1
Significance Rating with Mitigation -	N x (E+D) x I x P ÷ ½(M+R)	**Negligible**	4.8

Table 9-6: Impacts of archaeology during construction/operation (above and below ground) – Significance Rating			
Negative Impact (S)			
Significance Rating without Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)	**Low**	24
Significance Rating -Positive Impact (S)	N x (E+D) x I x P x (H).		-

Management Actions

The proposed development has already conducted required mitigation work and due to the homogenous nature of the area it was identified by the specialist that no further mitigation needs to be implemented. However the following mitigation measures should apply:

- The subterranean presence of archaeological and/or historical sites features or artefacts are always a distinct possibility. Care should therefore be taken during any development activities that if any of these are accidentally discovered, a qualified archaeologist be called in to investigate. In this case unmarked LSA burials are a possibility as well. The red sands are covering possible archaeological traces.
- ECO should be trained to identifying relevant archaeologist materials that could potentially be found on site by a suitable qualified archaeologist, and should also inform construction supervisors on what to look out when digging on the site.
- The recommendations made in the Phase 2 Report must be implemented as part of the expansion project. Also, as part of the mitigation process accepted by the client, an information plaque on the Stone Age archaeology of the area will be erected at the solar plant as well.

9.3.6. SOIL AND AGRICULTURAL POTENTIAL

Introduction

A desktop soil assessment was undertaken by EScience Associates (Pty), in consultation with Prof. Andries Claassens (Soil Science and Plant Nutrition Consultant) in relation to the proposed establishment of a PV solar power plant on the farm KleinZwart Bast (Please refer to Appendix 7.6). The primary objective of the study was to determine the potential impacts of the proposed development on the land capability, land use, soils and agricultural potential of the subject site:

The study details the following:

- Soil form(s) present over the site, as well as the geographic distribution thereof over the development site;
- The size of the affected farm portions encompassing the development site;
- The locality of the development site;
- Potential land use alternatives for the site in question; and
- Impacts of the proposed change in land use on land capability and agricultural potential.

Impact Discussion & Significance Assessment

Due to the sandy to loamy soil characteristics of the study area, limited soil depths, as well as prevailing climatic conditions, the agricultural potential of the site is considered to be

very low. The inferred cost associated with the preparation of site soils for crop production, as well as to install irrigation systems (due to low relative rainfall in the area), render a change in land use to crop production as largely impractical. The potential loss of grazing land is not considered to be a significant issue as the area is not supportive of high stocking rates. Stocking rates in the region are typically in the order of approximately 22-25 ha/large stock unit (LSU); where, for example, 100 ha of land would typically only support four (4) head of cattle on a sustainable basis.

The project's impact on site soils is considered to be low, due to the erection of the PV facility. There are, however, some mitigation measures that would need to be implemented to prevent and contain erosion associated with soil disruptions during the construction phase. The impact is considered negligible when comparing it, for example, to coal mining on the Highveld which occurs on high agricultural soils which produce similar quantities of electricity (van der Waals, 2011). Apart from the access road and construction sites where the soil (environment) may be impacted on, the proposed development should not have a major influence on the soils on the rest of the farm. For Clovelly or Hutton soil forms, the soil potential is low. The major use of the land type is therefore grazing. The nature of the underlying parent material (mainly Tillite and Shale), combined with low rainfall in the area, has led to the development of shallow soils (i.e. soils with limited pedological development); with underlying solid rock as the limiting factor to the depth thereof. Deeper soils are, however, found in the lower lying areas.

An assessment of the proposed project's potential impacts on land capability, land use, soils and agricultural potential concludes that there should be no discernable impacts on the aforementioned site as a result of the development of the proposed PV facility, and that the impacts associated with the proposed development are considered to be low, mostly as the site has a low agricultural potential. Due to the geology and climate the soil in the area is mostly shallow with a low carrying capacity for grazing. There are not really opportunities for agricultural land use. Any impact on the environment due to the proposed activity and the maintenance management in the area should be localized.

Table 9-7: Potential project impacts on current land capability/land-use (i.e. loss of extensive livestock grazing)– Significance Rating		
Nature (N)	Potentially negative impacts on land use as the area will be transformed and therefore a loss in the potential land capability for grazing.	1
Extent (E)	Site: The impact will be isolated to the development footprint.	1
Duration (D)	Very long term: The proposed facility is permanent but could be removed	5
Intensity (I)	Minor: The impact alters the environment in such a way that the natural processes or functions are hardly affected; the system does however, become more sensitive to other impacts	2
Probability (P)	Unlikely: Improbable due to low baseline agricultural/grazing potential.	1
Mitigation (M)	None: Possible disturbance will be limited to immediate surroundings.	-
Enhancement (H)	N/A	-
Reversibility (R)	Mostly reversible: the impact can mostly be reversed, although if the duration of the impact is too long, it	4

Table 9-7: Potential project impacts on current land capability/land-use (i.e. loss of extensive livestock grazing)– Significance Rating			
	may make the rehabilitation less successful, but otherwise a satisfactory degree of rehabilitation can generally be achieved quite easily.		
Significance Rating with Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)	**Negligible**	6
Significance Rating without Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)	**Negligible**	6
Significance Rating -Positive Impact (S)	N x (E+D) x I x P x (H).		-

Table 9-8: Potential project impacts in respect of potential for alternative land-use (crop production) – Significance Rating			
Nature (N)	Potentially negative impacts from the proposed project will result in loss of area which could be used to cultivate crops.		1
Extent (E)	Site: The impact will be isolated to the development site.		1
Duration (D)	Very long term: The proposed facility is permanent but could be removed.		5
Intensity (I)	Minor: The impact alters the environment in such a way that the natural processes or functions are hardly affected; the system does however, become more sensitive to other impacts. The nature of the underlying soils is of such a nature that it does not provide for productive agriculture.		2
Probability (P)	Unlikely: Improbable due to low baseline agricultural potential.		1
Mitigation (M)	None: possible disturbance will be limited to immediate surroundings.		
Enhancement (H)	N/A		-
Reversibility (R)	Mostly reversible: the impact can mostly be reversed, although if the duration of the impact is too long, it may make the rehabilitation less successful, but otherwise a satisfactory degree of rehabilitation can generally be achieved quite easily ,		4
Significance Rating with Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)	**Negligible**	6
Significance Rating without Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)	**Negligible**	6
Significance Rating -Positive Impact (S)	N x (E+D) x I x P x (H).		-

Management Actions

The following recommendation must however be implemented:

1. Erosion must be managed though adequate control and mitigation. Early identification of erosion prone areas is essential.
2. Potential impact from hydrocarbon soil contamination such vehicle oil/fuel leaks, concrete mixing and oil spillage should be prevented by providing overnight vehicle with drip trays, ensure concrete mixing does not take place on bare soils, etc.
3. Ensure that soil surrounding the installed panel and associated infrastructure is rehabilitated, as well re-vegetated with indigenous seed mix where applicable.

9.3.7. VISUAL

Introduction

The specialist Visual Impact Assessment (VIA) undertaken for the project (Appendix 7.3) took cognisance of the following principles and concepts underpinning Visual Input, according to Guidelines for involving visual and aesthetic specialists in EIA processes:

- An awareness that 'visual' implies the full range of visual, aesthetic, cultural and spiritual aspects of the environment that contribute to the area's sense of place;
- The consideration of both the natural and the cultural landscape and their inter-relationships;
- The identification of all scenic resources, protected areas and sites of special interest, together with their importance in the region;
- The nature and location of any cultural heritage sites, and areas of special or historical interest;
- An understanding of the landscape processes, including geological, vegetation and settlement patterns, which give the landscape its particular character or scenic attributes;
- The need to include both quantitative criteria, such as 'visibility', and qualitative criteria, such as landscape or townscape 'character';
- The need to include visual input as an integral part of the project planning and design process, so that the findings and recommended mitigation measures can inform the final design, and hopefully quality of the project.

Importantly, background research in respect of informing the legislative context of the area with respect to visual impact was undertaken and revealed that:

- No listed or proclaimed sites, such as nature reserves, biosphere reserves, proclaimed scenic routes, national parks or proclaimed view-shed protection areas were identified in proximity to the proposed development terrain; and
- No scenic routes, special areas or proclaimed heritage sites are within proximity of proposed development terrain.

Impact Discussion & Significance Assessment

The proposed development area was deemed by the relevant specialist to have a moderate scenic quality, predominantly due to:

- The area consists of ubiquitous flat, outstretched plains
- The sense of place of the area is dominated by intact natural Nama-Karoo vegetation, showing signs of light to medium grazing.
- Distribution of vegetation is sparse, with very few trees and shrubs.
- The colours found in the vegetation of the area are not conventionally beautiful. The area is very arid, and doesn't lean itself to instilling conventional perceptions of fertility. There are, however, very strong complementary colour pairs to be found in

the combination of the saturated brown hues of soil combined with the blue hues of sky.
- The site is located directly adjacent to the already existing Aries sub-station. The station comprises almost 20 Ha in area, as large as the already approved photovoltaic development's area.

An assessment of 'visual sensitivity' will vary with varying user types/receptors. Recreational sightseers, for example, may be highly sensitive to changes in visual quality. The developments are centred around the gravel roads and the entrances to the Eskom sub-stations; it is inferred that the predominant type of viewers will be workers in the area and local commuters travelling to Pofadder and Kenhardt. It is, however, inferred that occasional sightseers will be outnumbered by individuals who frequently travel on the road to farm areas.

Using the guidelines for VIA the expected level of impact was determined. The study area was identified as being an area of low scenic quality, cultural or historical significance. It was determined by the specialist that a low visual impact is expected; however due to the distance from vantage point D (20 m) the facility is anticipated to be highly visible. The gravel road to Pafadder – Kenhardt (crossing the study area) was used as the most important vantage point (mainly due to the fact this road has the most frequent road users); however it displayed extremely low viewer frequencies. The fact that the viewer frequencies are very low ultimately diminishes the expected visual impact.

The visual impact was assessed mainly though using the following deliverables:
- Viewshed analysis (Figure 9-3): A viewshed is an area dispersed over the topography and indicating the relative positions from where the development might be visible. This was used to determine the relative vantage point from where photographic audits were conducted.
- Vantage Point D (Figure 9-4) was modelled by means of photomontage, as this vantage point is where the proposed development would potentially be visible to the most viewers. This vantage point was considered the most important as limited viewers travel directly past the site and substation except relevant landowners and substation maintenance staff.

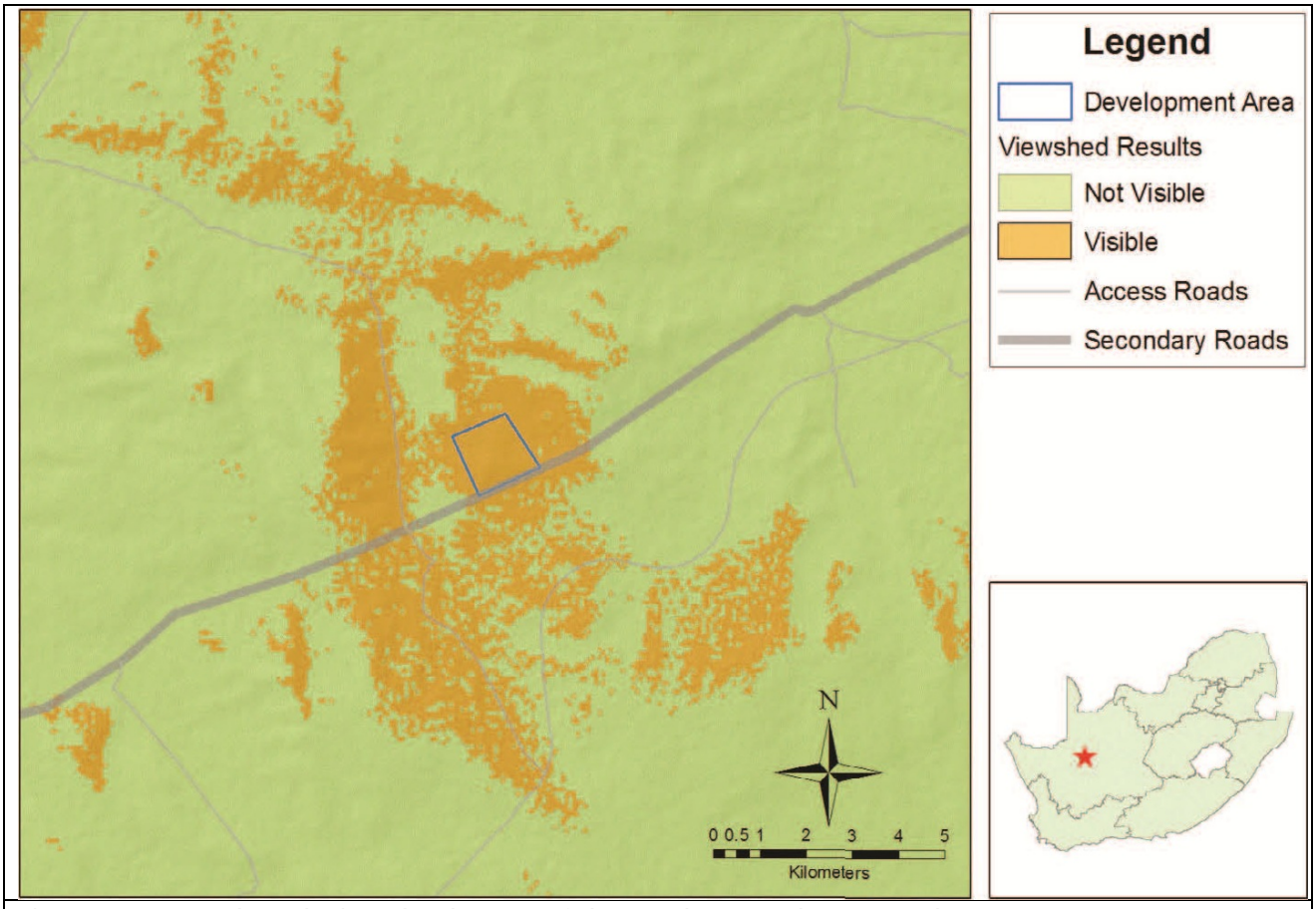


Figure 9-3: Rendered Viewshed map of the study area (ESA, 2012)

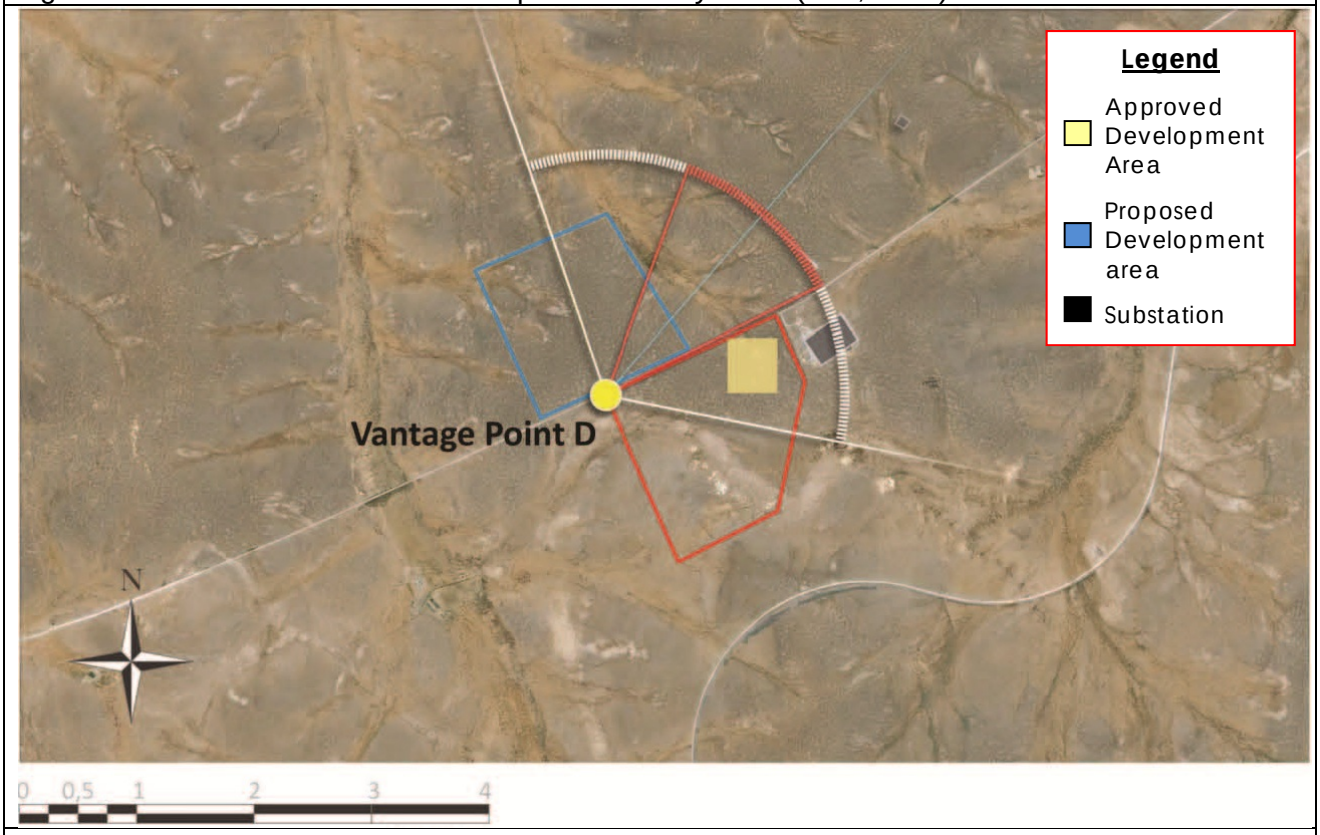


Figure 9-4: Chosen Vantage Point D

Figure 9-5 provides view simulations for daytime visual quality changes anticipated from Vantage Point D on visual receptors as a result of the development. The figure provides

one with an idea of what the proposed project would look like from a ground level perspective if implemented.

The specialist VIA undertaken for the project concluded the following:

- "*The existing scenic quality of the area indicates moderate scenic quality;*
- *The level of contrast the development will have in relation to its environmental indicated a medium contrast ratio; with anticipated medium compatibility with the surrounding scenery.*
- *The existing cultural modifications and adjacent industrial activity surrounding the proposed development will constitute a potential low contrast ratio with the environment;*
- *The development Visual Change Rating, where viewer sensitivity is not considered high.*
- *Due to its distance from vantage point D (4,2 km) it is anticipated to be minimally visible or not visible at all."*

Table 9-9: Visual and Aesthetic Impact Significance Rating			
Nature (N)	Negative impact on visual character of the area		1
Extent (E)	Locally: Within the vicinity of the site and immediate surrounds		2
Duration (D)	Life of solar facility: Approximately 25 - 30 years		5
Intensity (I)	Low: Visual and scenic resources are not affected		2
Probability (P)	Definite: Distinct possibility that the impact will occur		4
Mitigation (M)	Unmitigated: No practical mitigation possible except painting options.		1
Enhancement (H)	N/A		-
Reversibility (R)	Entirely reversible at Closure and Decommissioning of the solar facility		4
Significance Rating with Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)	**Moderate**	22.4
Significance Rating without Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)	**Moderate**	22.4
Significance Rating -Positive Impact (S)	N x (E+D) x I x P x (H).		-

Management Actions

Due to the development's size, as well as its distance from identified sensitive receptors, no implementable or manageable management actions can be suggested that would be effective, other than painting auxiliary surface structures with non-reflective paint in the same hue as the colour of the soil. In terms of painting the installation in muted colours, is not recommended, since the installation's flat surfaces will serve to blend it into the landscape through reflection of the ambient sky colour. It was therefore in the opinion of the visual specialist that the proposed development can be developed without posing significant impact towards the identified sensitive receptors along the Kakamas-Pofadder road.

Pre Development View

Post Development View

Figure 9-5: Daytime Pre- and Post-Development View Simulations (Divisional Road (P2986), to Pofadder- Kenhart)

9.3.8. TRAFFIC

Introduction

Impacts associated with traffic will mostly be concentrated during the construction phase of the project. These impacts are not considered to be significant in isolation; however they become more significant in combination with surrounding development if construction periods occur simultaneously. The main concern relating to traffic is as follows:

- Off-site accommodation of employees during the construction and daily transfers to the site,
- Increase in vehicular traffic mainly during the construction phase.

Impact Discussion & Significance Assessment

The anticipated traffic volumes during the construction phase is approximately 5 light vehicles, 2 medium/light vehicle and one heavy vehicle daily. An average daily traffic (ADT) volume is expected to increase by 11 vehicles during the construction period. During operation the ADT volumes will only increase by 3 vehicles and should be considered negligible from an environmental point of view.

The anticipated traffic loads on both the R27 and P2986 roads are significantly less that the design capacity of these roads. With this in mind, the traffic volumes contributed by the construction and operation phases of the Photovoltaic Power Plant on the existing traffic volumes are considered negligible (Schwartz, 2012).

Table 9-10: Negative impacts on increased traffic and impacts on road surfaces (mainly during Construction) - Significance Rating			
Nature (N)	Negative impact on social character of the area		1
Extent (E)	Regionally: Within the local municipality		3
Duration (D)	Medium Term: The impact will mostly be associated with the construction phase and will only be approximately up to a year or two.		3
Intensity (I)	Minor: The impact on the road surfaces alters the environment in such way that natural process or functions are hardly affected; the system does however, become more sensitive to other impacts.		2
Probability (P)	Unlikely: the probability that the impact causes significant impacts on the road surface due to increase traffic volumes is considered low. The only potential concern is of safety due to increased traffic volumes mainly during the construction phase.		1
Mitigation (M)	Well mitigated: the impact can be mostly mitigated		4
Enhancement (H)	N/A		-
Reversibility (R)	Mostly reversible: the impact can be mostly reversed, although if the duration of the impact is too long, it may make the rehabilitation less successful, but otherwise a satisfactory degree of rehabilitation can generally be achieved quite easily.		4
Significance Rating with Mitigation -	N x (E+D) x I x P ÷ ½(M+R)	**Negligible**	3

Negative Impact (S)			
Significance Rating without Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)	**Negligible**	4.8
Significance Rating -Positive Impact (S)	N x (E+D) x I x P x (H).		-

Management Actions

No mitigation is required, however if the P2986 road becomes very degraded corrective action would be required through liaison with the Siyanda and Namakwa District Municipalities.

9.3.9. SOCIO-ECONOMICS

Introduction

With regards to the effect of social impacts due to the proposed activity, it is very important not at first glance to assume the positives outweigh the negatives, as there are various negative impacts associated with the proposed PV development that need to be incorporated in the assessment of the socio-economic environment. The following negative impacts on the socio-economic situation are associated with the proposed development:

- Influx of job seekers to the area
- Impact of heavy vehicles, including safety, dust, damage to roads and noise
- Increased risk of stock theft, damage to farming infrastructure and poaching associated with construction workers on site.
- Risk to farmers' and workers' safety and security due to presence of construction workers.
- Loss of grazing land due to the development (construction and operation)

During the operational and construction the following positive impacts are expected:

- Energy security to the country,
- Climate change: Zero carbon emissions whilst producing clean, renewable energy,
- Job creation for local communities and South Africa in general during construction and operation.

Impact Discussion & Significance Assessment

- Construction

The construction activities associated with establishment of the proposed facility will mainly be conducted by a single EPC contractor from South Africa. It is expected that approximately 100-200 construction workers will be employed. The construction phase is expected to take 2 years to complete. There will be some employment opportunities during construction - with the majority of construction labourers coming from the local areas. The opportunities available for the local communities will mostly be targeted at unemployed individuals for unskilled to semi-unskilled work, mostly due to the area's low population density, unemployment rate and low education levels. Locals with limited skills employed only as part of the construction phase should be provided with supportive training programmes as to become eligible for higher skill positions.

Construction staff will be housed in existing facilities in the area mostly from Kenhardt; therefore no temporary accommodation on the site will occur except in existing facilities. The construction activities of the proposed development could potentially impact on the

daily movement and living patterns of the surrounding community. Due to the influx of construction workers to the area it would potentially increase the incidences of livestock theft and increase criminal activity.

- Operation

The proposed operation of the PV facility does not require large numbers of employees. It is anticipated that approximately sixty (60) full time employees would be required during the operational phase of the project. The majority of these employees will be responsible for the maintenance of the facility. The Aries II solar expansion project is encouraging even only on a small scale as it could potentially have quite significant economic spin offs. The operational phase of the proposed project is not expected to have any direct negative impact on the surrounding property owner's movement and daily living patterns. The operational phase of the facility consists of limited vehicle movement to and from the site with no associated health risk.

- Decommissioning

The project is planned to be decommissioned in approximately 20-25 years. It this facility is indeed decommissioned it would result in all the jobs to be lost, as well as much needed income to survive. This would also have associated indirect impacts on the local area workforce, businesses and SMMEs

Table 9-11: Negative impacts on socio-economics (mainly during construction) - Significance Rating			
Nature (N)	Negative impact on social character of the area		1
Extent (E)	Local: Within the vicinity of the site and immediate surroundings.		2
Duration (D)	Medium Terms: Most negative impacts on the social character of the area will be during construction phase of the development. The increase in employees to the area would have associated negative impacts as discussed above.		3
Intensity (I)	Moderate: The social environment is altered, but function and process continue, albeit in a modified way, the system has been damaged and is no longer what it used to be, there are however still remaining functions; the system will probably decline further without positive intervention.		3
Probability (P)	Definite: Distinct possibility that the impact will occur. The proposed development will have an impact in the sense that it will change the movement and living patterns, mostly during construction. The negative impact associated with the operational phase it expected to be almost negligible.		4
Mitigation (M)	Slightly mitigated: a small reduction in the impact is likely		2
Enhancement (H)	N/A		-
Reversibility (R)	Slightly reversible: Once the impacts have occurred it will not be easily reversed		2
Significance Rating with Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)	**Low**	12

Table 9-11: Negative impacts on socio-economics (mainly during construction) - Significance Rating			
Significance Rating without Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)	**Moderate**	16
Significance Rating -Positive Impact (S)	N x (E+D) x I x P x (H).		-

Table 9-12: Positive Impact on Socio Economics of the facility- Significance Rating			
Nature (N)	Negative impact on visual character of the area		-1/4
Extent (E)	Nationally: The proposed project is of national significance as to reduce our dependence on fossil fuels, and increase power generation from renewable sources.		5
Duration (D)	Life of solar facility: Approximately 20 - 25 years		5
Intensity (I)	Minor: The solar facility on national scale has minor influence; however on a local scale it has the potential to have major contribution. On a national scale the cumulative impact in combination with all the proposed renewable plant has the potential to have a significant positive contribution to the country.		2
Probability (P)	Very Likely: The impact will probably occur but it is not certain.		3
Mitigation (M)	N/A		-
Enhancement (H)	Well-enhanced: The social benefit can be substantially enhanced to reach a far greater number of receptors. Through community development programmes, capacity building and community trust establishment etc. the positive impact can be severely enhanced on a local scale/regional scale.		4
Reversibility (R)	Moderately reversible: At Closure and Decommissioning of the solar facility the social benefits would remain, however the sustainability of the development would have not been realised.		3
Significance Rating with Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)		
Significance Rating without Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)		
Significance Rating -Positive Impact (S)	N x (E+D) x I x P x (H).	Moderate	-60

Management Actions

It recommended that:

- Unskilled labour (local sub-contractor or directly) be employed from around the study area as to enhance the social benefit to the local population. The proponent must verify local residence status before employment.

- Biotherm Energy implements a skills transfer and capacity building programme.
- No informal settlements must be allowed close to the site.
- Once construction starts security personnel must be permanently stationed on site.
- Employees must be provided with sufficient ablution facilities and transport to the site.
- Construction workers and permanent employees should wear uniforms, PPE and name tags to be easily identifiable.

9.3.10. CUMULATIVE IMPACTS

A cumulative impact is an instance that occurs as a result of the addition of many similar smaller impacts. These smaller impacts may occur from similar or very different developments and individually they may each be within the assimilative capacity of the environment, but together they reach a threshold that then cause serious damage. At the time of writing of this EIA only the existing Sevenstones Aries PV facility is in the process of being developed in close proximity to the site. It should be noted that this project is however planned to be developed around this existing facility to cover the entire remaining feasible area. Therefore due to no facilities being currently located in close proximity to the site, there is limited potential to assess the impact in combination with similar developments, and is beyond the scope and purpose of this document.

There are however various EIA applications surrounding the Aries substation, these include:

- Orlight SA (Pty) Ltd – Kenhardt Solar PV Power Plant
- Green Continent – Solar PV development

The subject facility will definitely, in combination with the existing Aries substation and various transmission/distribution lines intersecting the site, add to the impact associated with these; however this impact is not in the opinion of the environmental specialist considered to be significant, considering the findings of this EIA.

10. CONCLUSIONS AND EAP RECOMMENDATIONS

BioTherm Energy (Pty) Ltd is proposing to develop a commercial photo-voltaic (PV) solar power facility on Portion 1 (remaining extent) of the farm Klein Zwart Bast No. 188 approximately 42 km's south-west of the town of Kenhardt in the Northern Cape Province. The proposed development will be referred to as the Aries II PV Solar Energy Facility, relating to the Eskom Aries Substation located adjacent to the site. A 10 MW facility is located within the area assessed as part of the environmental assessment (DEA Ref: 12/12/20/2098/2).

The proposed project would entail the development of a Photo-voltaic (PV) solar power plant up to 194 hectares in extent with a generation capacity of +/- 100 MW, covering the entire feasible area. The final capacity would be dependent on the continuing development of photovoltaic technologies, as more efficient modules may become available by the time that the project would begin construction. The envisaged generation capacity is, however, expected to range between 75 – 100 MW. The development footprint can however not exceed 194 hectares; however the generation capacity may vary based on the availability of more efficient PV panels. The IPP Procurement programme currently allows for a maximum export capacity of 75MW for solar PV projects. However, the available allocation will determine if the site is to be developed in phases as a reduction the maximum allocation will allow several smaller plants to be constructed

The EIA was commissioned to determine the areas available for construction of the PV facility, taking all environmental aspects into consideration, as to determine the actual feasible area for development. By integrating all the relative specialist assessments commissioned, a site development / layout plan was developed (Figure 10-1). The plan identifies areas on the proposed site that are considered to be "no go" areas, and where no development should occur. Furthermore, certain areas within the proposed study area were identified, which are considered to be most feasible from an environmental point of view. Accordingly, of the 425 hectares assessed as part of this study, 194 hectares have been proposed for authorisation and for development. This area can accommodate approximately 100 MW of electricity for delivery into the national grid

The EIA was commissioned to determine the available area for construction of the PV facility, taking all environmental aspects into consideration. A site layout plan integrating all the relative specialist assessments were developed (Appendix 1). The plan identifies areas on the site that are considered to be "no go" areas, and where no development should occur. Furthermore, feasible areas within assessment location were identified. 194 hectares of 425 hectares assessed have been proposed for authorisation. This area can accommodate approximately 100 MW of electricity for delivery into the national electrical grid.

The Environmental Impact Report presented a comprehensive assessment of the anticipated environmental impacts over the full life-cycle of the proposed Aries II PV facility on Portion 1 (remaining extent) of the farm Klein Zwart Bast 188. Table 10-1 contains a summary of the environmental impact assessment significance rating. The project could potentially result in direct and indirect negative impacts of significance in the absence of appropriate environmental management solutions. The environmental assessment practitioner (EAPs) however, believes that appropriate/ feasible mitigation is readily available to the proponent that would effectively reduce the significance of potentially negative impacts to within acceptable levels. These impacts and mitigation measures

that were assessed as part of the detailed Environmental assessment report (EIR) have been incorporated into this draft EMPr (Appendix 8). This draft EMPr, once approved by the DEA, will be the Aries II PV Solar Energy Facility's formal plan to manage the development and associated environment in an appropriate and responsible manner.

Renewable power generation has various social and environmental advantages such as:

- Clean form of energy compared to conventional coal firing methods. PV power generation does not emit any harmful pollutants to the atmosphere.
- The project has global significance as it reduces carbon dioxide released into the atmosphere
- Local communities' skills development, employment creation as well as capacity building benefits gets created by the proposed development in an area of South Africa with limited economic development opportunities

It is the EAP's opinion that the EIA process to date has been undertaken in an independent, scientifically correct manner, and in compliance with the requirements of applicable legislation. It is, therefore, recommended that the EIA Report be accepted by the Department of Environment Affairs (DEA). Furthermore, it is the EAP's opinion that the positive project impacts are deemed significant, and the negative project impacts can be mitigated to the extent that no significant, or residual, environmental damage will result from project approval. Therefore, it is recommended that the application for Environmental Authorisation be viewed favourably by the Competent Authority, provided that the proposed mitigation and conditions put forward in the EIA and associated EMPr are adhered to and made legally binding to the proponent (i.e. The Project Company).

The following conditions would be required within an authorisation issued:

- All sensitive areas identified in Figure 9-2 should be avoided by the proposed development and no un-authorised access to these areas should be allowed.
- All mitigation measures detailed within this report, specialist reports (Appendix 7) and draft EMPr (Appendix 8) must be implemented.
- This EMPr must be made binding to the project company as well all contractors.
- All required and relevant permits must be submitted to the relevant competent authorities.
- The EMPr (Appendix 8) is seen as a living document and should be updated as determined/required.
- An Environmental Control Officer (ECO) must be appointed to monitor compliance with the attached EMPr for the entire life of the facility.

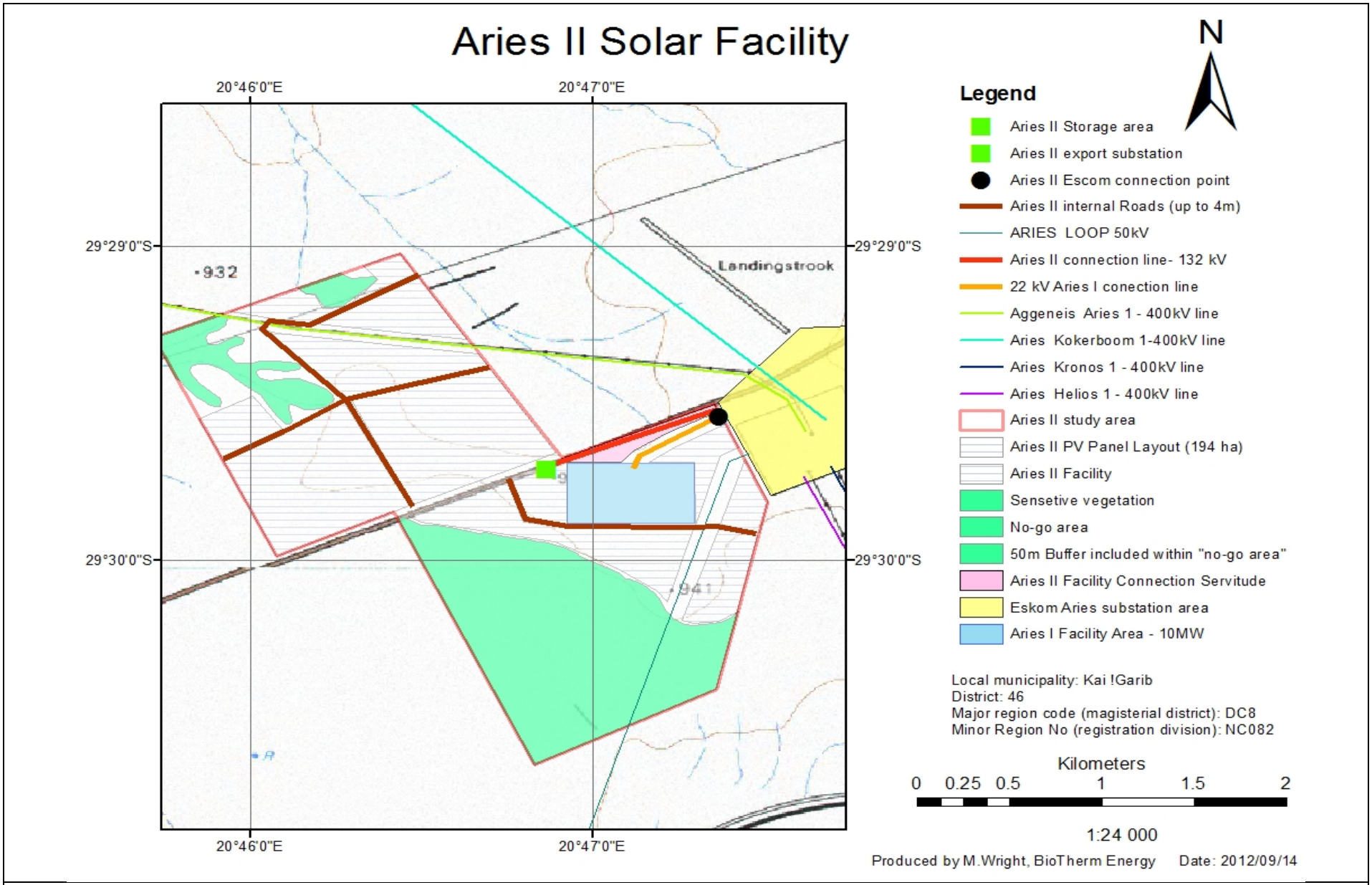


Figure 10-1: Proposed Klein Zwart Bast PV Solar expansion Topological layout plan.

10.1. SUMMARY OF IMPACTS

The EIA process determined the significance of each identified significant impact, the table below provides a summary of all the impacts assessed and their relative significance.

Table 10-1: Tabular Summary of Impact Assessment		
Aspect	**Impact Significance (No mitigation)**	**Impact Significance (mitigation)**
Construction & Operation		
Fauna & Flora	Moderate (-)	Low (-)
Waste Generation	Low (-)	Low (-)
Ground/Surface water Quality	Low (-)	Moderate (-)
Surface Water Runoff (During construction & Operation	Low (-)	Negligible (-)
Heritage	Low (-)	Negligible (-)
Soil & Agricultural Potential		
• Impacts on current land capability/land-use	Negligible (-)	Negligible (-)
• impacts in respect of potential for alternative land-use	Negligible (-)	Negligible (-)
Visual	Moderate (-)	Moderate (-)
Traffic	Negligible (-)	Negligible (-)
Socio Economic	Negligible (-)	Negligible (-)
• Negative impacts on Socio Economics (mainly during Construction)	Low (-)	Moderate (-)
• Positive Impact on Socio Economic	Moderate (+)	Moderate (+)

Table 10-2: Final Significance Scoring		
Final score (S)	**Impact significance**	
0 – 10	Negligible	the impact should cause no real damage to the environment, except where it has the opportunity to contribute to cumulative impacts
10 – 20	Low	the impact will be noticeable but should be localized or occur over a limited time period and not cause permanent or unacceptable changes; it should be addressed in an EMPr and managed appropriately
20 – 50	Moderate	the impact is significant and will affect the integrity of the environment; effort must be made to mitigate and reverse this impact; in addition the project benefits must be shown to outweigh the impact
50 – 100	High	the impact will affect the environment to such an extent that permanent damage is likely and recovery will be slow and difficult; the impact is unacceptable without real mitigation or reversal plans; project benefits must be proven to be very substantial; the approval of the project will be in jeopardy if this impact cannot be addressed

Table 10-2: Final Significance Scoring		
Final score (S)	**Impact significance**	
100 – 200	Severe	the impact will result in large, permanent and severe impacts, such as local species extinctions, minor human migrations or local economic collapses; even projects with major benefits may not go ahead with this level of impact; project alternatives that are substantially different should be looked at, otherwise the project should not be approved

10.2. LIMITATION AND ASSUMPTIONS OF THE ASSESSMENT

The EIA was undertaken successfully; including the following limitation and assumptions

- No alternative site was assessed as part of this EIA and only the optimal generation capacity within the identified areas was determined. ‘
- The cumulative impact on similar development in the area cannot be accurately assessed as various EIA are undertaken in the area, however actual development of these facilities depend on allocation by the DoE. The project was therefore very project specific.
- Information provided by Boitherm Energy to the EAPs was correct and valid at the time it was provided.
- Connection to the national grid is dependent on Eskom, however different options have been identified within this report, please refer to section 4.3.

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