MAINSTREAM RENEWABLE POWER

Construction of a CSP and CPV/ PV Plant in, De Aar, Northern Cape Province of South Africa

Draft Environmental Impact Report

- Ref #12/12/20/2025

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Signature:	
For:	SiVEST Environmental Division

The Independent Environmental Assessment Practitioner in terms of Regulation 17(1):
We, SiVEST Environmental, declare that we –

- act as the Independent Environmental Assessment Practitioners in this application for the proposed construction a Concentrated Solar Plant (CSP) and Concentrated Photovoltaic (CPV/ PV) Plant in, De Aar, Northern Cape Province of South Africa.
- do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the Environmental Impact Assessment Regulations, 2006;
- have and will not have any vested interest in the proposed activity proceeding;
- have no, and will not engage in, conflicting interests in the undertaking of the activity; and
- will provide the competent authority with access to all information at our disposal regarding the application, whether such information is favourable to the applicant or not.

KEY PROJECT INFORMATION

FARM DESCRIPTION: Portion 29 of the Farm Paarde Valley No.145

21 DIGIT SURVEYOR GENERAL CODE: 57000000000014500029

TITLE DEEDS: Attached as Appendix 1

PHOTOGRAPHS OF SITE:

General Characteristics of the study area

General Characteristics of the study area

SENSITIVE VISUAL RECEPTORS:

Name	Receptor Type	Primary Orientation	Zone of visual Impact
Maria's Farm House Bed and Breakfast	Accommodation facility	East (opposite direction of site)	Moderate Visual Impact
Exiting dwellings in De Aar	Homesteads	North-east (toward site)	Moderate Visual Impact
New residential development in De Aar	Future homesteads	North-east (toward site)	Moderate Visual Impact
Britstown road	Main arterial route	South-east / North-west (partially toward site)	Moderate Visual Impact

The visual assessment has determined the visual impact to be low.

TYPE OF TECHNOLOGY: Concentrated Solar Power and Photovoltaic or Concentrated Photovoltaic Power Plant

STRUCTURE HEIGHT: 8-10m

SURFACE AREA TO BE COVERED: 7km^2.

STRUCTURE ORIENTATION: Structure will be oriented in a northeast/northwest orientation

LAYDOWN AREA DIMENSIONS: 100m X 100m during construction.

GENERATION CAPACITY: 50MW (CPV/PV) and 100MW (CSP)

MAINSTREAM RENEWABLE

CONSTRUCTION OF A CSP AND CPV/ PV PLANT IN DE AAR

DRAFT ENVIRONMENTAL IMPACT REPORT

Executive Summary

Mainstream Renewable power intends to construct one Concentrated Solar Power (CSP) and one Concentrated Photovoltaic/Photovoltaic Plant (CPV/PV) in the De Aar area of the Northern Province. The objective of the project is to generate electricity to feed into the National Grid by installing solar power plants (and associated substations).

The proposed plants are regarded as a listed activity in terms of the Environmental Impact Assessment Regulations released on the 18th of June, 2010 and promulgated on the 2nd of August, 2010, and thus require an Environmental Impact Assessment. SiVEST Environmental Division has been appointed as independent consultants to undertake the EIA on Eskom's behalf.

The proposed project involves the construction of a 50 MW PV/CPV and 100 MW CSP plant. Due to the licensing process that needs to be undertaken by Mainstream, it is likely that the project will be phased with the construction of the PV occurring first followed by the CSP project.

The construction of a CSP plant requires the use of large amounts of water. In order to reduce this impact on the environment, the project proposes the use of waste water from the De Aar Municipal Waste Water Treatment Works as opposed to using fresh water from a borehole or river.

The proposed project is required to improve electricity supply to the Eskom Grid and to assist in achieving the Government's mandate for the establishment of renewable energy generation facilities.

The proposed project involves the construction a CSP and PV/CPV plant. Layout alternatives have been investigated and these relate to the location of the associated infrastructure on the site. These are illustrated below:

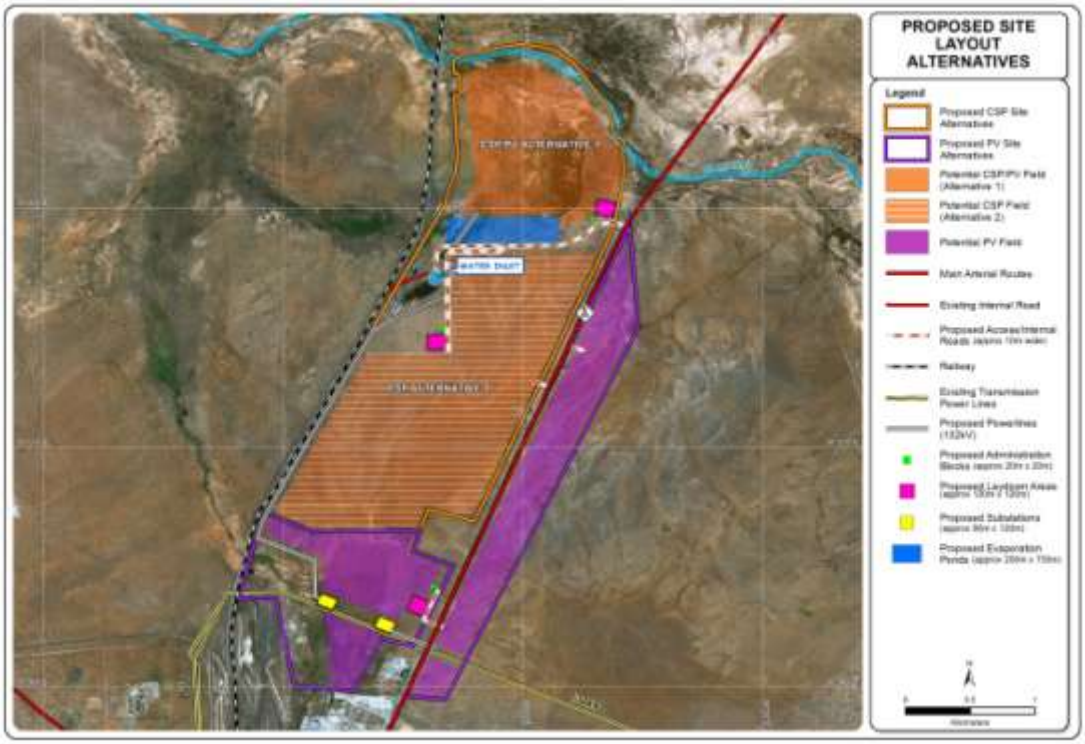

Figure i: Site layout alternatives

The site is characterized by shrublands which are generally dominated by dwarf karoo shrubs and grasses. The site was found to be in a disturbed condition, most likely due to sheep grazing which is known to take place in the area as well as construction activities associated with the secure care centre.

Several specialist studies were conducted for the EIR Phase as stipulated in the Plan of Study for EIA. These included:

- Biodiversity (including fauna, flora and avi-fauna) Assessment
- Surface Water Impact Assessment
- Groundwater Study
- Noise Impact Assessment
- Visual Impact Assessment
- Heritage Assessment
- Socio-economic Impact Assessment (incorporating tourism)
- Waste Management Plan
- Compliance with Equator Principles

Table i: Summary of findings

Environmental Parameter	Summary of major findings	Recommendations
Biodiversity Impact Assessment	The site has been determined to be fairly transformed by anthropogenic activities. The property is also earmarked for future industrial development by the SDF. Birds are the faunal grouping which could be affected the worst by the proposed development. The clearing of the waste water has been identified as a positive impact on both the soils and the bird species present.	The development will not result in a detrimental effect on the environment. Recommended mitigation measures must be put in place to reduce the identified impacts.
Surface Water Impact Assessment	Two surface water features are present on the property, these are however not to be directly affected by the proposed development. The removal of the waste water has been identified as a positive impact.	In consideration of the potential impacts that may affect the functional aspects of the surface water resources, a buffer zone of 32 metres has been applied to the water courses. The mitigation measures stipulated in terms of the above-mentioned impacts have been elaborated on. It is critical that these are followed in order to minimize impacts on the surface water resources found on the proposed study area.
Groundwater Impact Assessment	The proposed development has not been identified as a major risk to groundwater however minor risks associated with hydrocarbons are present which require management.	Stringent implementation of mitigation measures.
Noise Impact Assessment	The proposed development is not likely to affect the current	Infrastructure should be placed as far away as possible from the

	noise environment.	secure care centre.
Visual Impact Assessment	It was ascertained that the proposed development will not have a high visual impact on any visually sensitive receptors, most of which are located to the north of De Aar and include existing and future dwellings and motorists travelling along sections of the R48. The study revealed that the proposed solar energy facility will have a negative low visual impact during construction and a negative medium visual impact during operation, with very few mitigation measures available.	Mitigation measures suggested in the visual study must be implemented to reduce potential visual impacts.
Heritage Impact Assessment	Several heritage features have been identified on the site. Those that fall within the footprint will require documentation and removal by a qualified heritage specialist prior to construction. No palaeontological concerns were identified.	Strict implementation of mitigation and management measures. Consultation with SAHRA through a heritage specialist for the duration of construction.
Socio-economic Impact Assessment	Negative social impacts have been identified however these are able to be mitigated. Several positive impacts associated with the proposed development have also been identified such as a corporate social investment plan to address the high levels of poverty and unemployment in	▪ Social issues identified during the EIA phase are addressed during construction. This could be done by engaging social specialists where necessary or by ensuring that ECOs used during construction have the necessary

	the local community. The proposed development is in line with the SDF and provides an opportunity for reviving the tourism environment of De Aar.	knowledge and skills to identify social problems and address these when necessary. Guidelines on managing possible social changes and impacts could be developed for this purpose. ▪ Neighbouring landowners are informed beforehand of any construction activity that is going to take place in close proximity to their property. Prepare them on the number of people that will be on site and on the activities they will engage in. ▪ Employees are aware of their responsibility in terms of Mainstream's relationship with landowners and communities surrounding the site. Implement an awareness drive to relevant parts of the construction team to focus on respect, adequate communication and the 'good neighbour principle.' ▪ All mitigation measures in the SIA that are relevant to the construction phase are

		incorporated in the EMP to ensure that Mainstream and the contractor adhered to these

These specialist studies were conducted to address the potential impacts relating to the proposed development that were identified during the scoping phase. An impact assessment was conducted to ascertain the level of each identified impact, as well as mitigation measures which may be required. The potential positive and negative impacts associated within these studies have been evaluated and rated accordingly. The results of the specialist studies have indicated that no fatal flaws exist as a result of the proposed substations and associated power lines.

Based on the findings of the specialist studies, the following layout was chosen as the preferred layout.

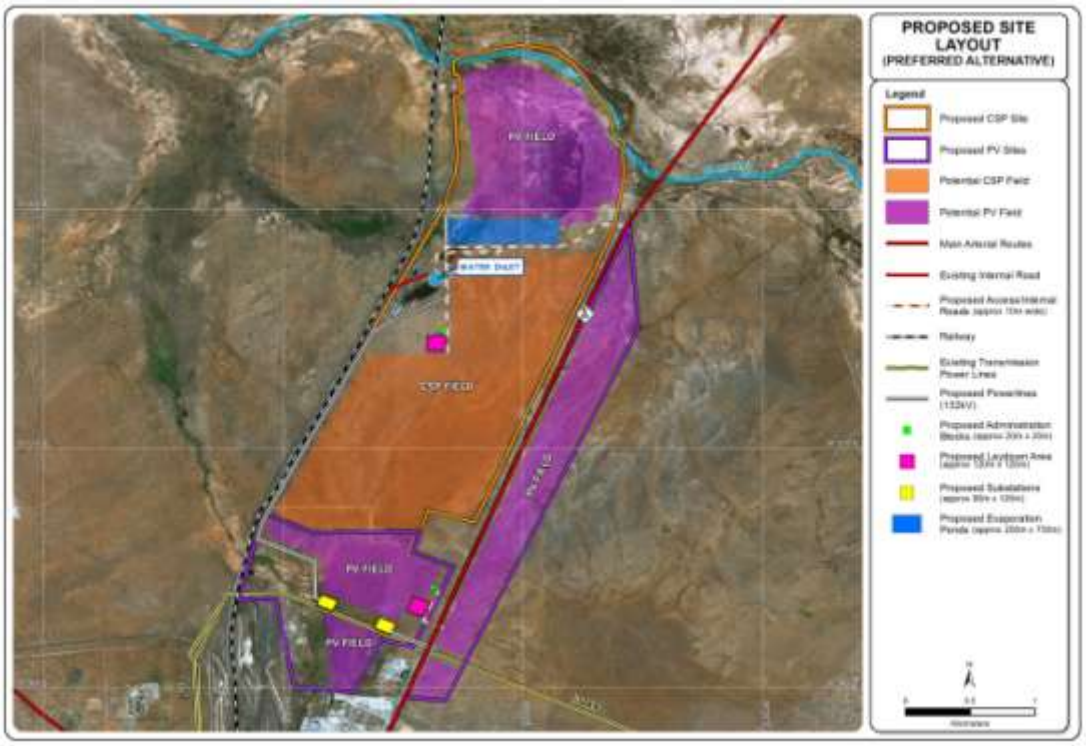

Figure i: Site layout alternatives

It is the opinion of the EAP that the proposed project be allowed to proceed provided that the recommended mitigation measures are implemented.

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CONSTRUCTION OF ONE CSP AND TWO CPV/ PV PLANTS

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Glossary of terms

Archaeological resources: This includes:

- material remains resulting from human activity which are in a state of disuse and are in or on land and which are older than 100 years including artefacts, human and hominid remains and artificial features and structures;
- rock art, being any form of painting, engraving or other graphic representation on a fixed rock surface or loose rock or stone, which was executed by human agency and which is older than 100 years, including any area within 10m of such representation;
  wrecks, being any vessel or aircraft, or any part thereof which was wrecked in South Africa, whether on land, in the internal waters, the territorial waters or in the maritime culture zone of the republic as defined in the Maritimes Zones Act, and any cargo, debris or artefacts found or associated therewith, which is older than 60 years or which SAHRA considers to be worthy of conservation;
- features, structures and artefacts associated with military history which are older than 75 years and the site on which they are found.

Alluvial: Resulting from the action of rivers, whereby sedimentary deposits are laid down in river channels, floodplains, lakes, depressions etc

Biodiversity: The variety of life in an area, including the number of different species, the genetic wealth within each species, and the natural areas where they are found.

Cultural significance: This means aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance

Cumulative Impact: In relation to an activity, cumulative impact means the impact of an activity that in itself may not be significant, but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area.

Cycle water blowdown: to open a valve in a steam boiler to eject any sediment that has collected

The "Equator Principles": A financial industry benchmark for determining, assessing and managing social & environmental risk in project financing

Environmental Impact Assessment: In relation to an application, to which Scoping must be applied, means the process of collecting, organising, analysing, interpreting and communicating information that is relevant to the consideration of the application.

Environmental Impact Report: In-depth assessment of impacts associated with a proposed development. This forms the second phase of an Environmental Impact Assessment and follows on from the Scoping Report.

Environmental Management Programme: A legally binding working document, which stipulates environmental and socio-economic mitigation measures that must be implemented by several responsible parties throughout the duration of the proposed project.

Ephemeral: When referring to a stream or drainage line, it refers to the flow characteristics by which only periodic surface flows typically occur. Similarly when referring to a pan or depression, this would be characterised by only periods of time when surface water occurs within it, usually associated with the rainy season.

ESRI is a software development and services company providing Geographic Information System (GIS) software and geodatabase management applications.

Heritage resources: This means any place or object of cultural significance. See also archaeological resources above

Hyrdomorphic / hydric soil: Soil that in its undrained condition is saturated or flooded long enough during the growing season to develop anaerobic conditions favouring growth and regeneration of hydrophytic vegetation. These soils are found in and associated with wetlands.

Kilovolt (kV): a unit of electric potential equal to a thousand volts (a volt being the standard unit of electric potential. It is defined as the amount of electrical potential between two points on a conductor carrying a current of one ampere while one watt of power is dissipated between the two points).

Macro-geomorphological: Related to / on the scale of geomorphic provinces. A geomorphic province is a spatial entity with common geomorphic attributes.

P**arabolic trough** is a type of solar thermal energy collector. It is constructed as a long parabolic mirror (usually coated silver or polished aluminium) with a Dewar tube running its length at the focal point.

Precipitation: Any form of water, such as rain, snow, sleet, or hail that falls to the earth's surface.

Red Data species: All those species included in the categories of endangered, vulnerable or rare, as defined by the International Union for the Conservation of Nature and Natural Resources.

Riparian: The area of land adjacent to a stream or river that is influenced by stream induced or related processes.

Scoping Report: An "issues-based" report which forms the first phase of an Environmental Impact Assessment process

List of Abbreviations

AIA	- Archaeological Impact Assessment
AP	- Action Plan
ASAPA	- Association of South African Professional Archaeologists
CRM	- Cultural Resource Management
CSP	- Concentrating Solar Power
CPV	- Concentrating Photovoltaic
BID	- Background Information Document
DEA	- Department of Environmental Affairs
DEAT	- Department of Environmental Affairs and Tourism (currently known as DEA)
DWA	- Department of Water Affairs
EIA	- Environmental Impact Assessment
EIR	- Environmental Impact Report
EMPR	- Environmental Management Programme
ENPAT	- Environmental Potential Atlas
EP	- Equator Principles
EPFI	- Equator Principles Financial Institutions
ESA	- Early Stone Age
FGM	- Focus Group Meeting
FSR	- Final Scoping Report
GDP	- Gross Domestic Product
GGP	- Gross Geographic Product
GIS	- Geographic Information System
GPS	- Global Positioning System
HIA	- Heritage Impact Assessment
I&APs	- Interested and Affected Parties
IDP	- Integrated Development Plan
IPP	- Independent Power Producer
ISEP	- Integrated Strategic Electricity Planning
IUCN	- International Union for the Conservation of Nature and Natural Resources

KSW - Key Stakeholder Workshop
kV - Kilo Volt
LSA - Late Stone Age
LIA - Late Iron Age
MSA - Middle Stone Age
MIA - Middle Iron Age
MW - Megawatt
MWp - Megawatt peak
NEMA - National Environmental Management Act, 1998 (Act No. 107 of 1998)
NEMBA - National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)
NHRA - National Heritage Resources Act, 1999 (Act No. 25 of 1999)
NSBA - National Spatial Biodiversity Assessment
NWA - National Water Act, 1998 (Act No. 36 of 1998)
PHRA - Provincial Heritage Resources Agency
PSSA - Palaeontological Society of South Africa
PM - Public Meeting
PPP - Public Participation Process
PV - Photovoltaic
RED - Restructuring Electricity Distribution
SADC - Southern African Development Community
SAHRA - South African Heritage Resources Agency
SANBI - South African National Biodiversity Institute
SAWS - South African Weather Service
SDF - Spatial Development Framework
STEP - Subtropical Thicket Ecosystem Project
VT - Vegetation Type
VFR - Visiting Friends or Relatives
VAC - Visual Absorption Capacity

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DRAFT ENVIRONMENTAL IMPACT REPORT

1 INTRODUCTION

South Africa Mainstream Renewable Power (Pty) Ltd (hereafter referred to as Mainstream) has appointed SiVEST to undertake the EIA process for the proposed construction of a CSP (Concentrating Solar Power) and CPV/ PV (Concentrating Photovoltaic / Photovoltaic) plant in De Aar, Emthanjeni Local Municipality, Northern Cape Province, South Africa. The proposed project involves the construction of a 50 MW PV/CPV and 100 MW CSP plant. The objective of the project is to generate electricity to feed into the national grid by installing a solar panel field. The project is also in line with the government's commitment to provide renewable energy as an alternative energy source to those currently utilized and in line with the IRP 2010.

The applicant is applying for a 50MW PV and 100MW CSP plant, however it is likely that the license might be granted for less. The EIA however covers the larger amount in order to ensure that the maximum is authorised (should authorisation be granted).

In terms of the Environmental Impact Assessment Regulations (2010) published under the National Environmental Management Act, 1998 (Act No 107 of 1998) as amended, the proposed development is regarded as a listed activity under Government Notice R544 - R546 of 2010. The Scoping Phase of the project has been completed and has been accepted by the National Department of Environmental Affairs (DEA). The project is currently at the EIA phase.

This Report is compiled in accordance with World Bank IFC standards and the Equator Principles. The Equator Principles ("EP") are a financial industry benchmark for determining, assessing and managing social & environmental risk in project financing (Equator Principles, 2006). These are elaborated in Section 1.4 below.

This CSP and CPV/ PV project is considered a Category B project. Category B Projects are those with potential limited adverse social or environmental impacts that are few in number, generally site-specific, largely reversible and readily addressed through mitigation measures (Equator Principles, 2006).

1.1 Structure of this Report

This Draft Environmental Impact Report (DEIR) is structured as follows:

- Chapter 1 introduces the project and discusses the experience of the Environmental Assessment Practitioners (EAP), including specialists, who have contributed to the report. It expands on the relevant legal ramifications applicable to the project and describes the Equator Principles, IFC Performance Standards and the relevant development strategies and guidelines.
- Chapter 2 details the approach used to undertake the study i.e. the scoping study, authority consultation and the EIR.
- Chapter 3 elaborates on the assumptions and limitations pertaining to the EIA process for the proposed development.
- Chapter 4 provides explanation to the need and desirability of the proposed project by highlighting issues such as security of power supply; local employment as well as regional and local income profile.
- Chapter 5 gives detailed technical descriptions of the CSP and CPV/PV power plants as well as the alternatives involved.
- Chapter 6 provides a baseline description of the region in which the proposed development is intended to be located. Although the chapter provides a broad overview of the region, it is also specific to the application. It contains descriptions of the site and the specialist studies conducted during scoping are also summarised.
- Chapter 7 describes the Public Participation Process (PPP) undertaken during the EIA Phase and tables issues and concerns raised by Interested and Affected Parties (I&APs).
- Chapter 8 documents the findings of the specialist studies and associated potential impacts of the proposed CSP and CPV/ PV power plants.
- Chapter 9 presents a rating of each environmental issue before and after mitigation measures.
- Chapter 10 identifies potential cumulative impacts per environmental issue (specialist study) discussed in the report as well as mitigation measures.
- Chapter 11 gives a comparative assessment of all identified alternatives based on the various environmental issues (specialist studies).
- Chapter 12 provides a description of the environmental monitoring and auditing process to be undertaken for the proposed CPV/ PV power plants.
- Chapter 13 presents a checklist that ensures that the report has been compiled according to the requirements of the World Bank Standards and Equator Principles.
- Chapter 14 summarises the findings and recommendations per specialist study and provides the overall conclusion.
- Chapter 15 lists references indicated in the EIR.

1.2 Expertise of Environmental Assessment Practitioner

SiVEST has considerable experience in the undertaking of EIAs. Staff and specialists who have worked on this project and contributed to the compilation of this Environmental Impact Report are detailed in Table 1 below.

Table 1: Project Team

Name and Organisation	Role
Liesl Koch – SiVEST	Project Leader, Biodiversity (Flora, Fauna and Avi-fauna)
Shaun Taylor and Paul da Cruz – SiVEST	Surface water, Avifauna
Lucy Chimoyi - SiVEST	Report writing and compilation
Wouter Fourie – PGS	Heritage
John Almond – Natura Viva	Palaeontology
Paul Goldschagg and Francois Malherbe	Noise
Jude Cobbing – Metago Water Geosciences	Groundwater
Nonka Byker and Raoul de Villiers - MasterQ	Socio-economics
Kerry Schwartz - SiVEST	GIS and Mapping
Nicolene Venter and Andrea Gibb - SiVEST	Public participation

Please refer to attached CV's for more information (Appendix 2). Declarations of independence were included in the Scoping Phase.

1.3 Key Legal and Administrative Requirements Relating to the Proposed Development

1.3.1 National Environmental Management Act (Act No 107 of 1998) – NEMA EIA Requirements

The National Environmental Management Act (Act No. 107 of 1998) was promulgated in 1998 but has been amended on various occasions since this date. This Act replaces parts of the Environment Conservation Act (Act No 73 of 1989) with exception to certain parts pertaining to the Integrated Environmental Management. The act intends to provide for co-operative environmental governance by establishing principles for decision-making on matters affecting the environment, institutions that will promote co-operative governance and procedures for coordinating environmental functions exercised by organs of state; to provide for the prohibition, restriction or control of activities which are likely to have a detrimental effect on the environment; and to provide for matters connected therewith.

NEMA now governs the EIA process with the recent promulgation of the new EIA regulations in June 2010 (Government Gazette No. 33306 of 18 June 2010).

Activities that may significantly affect the environment must be considered, investigated and assessed prior to implementation.

In terms of the newly released EIA Regulations promulgated in terms of Chapter 5 NEMA (National Environmental Management Act), which came into effect on 2 August 2010 a full EIA is required for the proposed project

1.3.2 NEMA EIA Requirements

In terms of the new Regulations which have been released on the 18th of June, 2010 and promulgated on the 2nd of August, 2010, a full Environmental Impact Assessment is required for the proposed development.

The following Schedules of the Government Notice No. R. 544 - 545 of 18 June 2010 are of relevance to the proposed project in question. The Listed Activities identified in terms of Sections 24(2) and 24D are summarised in Table 2 and include;

Table 2: Listed activities in terms of the NEMA Regulations

Number and date of the relevant notice:	**Activity No (s)**	**Description of listed activity**
Government Notice R544 (18 June 2010)	Activity 1	The construction of facilities or infrastructure, including associated structures or infrastructure, for the generation of electricity where: *i. the electricity output is more than 10 megawatts but less than 20 megawatts or* *ii. The output is 10 megawatts or less but the total extent of the facility covers an area in excess of one hectare*
	Activity 9	The construction of facilities or infrastructure exceeding 1000 metres in length for the bulk transportation of water sewage or storm water- *i) With an internal diameter of 0.36 metres or more; or* *ii) With a peak throughput of 120 litres per second or more.* excluding where: a) Such facilities or infrastructure are for bulk transportation of water, sewage or storm water or storm water drainage inside a road reserve; or b) Where such construction will occur within urban

		areas but further than 32 metres from a watercourse, measured from the edge of the watercourse.
	Activity 10	The construction of facilities or infrastructure for the transmission and distribution of electricity- *i. outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts; or* *ii. Inside urban areas or industrial complexes with a capacity of 275 kilovolts or more*
	Activity 20	Any activity requiring a mining permit in terms of section 27 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) or renewal thereof.
	Activity 22	The construction of a road outside urban areas *i) with a reserve wider than 13.5 metres* *ii) where no reserve exists where the road is wider than 8 metres*
	Activity 23	The transformation of undeveloped, vacant or derelict land to- ii) *residential, retail, commercial, recreational, industrial or institutional use, outside an urban area, and where the total area to be transformed is bigger than 1 hectare but less than 20 hectares except where such transformation takes place for linear activities*
	Activity 24	The transformation of land bigger than 1000 square metres in size , to residential, retail , commercial, industrial or institutional use, where, at the time of the coming into effect of this schedule such lad was zoned open space, conservation or had an equivalent zoning.
Government Notice R545 (18 June 2010)	Activity 1	The construction of facilities or infrastructure, including associated structures or infrastructure, for the generation of electricity where the electricity output is 20 megawatts or more.
	Activity 8	The construction of facilities or infrastructure for the transmission and distribution of electricity with a capacity of 275 kilovolts or more outside and urban area or industrial complex.
	Activity 10	The construction of facilities or infrastructure for the transfer of 50,000 cubic metres or more of water per day, from and to or between any combinations of the following: *i) Water catchments* *ii) Water treatment works ; or* *iii) Impoundments,*

		excluding treatment works where water is to be treated for drinking purposes.
	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 the activity 16 in this schedule will apply*
	Activity 20	Any activity which requires a mining right or renewal thereof as contemplated in sections 22 and 24 respectively of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002).
Government Notice R546 (18 June 2010)	Activity 12:	The clearance of an area of 300 square metres or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation *a) within any critically endangered or endangered ecosystem listed in terms of section 52 of the NEMBA or prior to the publication of such a list, within an area that has been identified as critically endangered in the National Spatial Biodiversity Assessment 2004;* *b) Within critical biodiversity areas identified in bioregional plans;*

1.3.3 National Heritage Resources Act (Act No 25 of 1999)

This act requires all developers to undertake archaeological impact studies whenever any type of development activities is undertaken. Preliminary archaeological impact studies will consequently become a common procedure for all development activities, even if such development may be exempted in terms of the National Environmental Management Act (Act No 107 of 1998).

The law ensures community participation in the protection of national heritage resources and will involve all three levels of government in the management of the country's national heritage. The South African Heritage Resources Agency (SAHRA) will establish and maintain a national policy, strategy plans and standards for heritage resources management and will monitor the system as a whole.

Heritage authorities will assist and co-operate with individuals and organisations concerned with the study, the conservation and the promotion and utilisation of national heritage resources. A newly established National Heritage Resources Fund will provide financial assistance for heritage projects.

1.3.4 National Water Act (Act No 36 of 1998)

The National Water Act, No 36 of 1998 (NWA) was promulgated on 20 August 1998. This Act is important in that it provides a framework to protect water resources against over exploitation and to ensure that there is water for social and economic development, human needs and to meet the needs of the aquatic environment. The Act also recognises that water belongs to the whole nation for the benefit of all people.

It is important to note that water resources are protected under the Act. Under the act, water resources as defined include a watercourse, surface water, estuary or aquifer. A watercourse is defined as a river or spring, a natural channel in which water flows regularly or intermittently, or a wetland, lake or dam into which, or from which water flows.

One of the main aims of the Act is the protection of water resources. 'Protection' in relation to a water resource entails:

- Maintenance of the quality of the water resource to the extent that the water use may be used in a sustainable way;
- Prevention of degradation of the water resource
- The rehabilitation of the water resource

In the context of the proposed development and any potential impact on water resources, the definition of pollution and pollution prevention contained within the Act is relevant. 'Pollution', as described by the Act is the direct or indirect alteration of the physical, chemical or biological properties of a water resource, so as to make it (inter alia)

- less fit for any beneficial purpose for which it may reasonably be expected to be used; or
- harmful or potentially harmful to the welfare or human beings, to any aquatic or non-aquatic organisms, or to the resource quality.

This definition of pollution is quite wide ranging, and it applies to all types of water resources. Activities which cause alteration of the biological properties of a watercourse, i.e. the fauna and flora contained within that watercourse are also considered pollution.

In terms of section 19 of the Act owners / managers / people occupying land on which any activity or process undertaken which causes, or is likely to cause pollution of a water resource must take all reasonable measures to prevent any such pollution from occurring, continuing or recurring. These measures may include (inter alia):

- measures to cease, modify, or control any act or process causing the pollution
- comply with any prescribed waste standard or management practice
- contain or prevent the movement of pollutants
- remedy the effects of the pollution; and
- remedy the effects of any disturbance to the bed and banks of a watercourse

A surface water assessment has been conducted to explore how the proposed development may impact on water resources as protected by the Act.

1.3.5 National Protected Areas Act (Act No. 25 of 2003)

- Protected species – provincial ordinances

These are developed to protect both animal and plant species within the various provinces of the country which warrant protection. These may be species which are under threat or which are already considered to be endangered. The provincial environmental authorities are responsible for the issuing of permits.

1.3.6 National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004)

The overarching aim of the National Environmental Management: Biodiversity Act 10 of 2004 (NEMBA), within the framework of NEMA, is to provide for:

- The management and conservation of biological diversity within South Africa, and of the components of such biological diversity;
- The use of indigenous biological resources in a sustainable manner; and
- The fair and equitable sharing among stakeholders of benefits arising from bio-prospecting involving indigenous biological resources.

The South African National Biodiversity Institute (SANBI) was established by the NEMBA, its purpose being (*inter alia*) to report on the status of the country's biodiversity and the conservation status of all listed threatened or protected species and ecosystems.

NEMBA provides for a range of measures to protect ecosystems and for the protection of species that are threatened or in need of protection to ensure their survival in the wild, including a prohibition on carrying out a "restricted activity" involving a specimen of a listed threatened or protected species without a permit issued in terms of Chapter 7. Lists of critically endangered, endangered, vulnerable and protected species have been published and a permit system for listed species has been established.

It is also appropriate to undertake a Faunal and Botanical Impact Assessment where developments in an area that is considered ecologically sensitive require an environmental authorisation in terms of NEMA, with such Assessment taking place during the basic assessment or EIA. These two studies will be undertaken during the CSP project.

The NEMBA is relevant to the proposed project as the construction of the plants and other components such as power lines and the substations may impact negatively on biodiversity. The

project proponent is therefore required to take appropriate reasonable measures to limit the impacts on biodiversity, to obtain permits if required and to also invite SANBI to provide commentary on any documentation resulting from the proposed development.

1.3.7 The National Forest Act, 1998 (Act 84 of 1998) (NFA)

The National Forest Act, 1998 (Act 84 of 1998) (NFA) was enacted to:

- Provide for the protection, management and utilisation of forests;
- The protection of certain plant and animal life;
- The regulation of trade in forest produce;
- The control and management of a national hiking way system and National Botanic Gardens.

The NFA enforces the necessity for a license to be obtained prior to destroying any indigenous tree in a natural forest and, subject to certain exemptions, cutting, disturbing, damaging, destroying or removing any protected tree. The list of protected trees is currently contained in GN 32731 of 27/11/2009. Licenses are issued by the Minister and are subject to periods and conditions as may be stipulated.

The NFA is relevant to the proposed project as the removal and/or disturbance and/or clearance of indigenous vegetation may be required and a license in terms of the NFA may be required for this to be done.

1.3.8 Additional Relevant Legislation

- Occupational Health and Safety Act (Act 85 of 1993)
- National Environmental Management: Air Quality Act, 2004
- Project Facilitation Act (Act No. 67 of 1995)
- National Environmental Management: Biodiversity Act (Act No: 10 of 2004)

1.4 Equator Principles (EPs)

The Equator Principles are a financial industry benchmark for determining, assessing and managing social & environmental risk in project financing. A number of banks, exchanges and organisations worldwide have adopted the Principles as requirements to be undertaken for project funding on application and approval. Furthermore, certain funding institutions have not formally adopted the Principles, but require clients to be compliant with them in order to qualify for loans. The Equator Principles are summarised below:

Principle 1: Review and Categorisation

When a project is proposed for financing, the Equator Principles Funding Institution ("EPFI") will categorise the project based on the magnitude of its potential impacts and risks.

Principle 2: Social and Environmental Assessment

For each project assessed as being either Category A or Category B, the client / borrower must conduct a Social and Environmental Assessment ("Assessment") process to address the relevant impacts and risks of the proposed project. The Assessment should also propose mitigation and management measures relevant and appropriate to the nature and scale of the proposed project.

Principle 3: Applicable Social and Environmental Standards

The Assessment will refer to the applicable IFC Performance Standards and applicable Industry Specific EHS Guidelines.

Principle 4: Action Plan and Management System

The client / borrower must prepare an Action Plan ("AP") or management system that addresses the relevant findings, and draws on the conclusions of the Assessment. The AP will describe and prioritise the actions needed to implement mitigation measures, corrective actions and monitoring measures necessary to manage the impacts and risks identified in the Assessment. The management measures are required to comply with the applicable host country, social and environmental laws and regulations, and requirements of the applicable Performance Standards and EHS Guidelines, as defined in the AP.

Principle 5: Consultation and Disclosure

The client / borrower or third party expert must consult with project affected communities in a structured and culturally appropriate manner. For projects with significant adverse impacts on affected communities, the process will ensure their free, prior and informed consultation and facilitate their informed participation as a means to establish, to the satisfaction of the EPFI, whether a project has adequately incorporated affected communities' concerns.

In order to accomplish this, the non-technical summaries must be made available to the public by the borrower for a reasonable minimum period in the relevant local language and in a culturally appropriate manner.

Principle 6: Grievance Mechanism

To ensure that consultation, disclosure and community engagement continues throughout construction and operation of the project, the borrower must, scaled to the risks and adverse impacts of the project; establish a grievance mechanism as part of the management system. This will allow the borrower to receive and facilitate resolutions of concerns and grievances about the project's social and environmental performance raised by individuals or groups from among project-affected communities.

Principle 7: Independent Review

For all Category A projects and, as appropriate, for Category B projects, an independent social or environmental expert not directly associated with the borrower must review the Assessment, AP and

consultation process documentations in order to assist the EPFIs due diligence, and assess Equator Principles compliance.

Principle 8: Covenants

An important strength of the Principles is the incorporation of covenants linked to compliance. For Category A and B projects, the client / borrower will covenant in financing documentation:

- To comply with all relevant host country, social and environmental laws, regulations and permits in all material respects
- To comply with the AP (where applicable) during the construction and operation of the project in all material respects
- To provide periodic reports in a format agreed with EPFIs (with the frequency of these reports proportionate to the severity of impacts, or as required by law, but not less than annually), prepared by in-house staff or third party experts, that is; i) document compliance with the AP (where applicable), and ii) provide representation of compliance with relevant local, state and host country social and environmental laws, regulations and permits
- To decommission the facilities, where applicable and appropriate, in accordance with an agreed decommissioning plan

Principle 9: Independent Monitoring and Reporting

To ensure ongoing monitoring and reporting over the life of the loan, EPFIs will, for all Category A projects, and as appropriate, for Category B projects, require appointment of an independent environmental and/or social expert, or require that the borrower to retain qualified and experienced external experts to verify its monitoring information, which would be shared with EPFIs.

Principle 10: EPFI Reporting

Each EPFI adopting the Equator Principles commits to report publicly at least annually about its Equator Principles implementation processes and experience, taking into account appropriate confidentiality considerations.

Although this report is not written in terms of the Equator Principles (EPs), it fully acknowledges that EPs will need to be complied with should funding for the project be required. In general, the following documentation will need to be considered in that regard:

- The “Equator Principles” 2006
- International Finance Corporations Performance Standards on Social and Environment, IFC, April, 2006 namely:
    - Performance Standard 1: Social and Environmental Assessment and Management Systems
    - Performance Standard 2: Labor and Working Conditions
    - Performance Standard 3: Pollution Prevention and Abatement
    - Performance Standard 4: Community Health, Safety and Security
    - Performance Standard 5: Land Acquisition and Involuntary Resettlement

- Performance Standard 6: Biodiversity Conservation and Sustainable Natural Resource Management
- Performance Standard 7: Indigenous Peoples
- Performance Standard 8: Cultural Heritage

- International Finance Corporation – World Bank Guidelines, General EHS Guidelines 2007.

The Environmental, Health, and Safety (EHS) Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP). These EHS Guidelines are applied as required by the World Bank's respective policies and standards. These General EHS Guidelines are designed to be used together with the relevant Industry Sector EHS Guidelines which provide guidance to users on EHS issues in specific industry sectors.

- The EHS Guidelines contain the performance levels and measures that are generally considered to be achievable in new facilities by existing technology at reasonable costs.

1.5 Key Development Strategies and Guidelines

1.5.1 Integrated Development Plans

An Integrated Development Plan (IDP) is defined in the Local Government: Municipal Systems Act, 2000 (Act 32 of 2000), as an inclusive and strategic plan that:

- Links, integrates and co-ordinates plans and takes into account proposals for the development of the municipality;
- Aligns the resources and capacity of the municipality with the implementation of the plan
- Forms the policy framework on which annual budgets must be based; and,
- Is compatible with national and provincial development plans and planning requirements binding on the municipality in terms of legislation.

The main purpose of the IDP is for the enhancement of service delivery and fighting poverty through an integrated and aligned approach between different role-players and stakeholders.

Each municipality is required to produce an IDP which would address pertinent issues relevant to their municipality. However, common concerns include municipal transformation and development, and service delivery and infrastructural development. With regards to the latter, electricity, amongst other municipal services, is highlighted as a priority issue warranting attention, in particular the provision of access to electricity to affected communities and the improvement of the electricity infrastructure (mini-substations, cables). One of the objectives of the Pixley ka Seme District Municipality is to provide access to electricity to all households by 2014. This will be achieved through:

- Fast tracking the process of delivery of free basic electricity.
- Ensuring access to electricity or alternative source of energy for all.
- Undertaking a desktop survey on alternative source of energy.
- Upgrading and maintenance of electricity network.
- Provision of area lighting.

The Emthanjeni Local Municipal Integrated Development Plan (IDP, 2006 – 2011), indicates that the municipality encourages renewable energy projects which will play a role in increasing Economic development. The Municipality has already identified a number of investors in this respect (however these are not specified in the IDP). In terms of the IDP Capital Projects for the 2010-2013 Budgets, Electrification projects will see the According to the electrification of 229 houses.

In addition, the following projects are planned with regards to electricity as key performance area in the municipality (in terms of sustainable services):

- Electrifying of 109 houses Barcelona, phase 2. Also, provide street lighting in the Emthanjeni area in general.
- General maintenance to transformers of the municipality.
- Service of new hospital regarding electricity network i.e. ring fencing.
- Upgrading of Electrical Network of industrial area.
- Upgrading of Electrical Network in Waterdal.
- High mast lighting behind St Johns Primary School, Street.
- RED 2 restructuring Section 78 and Ring fencing process. Emthanjeni Municipality falls under RED 2 which comprises the whole of the Free State, the eastern part of the Northern Cape and a portion of Gauteng. Emthanjeni Municipality is required to do a MSA (Municipal Systems Act) Section 78 investigation.
- Britstown High mast lighting.

Therefore the proposed development is aligned with the goals of the municipal IDPs in the study area.

The following projects are planned per Local Municipality for the year 2010-11

Municipality	**Capital Project**
Kareeberg LM	▪ Upgrading of electricity network in riverside in Carnarvon ▪ Conversion of conventional electricity meters in Carnarvon
Renosterberg LM	▪ Supplying electricity and upgrading of network
Siyathemba LM	▪ Upgrading of electrical network in extension 9 in Prieska
Pixley ka Seme DM	▪ Upgrading of electricity network from Hydra station to Maritzberg via Victoria-west undertaking of a feasibility
Emthanjeni LM	▪ Upgrading of electrical network in industrial area

(Ref.: Pixley ka Seme District Municipality, Strategic Plan 2010/11; Pixley ka Seme District Municipality, IDP, 2010)

1.5.2 Integrated Energy Plan for the Republic of South Africa, 2003

The Integrated Energy Plan, developed by the DME, was formulated to address the energy demand of the country balanced with energy supply, transformation, economics and environmental considerations in concourse with available resources. One of the main objectives of the plan is to promote universal access to clean and affordable energy, with emphasis on household energy supply being co-ordinated with provincial and local integrated development programmes. Another objective is to ensure that environmental considerations in energy supply, transformation and end uses are met. This project will assist in achieving this goal.

1.5.3 Independent Power Producer Process

(The following information was extracted from the Eskom website: Guide to Independent Power Producer (IPP) processes in South Africa and Eskom**,** June 2010 http://www.eskom.co.za/live/content.php?Item_ID=14324)

The objective of this section is to provide an overview of the processes in the country and within Eskom relating to Independent Power Producers (IPPs). It is important that certain enabling policies, rules and regulations are in place to provide certainty and transparency in the introduction of IPPs.

- Country Process

South Africa has two acts that direct the planning and development of the country's electricity sector:

i. The National Energy Act of 2008 (No. 34 of 2008)
ii. The Electricity Regulation Act (ERA) of 2006 (No. 4 of 2006).

In August 2009, the Department of Energy (DoE) gazetted the Electricity Regulations on New Generation Capacity under the ERA. The New Generation Regulations establish rules and guidelines that are applicable to the undertaking of an IPP Bid Programme and the procurement of an IPP for new generation capacity. They also facilitate the fair treatment and non-discrimination between IPPs and the buyer of the energy.

- Formal Programmes

In terms of the New Generation Regulations, the Integrated Resource Plan (IRP) will be developed by the DoE and will set out the new generation capacity requirement per technology, taking energy efficiency and the demand-side management projects into account. This required, new generation capacity must be met through the technologies and projects listed in the IRP and all IPP procurement programmes will be executed in accordance with the specified capacities and technologies listed in the IRP.

A decision that additional capacity be provided by an IPP must be made with the concurrence of the Minister of Finance. Once such a decision is made, a procurement process needs to be embarked upon to procure that capacity in a fair, equitable and transparent process.

The New Generation Regulations set out the procurement process. The stages within a bid programme are prescribed as follows:

i. Request for Qualifications (RFQ)
ii. Request for Proposals (RFP)
iii. Negotiation with the preferred bidder(s).

A successful bidder will be awarded a Power Purchase Agreement (PPA) subject to approval by the Regulator.

The only programme currently in this category is the Renewable Feed-In Tariff (REFIT) programme with phase 1 targeting at least 1025MW as per IRP2010 released in March 2011. For the Renewable Energy Feed-In Tariff (REFIT) programme, specific selection criteria (currently being developed by the Regulator) will be used to elicit the preferred bidder(s). Once the Regulator has approved the bidder's associated PPA, the bidder may be licensed as a generator and grid connection may be possible. This programme is anticipated to commence in the third quarter of 2010 and it could take between 6 and 18 months from the date of commencement to sign the first PPA.

- Historical Projects

Certain projects were developed prior to the gazetting of the New Generation Regulations. In the absence of regulations, these vested projects were undertaken in order to ensure security of supply. The projects and programmes that fit into this category are Eskom's current new build programme, the medium term power purchase programme (~400MW) and the DoE's open cycle gas turbine (OCGT) IPP project (~1020MW).

- Unsolicited Projects

Per the New Generation Regulations, the "buyer" can only procure energy in accordance with the IRP. While a policy vacuum currently exists in respect of unsolicited offers (i.e. those proposals which are outside the scope and timeframe of particular programmes under the IRP, but present a unique opportunity which could leverage strategic and economic benefit for the country), work is being undertaken to establish a framework and process whereby such proposals could be considered. This will be discussed within Eskom and with the DoE and NERSA. Currently regional projects such as Mmamabula and Moambo also fall into this category but are covered by inter-government memoranda.

- Independent System and Market Operator

Concerns have been raised by stakeholders regarding the failure by Eskom to facilitate the introduction of IPPs in the Electricity Supply Industry and the concerns relate to:

i. The absence of an enabling framework for the introduction of IPPs.
ii. The role of Eskom, and in particular, the possible conflict of interest by Eskom in this regard.

The establishment of an Independent System and Market Operator (ISMO) has been suggested as a response to these challenges.

Eskom has indicated that the regulatory framework has addressed a number of the concerns over time and that the main obstacle related to funding. The developments within the current regulatory framework must therefore be taken into account in developing an appropriate solution. This will assist in understanding the nature of the problem and also the timeframes within which appropriate solutions can be implemented.

The Multi Year Price Determination (MYPD2) has, for the first time, allowed the costs for certain IPPs. As a result of this determination, Eskom is in the process of entering into PPAs on some of the historical projects and is gearing up to start the procurement process for the REFIT programme.

However, to the extent that it is required, there may be merit in establishing a non conflicted buyer office to manage the procurement process.

There is also a view that Eskom has a conflict with regard to the dispatch of power once a PPA has been entered into. In this regard it should be pointed out that none of the PPAs that have been contemplated require dispatch (with the possible exception of the DOE IPP should it proceed). The current PPAs and those contemplated over the next few years are all based on "self-dispatch" or on a "take or pay basis". What this means is that there is no competition to sell power on a day to day (or week to week or any other period) basis.

The restructuring of the electricity industry, and in particular, the decision to establish an ISMO is a critical decision that needs to be carefully considered. The current framework allows time within which to properly consider an appropriate model for the industry and an end state model for an ISMO, whilst allowing the entry of IPPs.

The timing of the establishment of an ISMO must balance the objective to be achieved with the need to minimise disruption of the industry at a time when there are significant capacity challenges.

It is important to note that the fundamental issues - pricing, government support and risk allocation - will not be addressed through structure alone.

- Current Eskom Process

The Single Buyer Office (SBO) housed within the System Operations and Planning Division was established in 2007. The Single Buyer Office is currently preparing itself to execute the mandate of the IPP procurement process envisaged in the New Generation Regulations. Currently the SBO consists of a core team, with support from Eskom staff providing the necessary expertise complemented by advisors as required: The SBO deals with all IPP programmes (historical, formal and unsolicited).

Regional import IPP programmes are being considered within the scope of inter-governmental memoranda of understanding.

- Current Programmes

The following programmes fall within the accountability of the SBO:

  - Renewable Energy Feed-in Tariff (REFIT) programme
  - Medium Term Power Purchase Programme
  - Department of Energy Open Cycle Gas Turbine (OCGT) programme
  - Municipality generation
  - Multi-Site base load (MSBL) IPP programme
  - Regional Import IPP programmes
  - Unsolicited bids

- Enabling Environment

A key prerequisite to attracting private sector participation in the electricity supply industry is the creation of a supportive "enabling environment". The enabling environment requires coordination and alignment between government departments, state-owned enterprises, businesses and development institutions. The following issues need to be addressed:

  - Coherent Energy Policy and an Integrated Resource plan
  - Cost Recovery Mechanism (CRM)
  - Risk Allocation
  - Government Guarantees
  - Tariff Path
  - Regulatory Environment

2 APPROACH TO UNDERTAKING THE STUDY

The Environmental Impact Assessment was undertaken in accordance with the Environmental Impact Assessment Regulations (2006) published in GN No. 385, No 386 and No 387 in terms of Section 24 (5) of the National Environmental Management Act, 1998 (Act No 107 of 1998) as amended; the World Bank Standards (IFC Guidelines) and the Equator Principles as well as with the relevant legislation and guidelines mentioned above.

2.1 Environmental Scoping Study

The Scoping Study identified the potential positive and negative impacts associated with the proposed development. The Scoping Study also identified the studies to be undertaken as part of the EIA-stage of the project. The Draft Scoping Report was made available for public review from the 23rd of November 2010 to the 13th of January 2011. The following studies have been taken through into the EIA Phase:

- Biodiversity (including fauna, flora and avi-fauna) Assessment
- Surface Water Impact Assessment
- Groundwater study
- Noise Impact Assessment
- Visual Impact Assessment
- Heritage
- Tourism
- Socio-economic Impact Assessment

2.2 Authority Consultation

The National Department of Environmental Affairs (DEA) is the determining authority on this application. The following consultation took place with DEA:

- An application was submitted to DEA on the 31st of August 2010. This application was acknowledged on the 14th of September 2010 and the reference number 12/12/20/2025 was allocated to the project. Authorisation was thus granted to undertake a scoping study and submit a Scoping Report for the project.
- A Landowner Consent form was also submitted with the said application forms.
- An amended application form was submitted on the 01st of October 2010 to include additional farm portions. This was accepted on the 15th of October. The reference number remained the same and all advertising and correspondence included this revised information.

- The Final Scoping Report was submitted to the DEA on the 19th of January 2011 and approved on the 6th of April 2011.

A record of all authority consultation is included within Appendix 3.

Consultation with other relevant authorities was and is also being undertaken through meetings and by telephones in order to actively engage and provide them with information as feedback is gained.

Authorities and key stakeholders consulted include the following:

- Department of Water Affairs (DWA)
- Department of Roads and Public Works
- Department of Mineral Resources (DMR)
- Department of Education
- Department of Housing and Local Government
- Department of Rural Development and Land Reform
- Department of Labour
- Northern Cape Department of Economic Development and Tourism
- Northern Cape Provincial Government
- Department of Environment and Nature Conservation
- Department of Agriculture Forestry and Fisheries (DAFF)
- South African Heritage Resources Agency (SAHRA)
- South African National Roads Agency Limited (SANRAL)
- Emthanjeni Local Municipality
- Pixley ka Seme District Municipality

2.2.1 Authority Site Visit

A site visit with DEA and other major stakeholders took place on the 15th of February 2011. The site was visited by stakeholders representingThe site was described to the attendees and proposed plans were explained. Environmental concerns were discussed on site. A site visit report is included in Appendix 3 as a record of this site visit.

2.3 Environmental Impact Report

The EIR Phase of the project has focused on consulting with Interested and / or Affected Parties as well as conducting specialist studies to address the potential impacts identified during the Scoping Phase.

The purpose of the EIR is to:

- address issues that have been raised during the scoping phase;
- assess alternatives to the proposed activity in a comparative manner;
- assess all identified impacts and determine the significance of each impact; and
- formulate mitigation measures.

3 ASSUMPTIONS AND LIMITATIONS

- All information provided by the Applicant to the Environmental Team was correct and valid at the time it was provided.
- It is not always possible to involve all Interested and / or Affected Parties individually. However, every effort has / is being made to involve as many interested parties as possible. It is also assumed that individuals representing various associations or parties convey the necessary information to these associations / parties.

4 PROJECT NEED AND DESIRABILITY

According to Eskom, the demand for electricity in South Africa has been growing at approximately 3% per annum. This growing demand, fueled by increasing economic growth and social development within Southern Africa, is placing increasing pressure on South Africa's existing power generation capacity. Coupled with this, is the growing awareness of environmental impact, climate change and the need for sustainable development. The use of renewable energy technologies, as one of a mix of technologies needed to meet future energy consumption requirements is being investigated as part of Eskom's long-term strategic planning and research process.

As the demand for electricity grows, there is need to establish new generation capacity in South Africa within the next several years. The available technologies may differ in their generation costs, state of commercial development and most importantly, suitability to the South African Environment.

The Government of South African has also committed to supporting the development of 8 000MW in solar electricity generation with the option of further allocation in the future.

As one of its strategies to meet future energy consumption requirements, the country is opting for the use of renewable energy technologies. This technology is therefore fast becoming an important energy option in South Africa and Mainstream plan to establish a Concentrating Solar Power (CSP) and Photovoltaic (PV) plant in the Northern Cape Province.

According to the solar map (Figure 1), large parts of the Northern Cape region of South Africa have the highest concentration of solar energy in the world; hence is ideal for the establishment of solar

plants. Solar energy is an abundant renewable energy resource which cannot be depleted. Furthermore it has been identified as predictable, clean and cost free fuel.

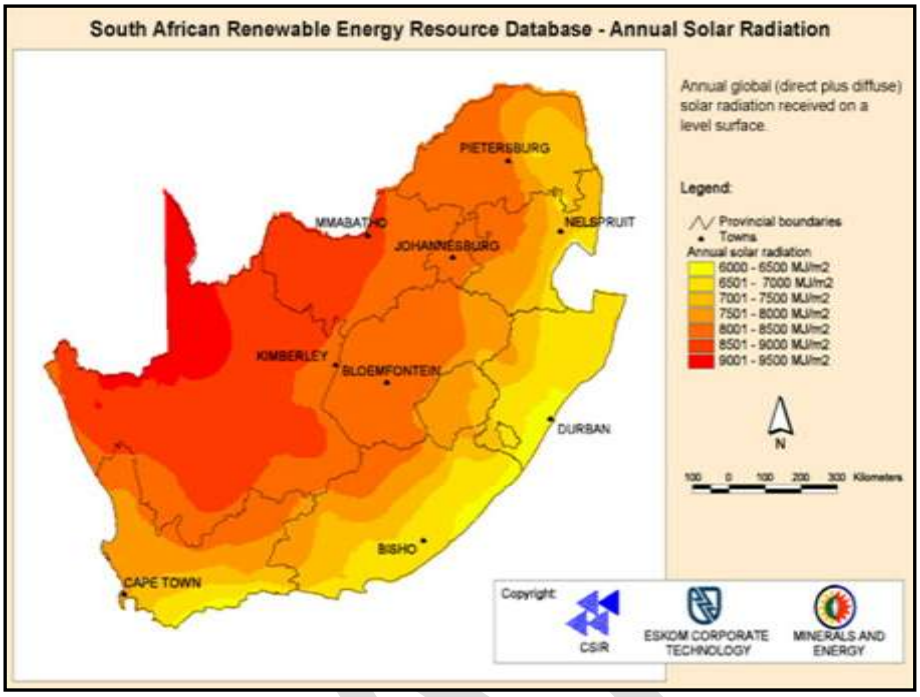

Figure 1: National Solar Resource Map (Source: Solar Vision, 2010)

In addition, CSP/ (PV/PV plants have been identified as potentially being viable and capable of being developed on a large scale. Cumulatively along with other Solar and renewable energy sources, this will contribute to meeting power needs.

It is important to note that the current CPV/ PV market in South Africa is relatively small {about 12 MWp (Megawatt peak) installed}. In 2002, the overall sales volume (including exports) was estimated at 3 to 3.5 MW, with a market turnover of approximately R200 million to R225 million (Cawood & Morris, 2002). At that time, a manufacturer indicated expected production of 8 MWp for 2003. Therefore the opportunity for investment into these facilities, given the overall increasing demand both locally and internationally, needs to be further stimulated.

4.1.1 Security of Power Supply

In the period immediately after the supply shortage and 2007/2008 power blackouts, Eskom announced a number of new power generation facilities including new coal-fired power stations, refurbishment of mothballed stations and oil, diesel or gas powered turbines in order to ensure appropriate supply and the needed reserve margin. In the intervening period, several of these projects have experienced delays as the economic recession has lead to reductions in demand pressure.

However, with possible recovery looming the situation may change in 2010/2011 and demand growth may resume. Short to medium term electricity supply security is instrumental in securing economic growth and investor confidence (IHS Global Insight, 2009).

The project has the potential of "securing" economic activity by assisting in removing supply constraints if Eskom generation activities result in a supply shortfall. When supply is constrained it represents a limitation to economic growth. When a supply reserve is available, it represents an opportunity for economic growth.

The development of renewable energy feed-in tariffs and recent comments by the International Monetary Fund (IMF) regarding a preference for financing cleaner energy are likely to influence the energy sector. These developments could lead to an increase in activity by independent power producers (IPPs) focusing on clean energy, creating a competitive environment for electricity provision. They may also increase public resistance to traditional generation methods, leading eventually to policy shifts and further economic incentives for cleaner energy such as tax advantages and rebates. These incentives are currently being expanded in Europe and the US and South Africa may follow with similar initiatives.

Renewable power producers may face competition in the long term from each other and resistance from Eskom as an increasing number of renewable IPPs attempt to provide energy to the grid and provide off-grid solutions. However, IPPs may benefit from better economic viability due to increasing economic policy incentives for renewable energy, if such incentives are fully implemented in South Africa.

4.1.2 Local Employment

With regards to the De Aar site, local employment seems to be better than both district level employment and that of the province, with a lower level of economic non-participation. This may be due to the exported unemployment to large centres, resulting in a higher locally employed population.

The proposed project will contribute to local economic progress by supporting industry development in line with provincial and regional goals and ensuring advanced skills are drawn to the Northern Cape. The project will likely encounter widespread support from government, civil society and businesses, all of whom see potential opportunities for revenues, employment and business opportunities locally (MasterQ 2011).

4.1.3 Regional and Local Income Profile

Additional evidence of the employment patterns discussed above is also apparent from the comparison of local, regional and provincial income figures. At the De Aar site, access to income seems to be slightly better compared to provincial levels, although there was an extremely low

response rate to income questions locally which makes interpretation of results difficult. There seems to be a lack of opportunity for the highly skilled, which may explain the very low percentage of respondents earning in the category R12 801 or more per month (MasterQ 2011).

4.1.4 Environment

The site in question has been determined as suitable for various reasons however one of the major desirable factors associated with the site is the fact that waste water can be used for the CSP plant and not fresh water.

5 TECHNICAL PROJECT DESCRIPTION

Eskom has confirmed that the existing infrastructure can accept the electricity generated by the PV plant (Appendix 4). In consultation with Eskom, the Applicant received confirmation that the grid can accommodate the project. Eskom will issue written confirmation as part of its proposed REFIT Report releases.

5.1 CPV/PV Project Components

The project will consist of two components:

- CPV/PV Power Plant
- Associated infrastructure

5.1.1 CPV/PV Project Description

PV panels silently convert sunlight to electrical energy. They generate direct current (DC) that is converted to alternating current (AC) to be used by the electricity grid. Regardless of the PV configuration, inverter hardware is required to change the direct current PV output to useable AC power for the grid. PV may be connected to the electricity network at the domestic level of 240V or at higher voltage, depending on the size and location of the generating plant. The PV components are described in detail below.

5.1.2 CPV/PV Solar Power Plant

The CPV/ PV plant will consist of the following infrastructure;

- Solar field
- Buildings

The proposed site falls on portion 29 of the farm Paarde Valley No 145. The SG number is C05700000000014500029. The total surface area to be covered will be approximately 7.36km^2 including all associated infrastructure during construction. The plant will generate 50MW and 100MW of electricity from the CPV and CSP plants respectively.

The property on which the plant is to be constructed will be leased by Mainstream from the property owner, Emthanjeni Local Municipality, for the life span of the project.

- Solar field

Concentrated Photovoltaic (CPV) or Photovoltaic (PV) panel arrays with approximately 160 000 panels will be installed. An area of approximately 2km^2 is likely to be required for the CPV/PV. The area required does not need to be cleared or graded however no tall vegetation such as trees can remain on the site. Not tall vegetation is present on the site.

The panel arrays are approximately 15m x 4m in area. These are mounted into metal frames which are usually aluminium. Concrete or screw pile foundations are used to support the panel arrays. The arrays are either fixed on a tracking system (CPV is always on a tracking system) or tilted at a fixed angle equivalent to the latitude at which the site is located n order to capture the most sun (Figure 2). Arrays usually reach up to between 5m and 10m above ground level. Either a CPV or PV plant will be installed. The difference between a PV and CPV is that the CPV panel is slightly different in that it contains small mirrors in addition to the normal photovoltaic cells.

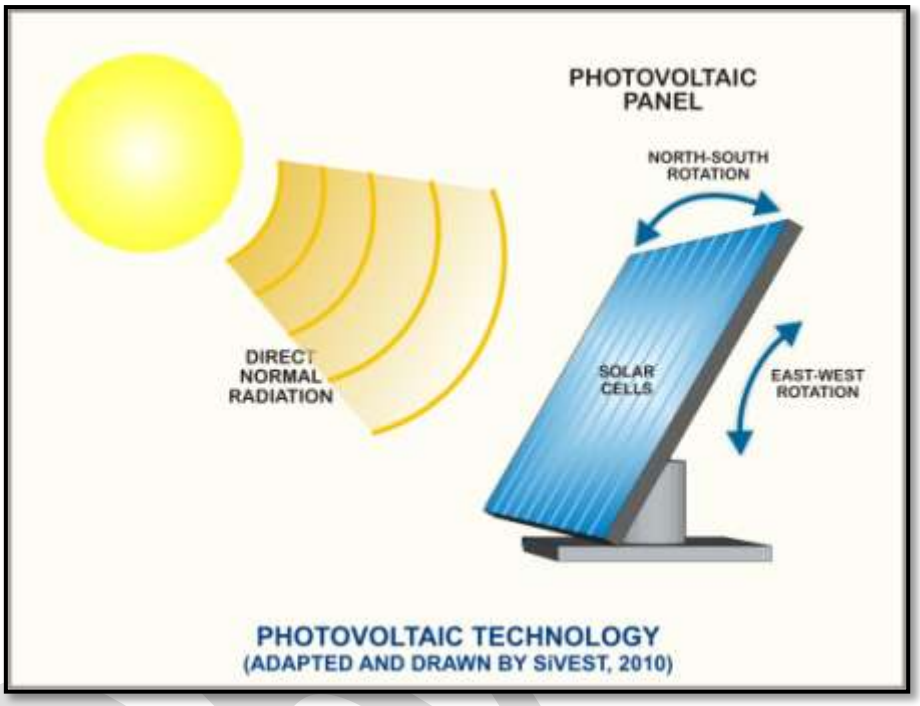

Figure 2: Illustration of how a CPV panel operates

- Building infrastructure

The solar field will require on site buildings which will relate to the daily operation of the plant. The plant will require administration buildings (office) and possibly a warehouse for storage. The buildings will likely be a single storey building with warehouse / workshop space & access (e.g. 5m high, 20m long, 20m wide). The office will be used for telecoms and ablution facilities will be included. Security will be required.

- **Associated infrastructure**

  - Electrical Infrastructure

The PV arrays are typically connected to each other in strings and the strings connected to DC to AC inverters (Figure 3). The DC to AC inverters may be mounted on the back of the panel's support substructures / frames or alternatively in a central inverter station. The strings are connected to the

inverters by low voltage DC cables. Power from the inverters is collected in medium voltage transformers through AC cables. Cables may be buried or pole-mounted depending on voltage level and site conditions.

The medium voltage transformers can be compact transformers distributed throughout the solar field or alternatively located in a central sub-station. It is likely to be a central substation in this instance.

The distribution substation will be approximately 90m x 120m in size and will ideally be located in close proximity to the existing power lines that traverse a part of the site. The substation will be a distribution substation and will include transformer bays which will contain transformer oils. Bunds will be constructed to ensure that any oil spills are suitably attenuated and not released into the environment. The substation will be securely fenced. The substation will be operated by Eskom.

The PV substation will be located adjacent to the existing power line and the connection to the line will be via drop-down conductors.

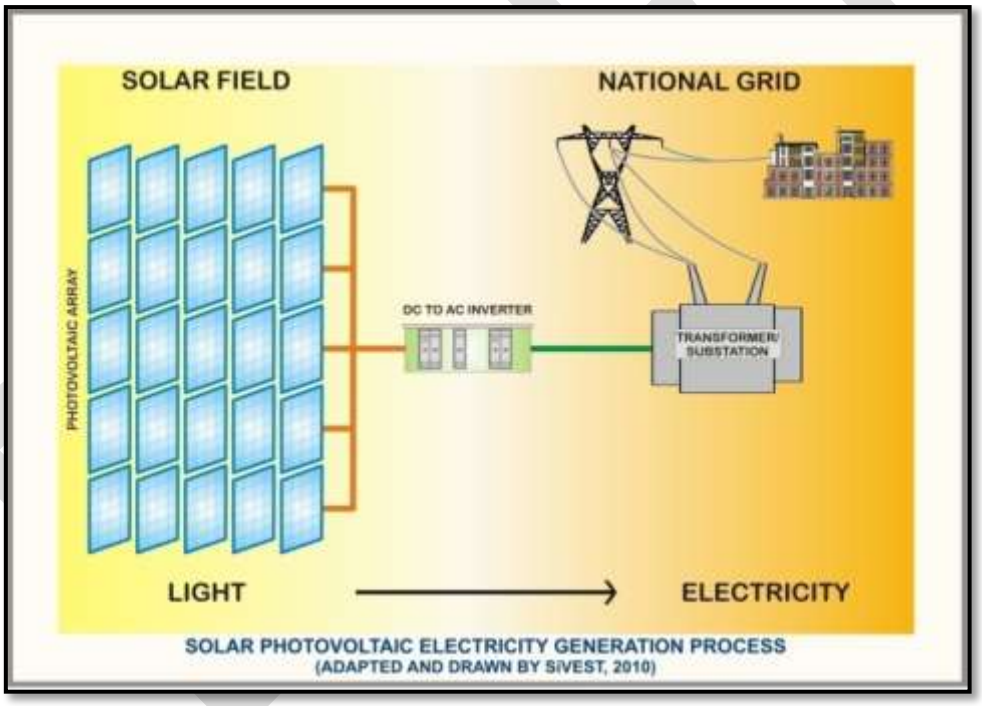

Figure 3: CPV/PV process

- Roads

An access road with a gravel surface from the public road onto the site will be required. An internal site road network to provide access to the solar field, power block & other infrastructure (substation & buildings) will also be required. Existing farm roads will be used where possible. The site road network will include turning circles for large trucks, passing points and where necessary, may include culverts over gullies and rivers/ drainage lines. All site roads will require a width of approximately 10m.

Drainage trenches along the side of the internal road network will be installed. In addition, silt traps at the outfall of the drainage trenches to existing watercourses will be installed.

- Fencing

For health & safety and security reasons, the plant will be required to be fenced off from the surrounding farm.

- Solar Resource Measuring Station

A permanent solar resource measuring station which will measure 100m^2 and which will be 5m in height will be required on site to measure incoming solar radiation levels on the site.

- Temporary work areas / activities during construction

A lay down area of a maximum of 10 000m^2, adjacent to the site or access route will be required. This will be temporary in nature (unless the property owner wishes to continue using it in the long term). Associated with this will be a contractors site offices which will require a maximum of 5 000m^2.

- Panel maintenance

The panels will require cleaning and dust will accumulate on them affecting their productivity. Cleaning will take place once every quarter (providing job creation). Treated waste water will be utilised for this exercise.

5.2 CSP Project Components

5.2.1 CSP Project Description

The project will consist of two components:

- CSP Power Plant
- Associated infrastructure

- **CSP Power Plant**

The Concentrated Solar Power plant will consist of the following infrastructure:

- Solar field
- Power block
- Water Pipeline
- Evaporation ponds
- Buildings

These are described in detail below:

- Solar field

The solar field will consist of parabolic trough mirrors. The mirrors require an area of approximately 600 hectares. This area will be required to be graded with terraces.

Figure 4: Parabolic trough solar collector assembly

The parabolic trough plants will have solar collector assemblies (Figure 4) which hold the mirrors and the solar energy receivers in place. The assemblies are oriented south-north and are able to rotate on one axis during the day to track the sun as it moves.

Depending on the soil conditions on site, the foundations for the parabolic troughs could be shallow or deep foundations. Shallow foundations refer to concrete slabs which are laid close to the surface of the soil and spread the load of the trough to the earth near the surface. If the soils on site are not suitable (e.g. compressible soils), then deep foundations will be required. However it is unlikely that foundations deeper than 1m will be required.

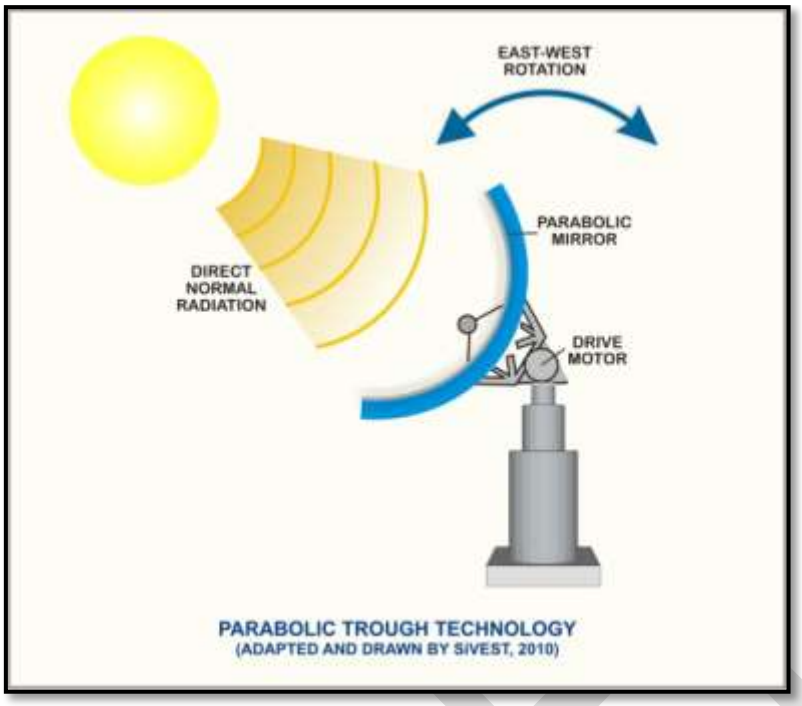

Figure 5: Functioning of the Parabolic Troughs

The rotation of the parabolic mirrors is typically operated using hydraulic arms (Figure 5). Maximum height of the mirrors during rotation will be approximately 8 meters above ground level. The mirrors are manufactured from low-iron glass, typically between 4-5mm in thickness. Solar energy is collected in the receivers which transfer that energy to synthetic oil, typically Therminol (VP-1), which is piped throughout the solar field. Therminol is a heat transfer fluid designed to meet the demanding requirements of high temperature systems.

- Power Block

The solar field will have a Power Block where the heat captured in the solar field is converted into electrical energy. The principal components (Figure 6) of the power block are solar steam generators (which include heat exchangers where heat in the synthetic oil Heat Transfer Fluid is used to generate steam), a Steam Turbine (which converts the energy in the steam to electricity) and a Wet Cooling Tower (which cools the condenser and condenses the process steam).

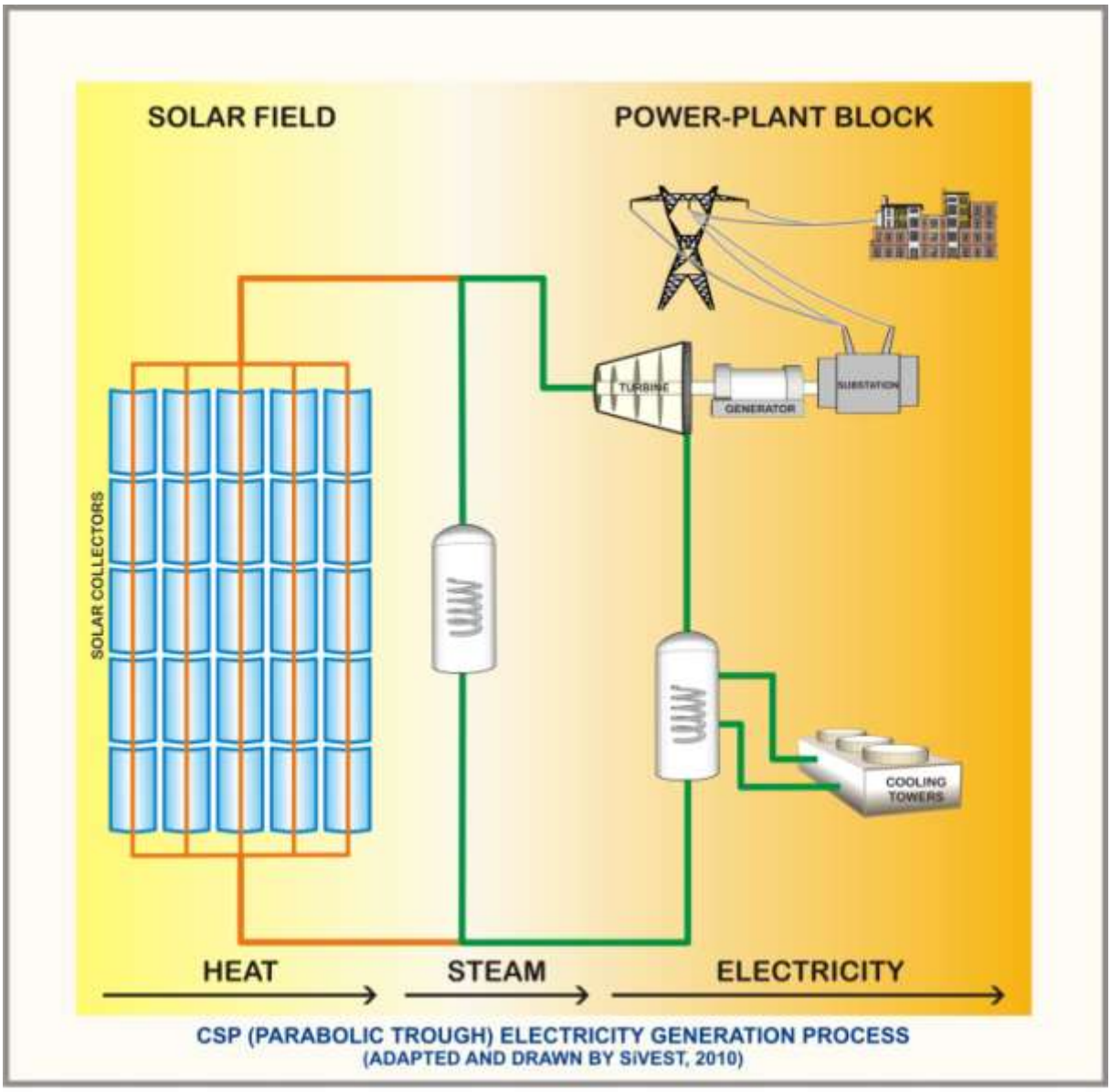

Figure 6: The CSP Process illustrated

- Water provision

The CSP Plant will require water to operate. The proponent has entered into an agreement with the Emthanjeni Local Municipality to make use of their waste water which is currently pumped into a system of oxidation ponds on the site in question. At present the pond system is not operating optimally and ideally the proponent will need to either upgrade the current sewage treatment works or construct an additional treatment facility as part of the CSP plant. The water needed for the operation of the plant needs to be industrial grade or better. At present the plan is to upgrade the current system in conjunction with the Local Municipality which will improve the current status quo with regards to the accumulation of waste water in the northern portion of the site.

- Water Pipeline

A water pipeline (350mm in diameter) will be used to deliver cooling water to the cooling tower. It is envisaged that the water pipeline will transport treated wastewater sourced from the municipal water treatment works to the CSP solar field. The route of this pipeline will be determined later in the design stages however the plant will be located directly adjacent to the waste water treatment works. It is important to note that waste water will be used for the cooling process and not fresh water..

- Evaporation ponds

An Evaporation Pond(s) for storage of waste water (e.g. cycle water blowdown, chemical waste water, etc) will be installed adjacent to the solar field (Figure 7). These will also be used for stormwater retention.

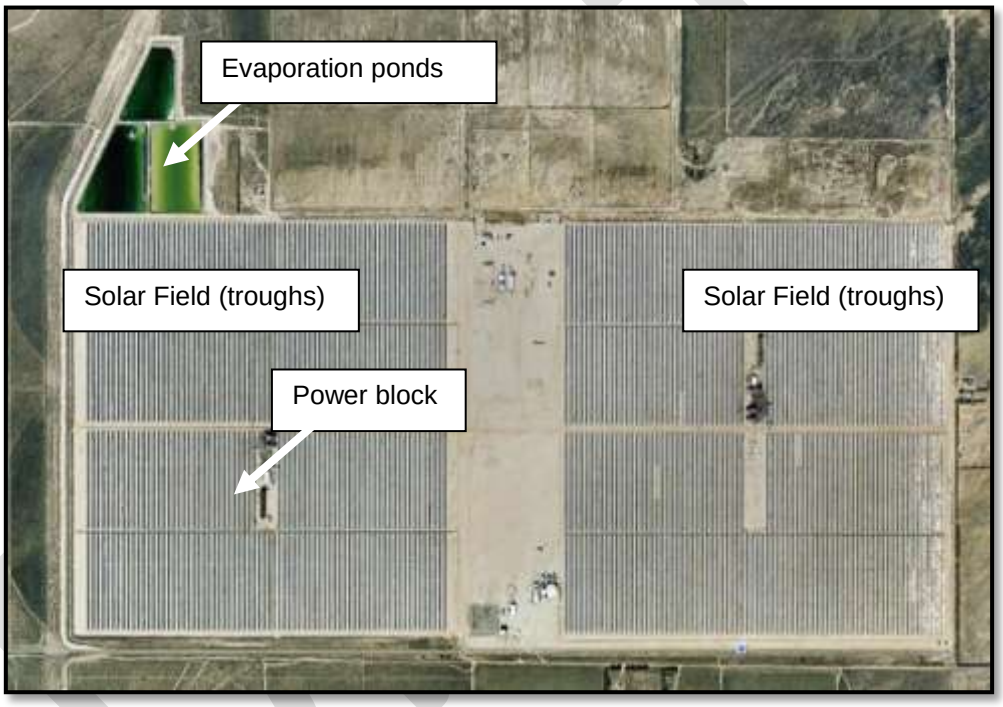

Figure 7: Google Earth Image© of the SEGS VIII and IX parabolic trough plants (Combined 160MW capacity) – Harper Lake, USA

- **Associated infrastructure**
  - Building infrastructure

The solar field will require on site buildings which will relate to the daily operation of the plant. The plant will require administration buildings (offices) (12m high, 70m long, 12m wide), a control room which may be housed in the main power block (16m high, 30m long, 30m wide). a fabrication building for the solar field (12m high, 150m long, 40m wide) and possibly a warehouse for storage. The office will be used for telecommunication and ablution facilities will be included. Security will be required. Small amounts of fuel and oils associated with the solar field will be stored on site. These amounts will

be below the thresholds requiring environmental assessments as stipulated in the NEMA EIA regulations. All materials will be bunded accordingly.

- Thermal Storage tanks

Thermal Storage tanks will be on site which will contain several thousand tonnes of salt associated with the functioning of a CSP plant. These structures will be bunded.

- Water Treatment Plant

A water treatment plant will be installed to ensure that the water removed from the sewage treatment plant is suitable for the cooling process.

- Electrical Connections

The project will provide electricity which will feed into the national grid. In order for this to occur, a new distribution substation needs to be constructed. The proposed distribution substation compound will be approximately 90m x 120m in size and will ideally be located in close proximity to the existing power lines that traverse part of the site of the proposed development. The distribution substation voltage is unknown at this stage. It will include transformer bays which will contain transformer oils. Bunds will be constructed to ensure that any oil spills are suitably contained and not released into the environment. The distribution substation will be fenced off for security purposes. The substation will be operated by Eskom upon completion.

Connection of the substation will be via drop-down conductors. Overhead power lines will however be required to connect the solar site to the substation.

- Roads

An access road with a gravel surface from the adjacent public road onto the site will be required. An internal site road network to provide access to the solar field, power block & other infrastructure (substation & buildings) will also be required. Existing farm roads will be used where possible. The site road network will include turning circles for large trucks, passing points and where necessary, may include culverts over gullies and rivers/ drainage lines. All site roads will require a width of approximately 10m. Drainage trenches along the side of the internal road network will be installed. In addition, silt traps at the outfall of the drainage trenches to existing watercourses will be installed.

- Fencing

For health, safety and security reasons, the plant will be required to be fenced off from the surrounding farm.

- Solar Resource Measuring Station

A permanent solar resource measuring station which will measure 100m^2 and 5m in height will be required on site to measure incoming solar radiation levels on the site.

- Temporary work areas / activities during construction

A lay down area of a maximum of 10 000m^2, adjacent to the site or access route will be required. This will be temporary in nature (unless the property owner wishes to continue using it long term). Associated with this will be the contractors site offices which will require a maximum of 5 000m^2. This will be leased from the landowner and rehabilitated after construction.

- Trough maintenance

The mirrors will require cleaning and dust will accumulate on them affecting their productivity. Cleaning will take place once a month (providing job creation). Treated waste water will be used for this exercise.

5.3 Site layout

The map below highlights the locality of infrastructure in terms of the alternatives being assessed.

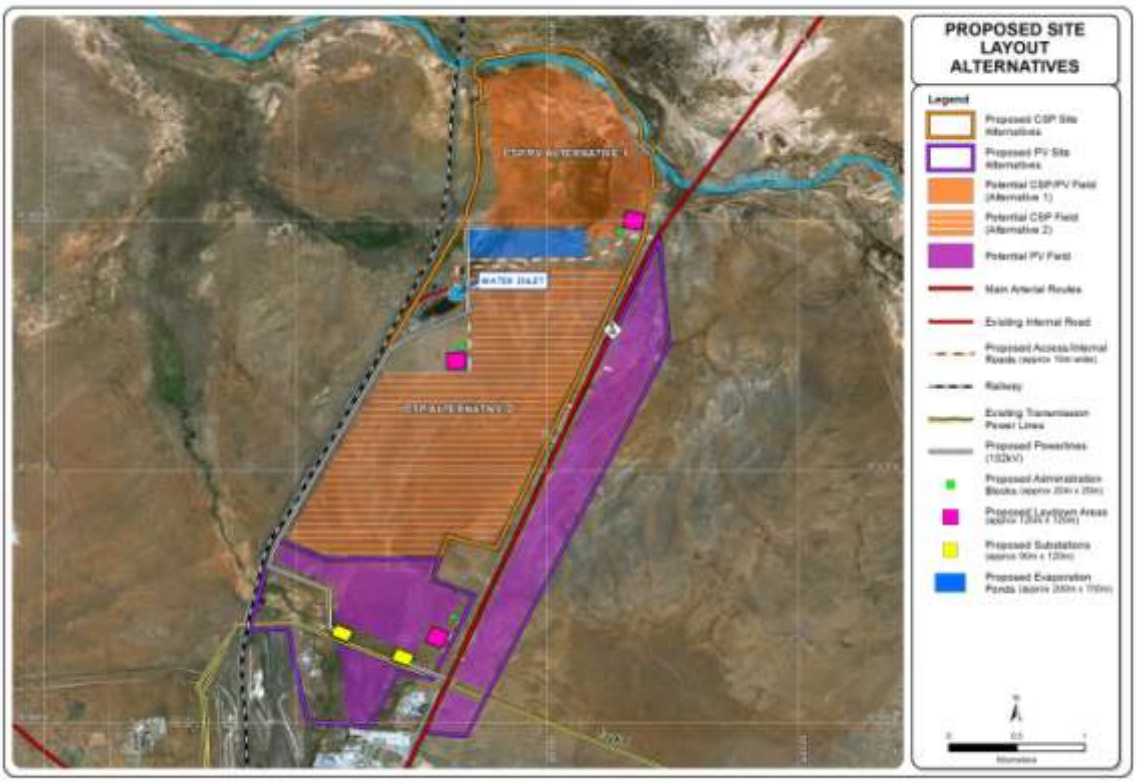

Figure 8: Site Layout Alternatives

The original application to DEA included several farms in order to allow for a comprehensive alternatives assessment and to allow for more technical options for the client. These surrounding farms however became unavailable for inclusion due to the landowners having agreements with other parties. The proposed project has thus become limited to the one farm.

In addition to the technological alternatives (elaborated on below), various layout alternatives have been investigated for the proposed project and these are presented in (Figure 8). Layout alternatives relate mainly to the associated infrastructure.

Three alternatives for the position of the admin / workshop block have been investigated; these are Administration buildings on the CPV solar site and CSP site.

Three alternatives for the position of the laydown areas have been investigated; these are laydown on the CPV solar site and CSP site.

Two alternatives were investigated for the positioning of the CSP plants namely CSP Alternatives 1 and 2. CSP Alternative one is also and alternative for PV location.

These alternatives are compared below in Chapter 11.

6 DESCRIPTION OF THE RECEIVING ENVIRONMENT

The Northern Cape Province is considered to be the most suitable region for the establishment of solar plants (CSP and CPV/ PV) due to the good solar resource, as mentioned above. Mainstream is proposing the establishment of a Concentrated Solar Power plant and two Concentrated Photovoltaic (CPV) / Photovoltaic (PV) plants in De Aar, Northern Cape Province.

6.1 Locality

The study site is located in the town of De Aar which falls within the boundaries of the in Emthanjeni Local Municipality of the Pixley ka Seme District, Northern Cape Province (Figure 9). The proposed site falls on portion 29 of the farm Paarde Valley No 145 north of De Aar town. The site is approximately 643.15 ha in size.

De Aar itself is found south of the site, whilst the remaining surrounding area can be described as generally vacant. The site is traversed to the east by the R48 road to Phillipstown and is bounded by a railway line to the west. 132kV distribution lines span the southern boundary. A wastewater treatment plant is also located on site, to the west near the railway line. The wastewater is currently discharged from the treatment works and flows via a series of ditches / drains into a wide flat area into which the wastewater is discharged. This discharge of the wastewater has resulted in the creation of artificial wide open areas of shallow water and reedbeds which attract waterfowl to this part of the site. An ephemeral drainage line is found in the south west part of the site. The Brak River, can be found arching along the northern boundary of the site and flows to the west.

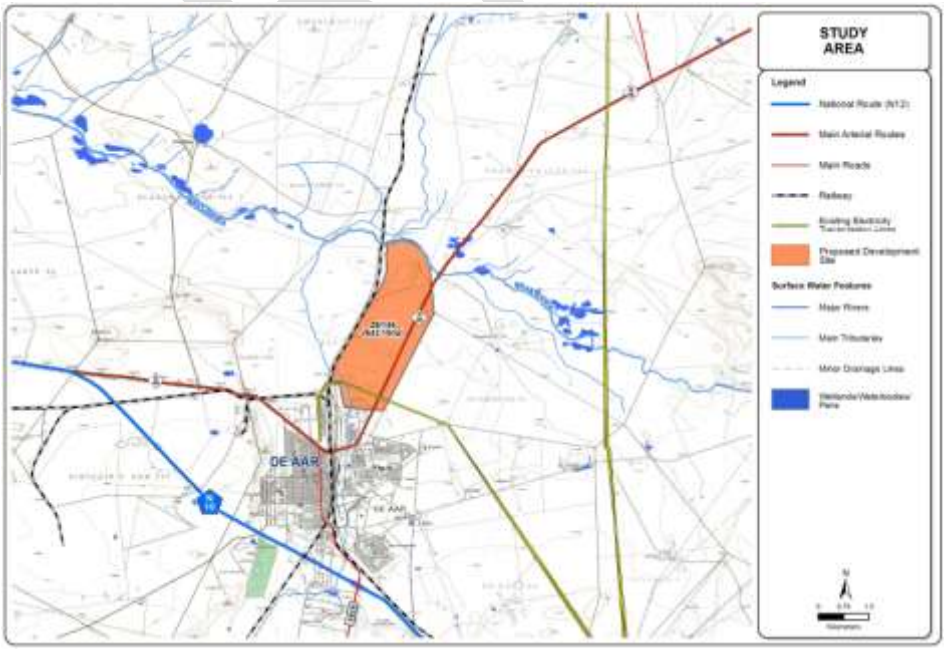

Figure 9: Site Locality Map

6.2 Study Area Description

The topography of the broader landscape consists of predominantly flat lowlands along with few flat-topped hills or 'mesas'. The site itself is generally flat towards the north and gently undulates further south, where rocky outcrops of dolerite dykes prevail. The site slopes from south west to the north east through an altitudinal range of between 1 215-1 240m above sea level, reaching a low point on the northern boundary adjacent to the valley bottom of the Brak River (Figure 10). Accordingly, the geology of the study area can be described as being underlain by flat-lying sedimentary rocks of the Karoo Supergroup, which have been intruded by innumerable sills and dykes of dolerite (Partridge *et al*., 2010). The overlying soils are variable from shallow to deep, red-yellow, apedal, freely draining soils to very shallow Glenrosa and Mispah forms (Mucina and Rutherford, 2006). Calcrete soils are also prevalent as a result of the climatic conditions and underlying parent material.

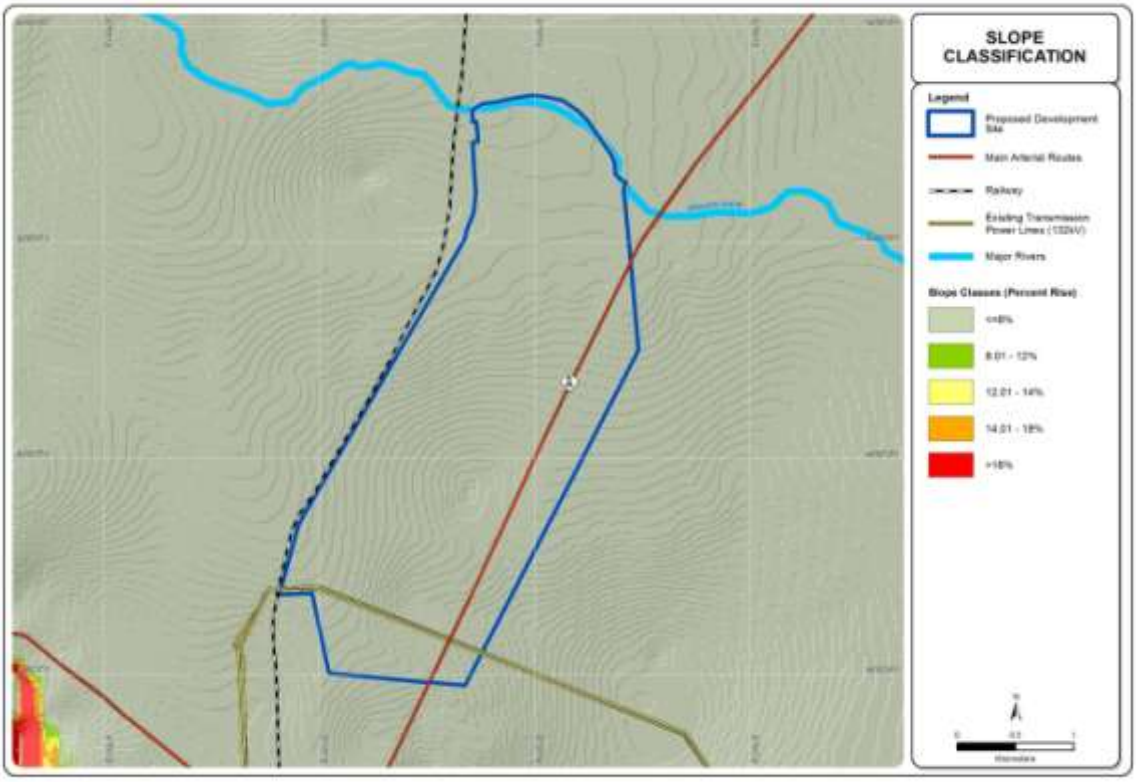

Figure 10: Slope of the study area

The landcover is characterized by shrublands (Figure 11). The shrublands of the region are generally dominated by dwarf karoo shrubs and grasses (Mucina and Rutherford, 2006). The site was found to be in a disturbed condition, most likely due to sheep grazing which is known to take place in the area.

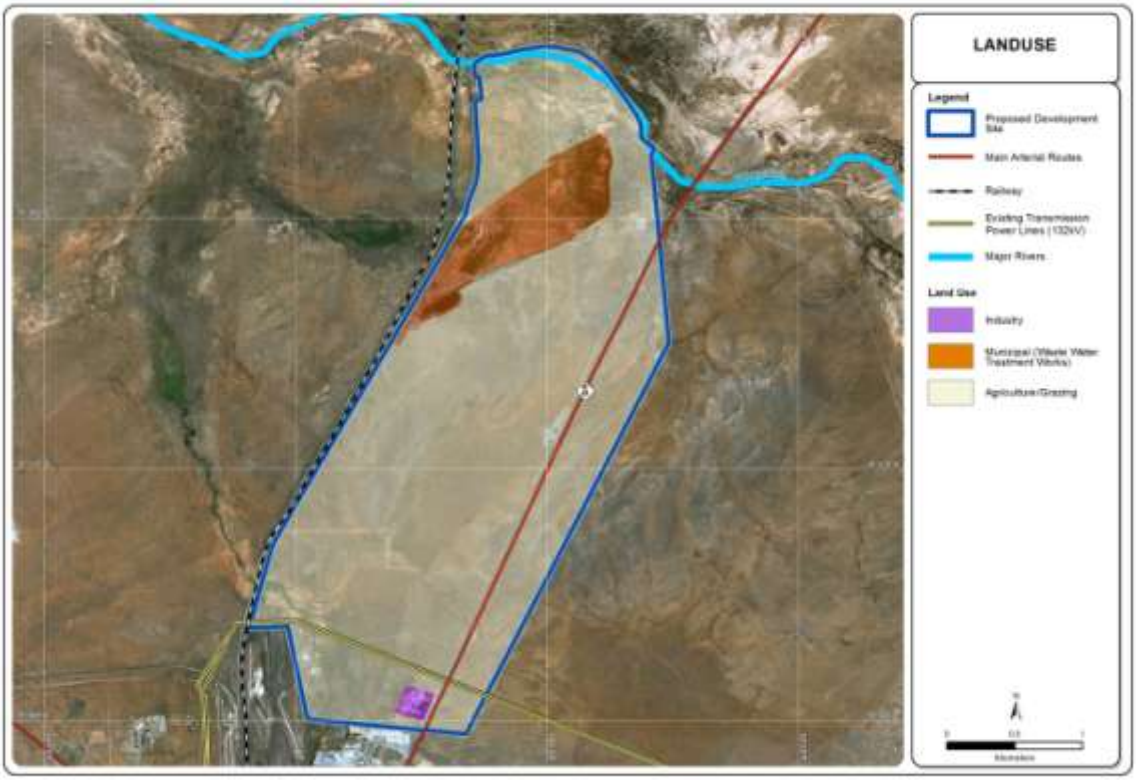

Figure 11: Land Cover Information

The site is located in close proximity to the industrial area of De Aar (south of the site).

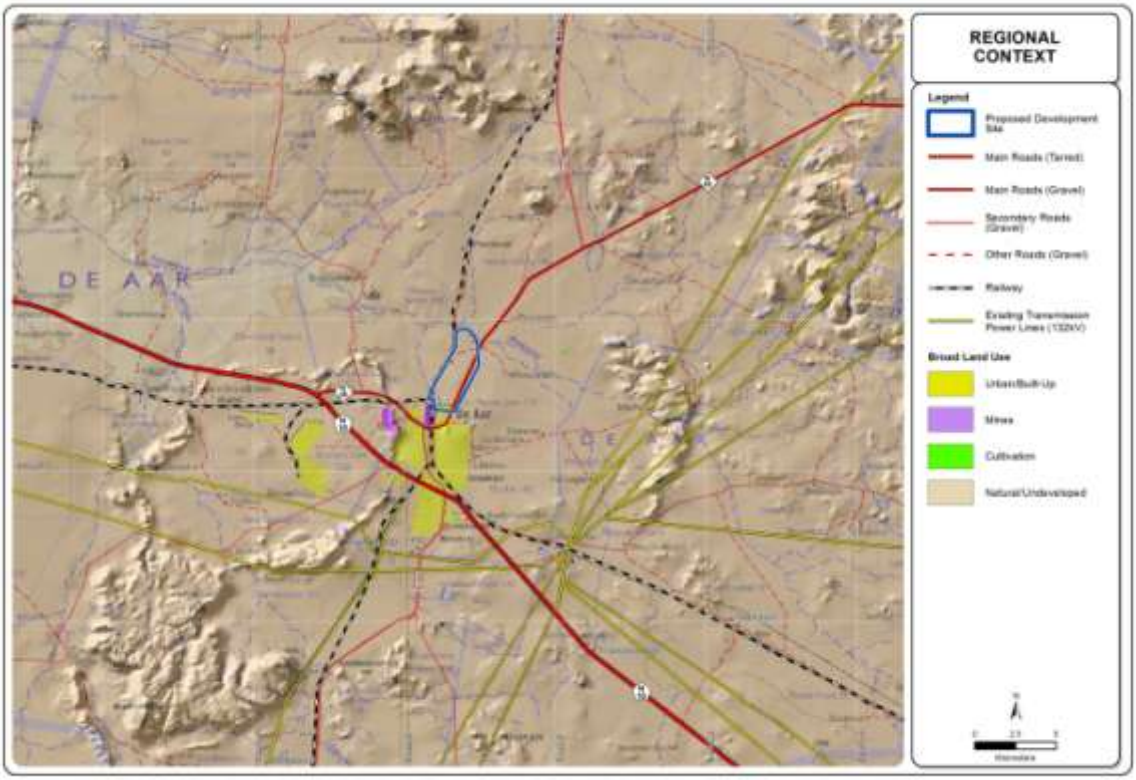

Figure 12: Regional Map

6.3 Climate

The study area has a semi-arid continental climate with a summer rainfall regime i.e. most of the rainfall is confined to summer and early autumn. Mean Annual Precipitation (MAP) is approximately 300 mm per year and without some form of supplementary irrigation natural rainfall is insufficient to produce sustainable harvests (Figure 13). This is reflected in the lack of dry land crop production within the study area. De Aar typically experiences hot days and cold nights with the highest maximum temperature of approximately 40°C and the lowest minimum temperature of approximately 8°C (Table 3 and Figure 14).

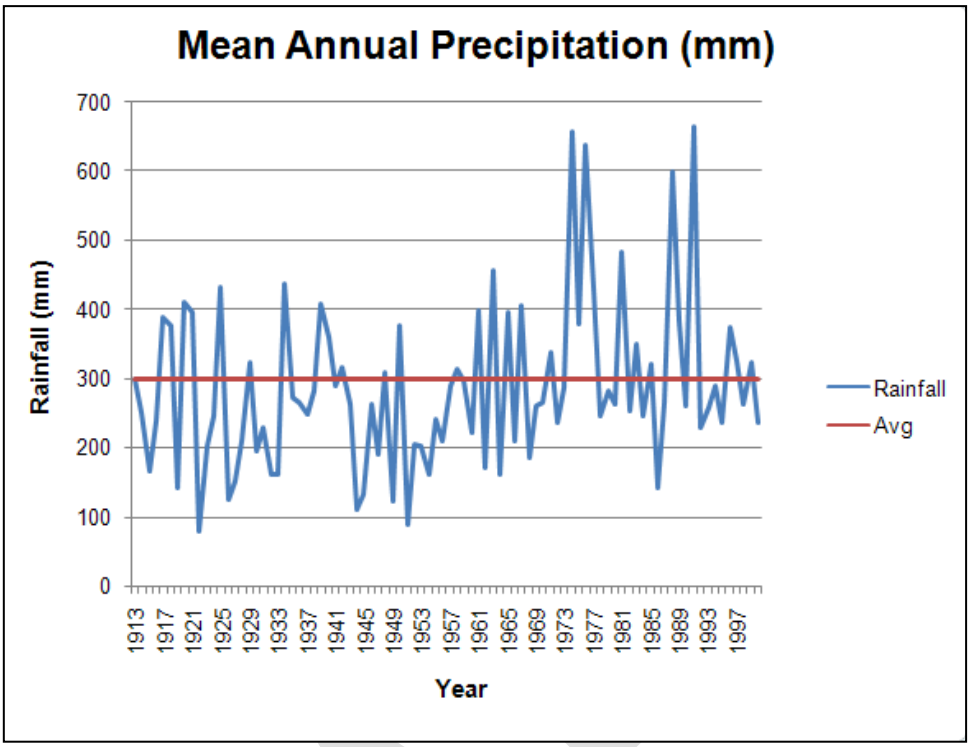

Figure 13: Mean Annual Rainfall for De Aar (1913 - 1998) (SAWS, 2010)

Table 3: Monthly Temperature Table for De Aar (SAWS, 2010)

Month	Temperature (° C) (1961 – 1990)			
	Highest Recorded	Average Daily Maximum	Average Daily Minimum	Lowest Recorded
January	40	32	16	7
February	38	31	15	4
March	37	28	13	1
April	34	24	9	-1
May	30	20	4	-5
June	26	16	1	-7
July	25	17	1	-8
August	28	19	2	-8
September	35	23	6	-5
October	36	26	9	-3
November	38	29	12	-1
December	39	31	14	3
Year	**40**	**25**	**9**	**-8**

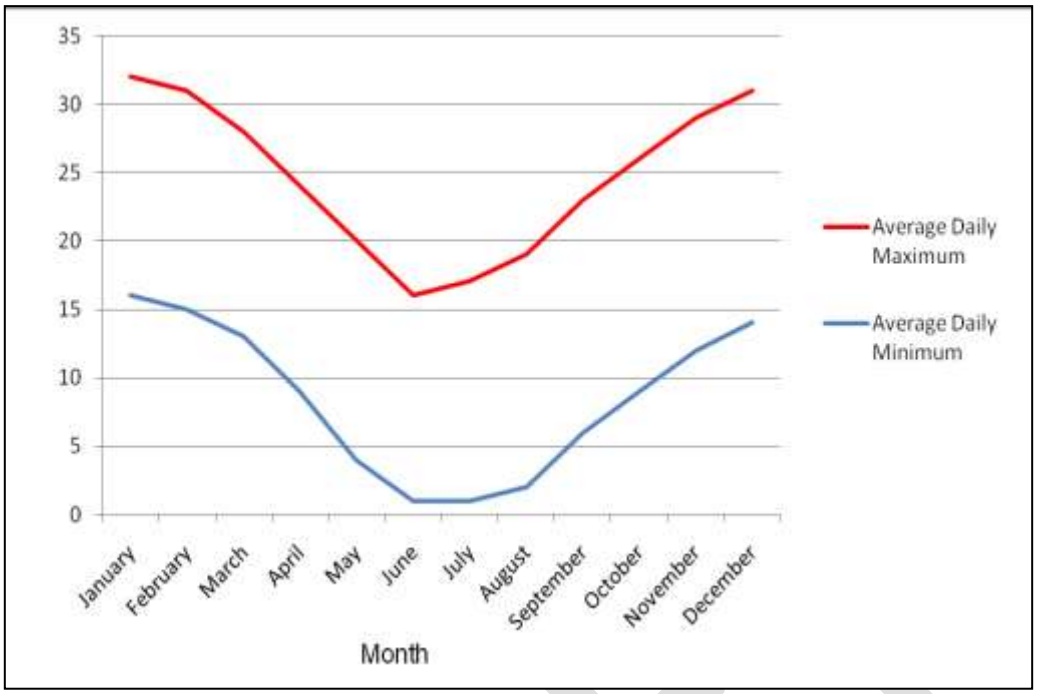

Figure 14: Average Daily Minimum and Maximum Temperatures for De Aar (SAWS, 2010)

6.4 Biodiversity (including fauna, flora and avi-fauna)

6.4.1 Flora in the study area

The site is located within the Nama Karoo Biome which occurs on the central plateau of the western half of South Africa. The vegetation is dominated by dwarf karoo shrubland with grasses being relatively rare within the area. Fire is rare in this biome due to the low fuel load. The Nama Karoo has very few rare or Red Data species.

- Northern Upper Karoo

This vegetation type is characterised by flat to gentle topography. It consists mainly of shrubland dominated by dwarf karoo shrubs, grasses and *Acacia mellifera* with some other low tree species.

The vegetation type is considered to be Least Threatened with large expanses remaining. None of the vegetation has been conserved in statutory conservation areas. Approximately 4% has been cleared for cultivation or transformed by building of dams.

6.4.2 Fauna in the study area (including Avi-fauna)

Friedman & Daly, (2004) list several red data mammal species that could potentially occur in the study area e.g. the Brown Hyaena (*Hyaena brunnea*), Geoffroy's Horseshoe Bat (*Rhinolophus clivosus*) and the South African Hedgehog (*Atelerix frontalis)* which listed as Near Threatened. Several of the species recorded for the study area are not likely to occur to the anthropogenic activities such as fencing etc that have taken place.

The site is located within an Important Bird Area (IBA) and bird life in the area is fairly diverse (SABAP 2). The IBA is known as the Platberg-Karoo Conservancy.

The Lesser Kestrel can be found in the study area and is considered to be Vulnerable according to BirdLife International.

The African Giant Bullfrog (*Pyxicephalus adspersus*), a Red Data species has been recorded in the large pan on the site (*pers comm*.).It occurs in seasonal shallow grassy pans, vleis and other rain filled depressions in open flat areas of grassland or savanna (Du Preez and Carruthers, 2009). This species is considered to be Near Threatened as its specialized habitat is at risk from increasing urbanization and agricultural activity (Du Preez and Carruthers, 2009).

6.5 Surface Water

6.5.1 Drainage Context

Drainage and hydrological information in the De Aar area is severely limited and/or inaccessible. Despite this, according to Dollar et al. (2007), regions can be grouped that have similar land areas containing a limited range of recurring landforms that reflect comparable erosion, climatic and tectonic influences, and impose broad constraints on lower levels of organisation, e.g., drainage basins, macro-reaches and channel types. Hence, on this basis, geomorphic provinces (Partridge et al. 2010) have been delineated that reflect a relatively common set of climatic, vegetation, geological and topographical characteristics that are akin to one another. Utilising this information, the drainage context of the study site can be elucidated. Under this context, the study site is located within the Upper Karoo geomorphic province of South Africa.

- Upper Karoo Geomorphic province

According to Partridge *et al.* (2010), this extensive province is underlain predominantly by flat-lying sedimentary rocks of the Karoo Supergroup which have been intruded by innumerable sills and dykes of dolerite, some in the form of transgressive cone-sheets. The relief associated with these lithologies ranges from tabular tafelkoppies (mesas) to sinuous, bouldery ridges and where dissection is

advanced, steep-sided mountains such as the Kompasberg near Nieu Bethesda dominate the landscape (Partridge *et al.* 2010). Rivers rising within this province are mostly ephemeral, occupy broad, open valleys, and have braided floodplains and concave longitudinal profiles (Partridge *et al.* 2010).

The Orange Water Management Area (WMA) or catchment encompasses the broader study area whereas, the site's specific quaternary catchment is found at D62D. The main river of concern in the context of the proposed development is the Brak River which serves as one of the tributaries to the Orange River (EWISA, no date). Other ephemeral rivers in the area include the Hondeblaf, Seekoei and Elandsfontein which all have rocky beds with intermittent wide flood-plains that contribute to the Orange River catchment. The perennial Orange River and large Vanderkloof Dam are dominant features in the north and east. Other impoundments consist of small- to medium-sized earthen farm dams on ephemeral rivers and drainage lines. Given the aridity of the area, surface water is at a premium for the overall region to such an extent that groundwater is widely used in the area to supply small towns in combination with surface water resources. However, the development and management of groundwater are seldom done properly, leading to unmanaged boreholes and abstraction from boreholes often resulting in their failure (EWISA, no date). Proper management and monitoring of groundwater sources by municipalities and other users therefore, are of crucial importance for the adequate allocation of water to the immediate area.

6.5.2 Surface Water Resource Occurrence in the Study Area

The study area features an ephemeral stream (in the southern part of the site) and a seasonal river (Brak River). The very flat nature of the topography is a strong factor in influencing the nature of surface water occurrence in the study area. In general, the flat topography, exhibiting shallow soils over solid parent material mean that groundwater is unlikely to have a considerable bearing as a source or input to surface water features. Hence, drainage of the study area as a whole can be assumed to take place primarily in the form of overland sheet flow during periods of high rainfall, eventually draining into adjacent rivers or streams. Here water will be transported downstream until broader constraints such as climatic influences cause the drainage systems to dry up (hence the ephemeral nature of the drainage systems for the area). Groundcover in this instance will play a significant role in preventing soil erosion for the site.

6.6 Agricultural Potential

According to the ENPAT database the De Aar site is dominated by red apedal soils formed predominately from Shale parent material. These well drained soils are associated with a high base status (an indicator of good fertility), lack of well formed peds and are weakly structured. The study area is classified as having an effective soil depth of less than 0.45 m deep which is a limiting in terms of sustainable crop production.

The ENPAT Database also provides an overview of the study area's agricultural potential based on its soil characteristics, it should be noted this spatial dataset does not take *prevailing climate into account*. Restrictive climate characteristics, due to heat and / or moisture stress will further reduce the agricultural potential of the area under assessment. The study area is dominated by soils which are not suited for arable agriculture but which can still used as grazing land, its current and dominant land use.

6.6.1 Overall Agricultural Potential

By taking all the site characteristics (climate, geology, land use, slope and soils) into account the agricultural potential for the majority of the study area is classified as being low for crop production while moderately low for grazing. This classification is primarily due to climatic and soil depth limitations.

The site can be classified as having a low agricultural value and is replaceable when assessed within the context of the proposed development. Consequently the overall impact of the Solar Energy Facility on the study area's agricultural potential and production will be negligible due to the site's low inherent agricultural potential.

No EIA investigation was thus required.

6.7 Groundwater

The proposed site is located in quaternary catchment D62D close to the boundary with D62C, within Water Management Area 14 (Lower Orange). The site is underlain entirely by rocks of the Volksrust Formation (Ecca Group of the Karoo Supergroup) (Figure 15). The Volksrust Formation consists predominantly of fine-grained rocks (grey to black siltyshales with subordinate siltstone and sandstone lenses). The General Series Hydrogeology Maps of South Africa (sheet 2924 Bloemfontein) classify the aquifers underlying the De Aar site area as "b3", meaning a fractured aquifer with median borehole yield (excluding recorded dry boreholes) of 0.5 to 2.0 litres per second.

The hydrogeology maps classify the geology of the site as "argillaceous", meaning a fine-grained sedimentary rock (Figure 16). These rocks are expected to be Minor Aquifers, with groundwater storage and flow being mainly via secondary features such as fractures, faults and bedding planes. However, De Aar relies on groundwater for almost all of the town's water supply, and whilst the main areas of abstraction are thought to be some distance from the proposed site, further work needs to be done to assess the contribution (if any) of the rocks underlying the proposed site to the town's water supply. The Minor Aquifer designation could change depending on the outcome of this work.

The Groundwater Harvest Potential Map of South Africa published by the Department of Water Affairs (Baron et al, 1998) classifies the area around De Aar as having a harvest potential of 6000 to 10000 m^3/km^2/annum, where "harvest potential" is defined as the maximum volume of groundwater that may

annually be abstracted per square kilometer per annum without depleting the aquifers. Figure 16 shows available macro-element chemistry for all samples in the Department of Water Affairs' National Groundwater Archive (NGA) for quaternary catchments D62C, D62D and D62E plotted on a trilinear diagram. Mg, Na and K dominate the cations, derived most likely from the host rocks, with Cl and HCO_3 dominating the anions.

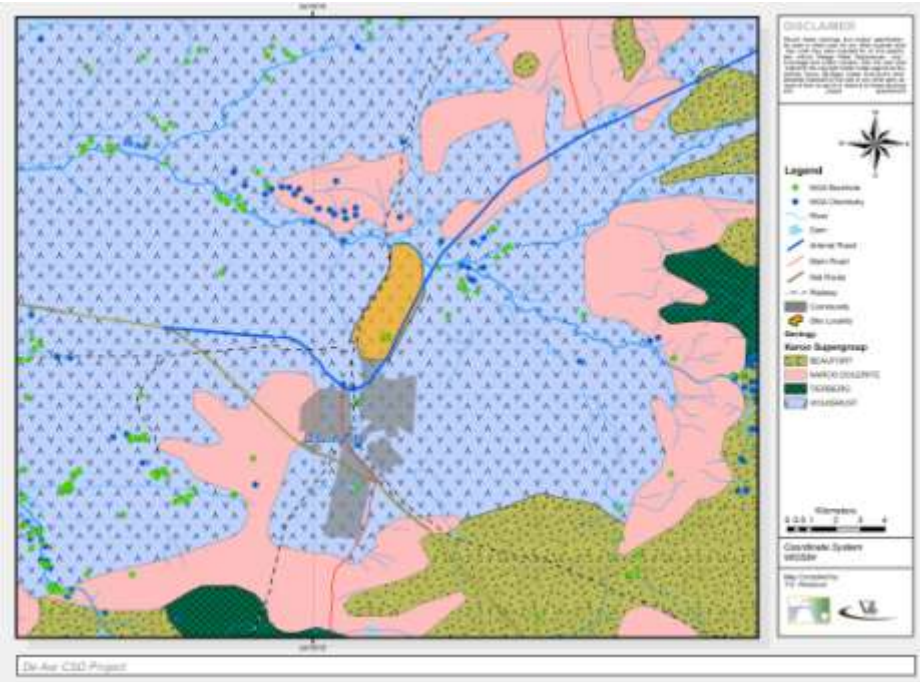

Figure 15: Geology map of the De Aar area

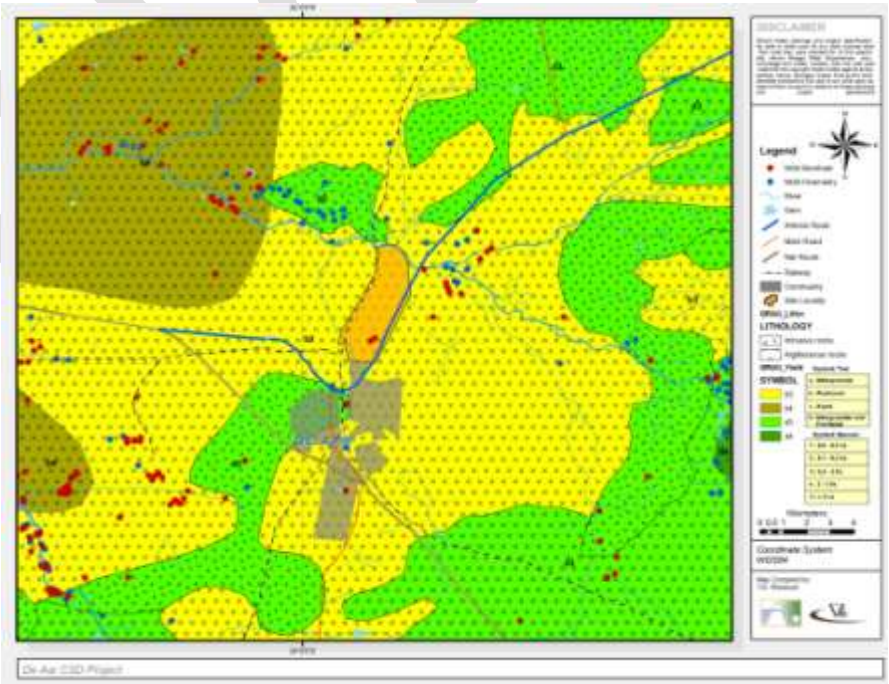

Figure 16: Hydrogeology map of the De Aar area

6.8 Noise

At this point, the actual distances to potential noise sensitive receptors can only be estimated since precise plant location and layout is yet been finalised During the site visit conducted in January 2011, the site was described as an open landscape, generally flat, with gentle undulations. The surface is comprised of loose sandy soil covered with knee-high grass and shrubs (Figure 17).

Figure 17: The De Aar site illustrating typical landscape and vegetation

The southern portion of the site borders on the De Aar industrial area (Figure 18). Lying about 700m from the southern boundary of the site and adjacent to the R48 road to the east is the Juvenile Secure Care Centre (Figure 19). On the western boundary and almost in the middle of the site is the sewage processing works (Figure 20).

Figure 18: The De Aar industrial area

Figure 19: The De Aar Juvenile Secure Care Centre

Figure 20: The De Aar Sewage Processing Works

6.9 Visual

6.9.1 Physical Landscape Characteristics

As part of the visual characterisation, the physical landscape characteristics are described in terms the prevailing topography, vegetation cover and landuse in the study area.

- Topography

The prevailing topography on the application site is gently undulating to relatively flat which gradually slopes down toward the Brak River on the northern boundary of the site. Variations in the topographical uniformity appear in the form of localised dolomite ridges and areas of gently rising and falling ground. Mountains and hills in the greater surrounds form a visual envelope around the site (see Figure 21).

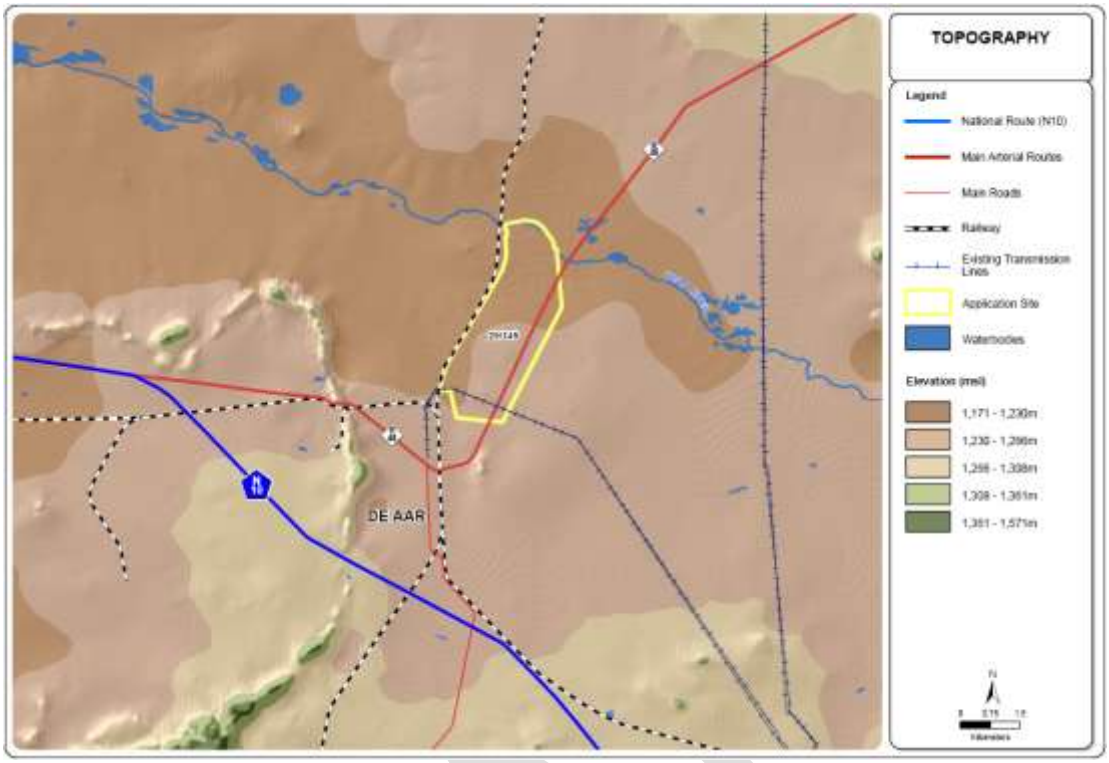

Figure 21: Topography within the study area

Visual Implications

The relatively flat topography on the site will result in typically wide-ranging vistas of the site, except for areas of gently rising ground on the western side of the R48 and lower lying ground in the northern parts of the study area which will restrict views in part. Hills directly to the west and south-west of the study area will constrict the viewshed to the south-west of the site.

- Vegetation

Natural Karoo vegetation, characterised by short karoo shrubs and grasses still prevails in most parts if the site, however it has been degraded in part as a result of sheep grazing activities and too large groves of exotic trees growing in the artificial wetland in the northern parts of the site.

Visual Implications

The short natural vegetation would typically promote wide open vistas of the proposed site. The tall exotic trees in the northern parts of the site will restrict views toward the site from parts of the R48; however it is likely that most of these trees will be removed during the construction phase of the proposed project.

- Landuse

The landuse within the application site is classified as natural vacant land; however it has been partially disturbed by grazing activities and dumping of dump rock and rubble in the south-eastern part of the site. The town of De Aar is located immediately to the south of the study area and consists of both commercial industry directly to the south of the site and residential landuses approximately 1.5km to the south-west of the southern site boundary. Most land immediately surrounding the proposed site

to the north, west and east is vacant land where natural untransformed vegetation still prevails (see Figure 22).

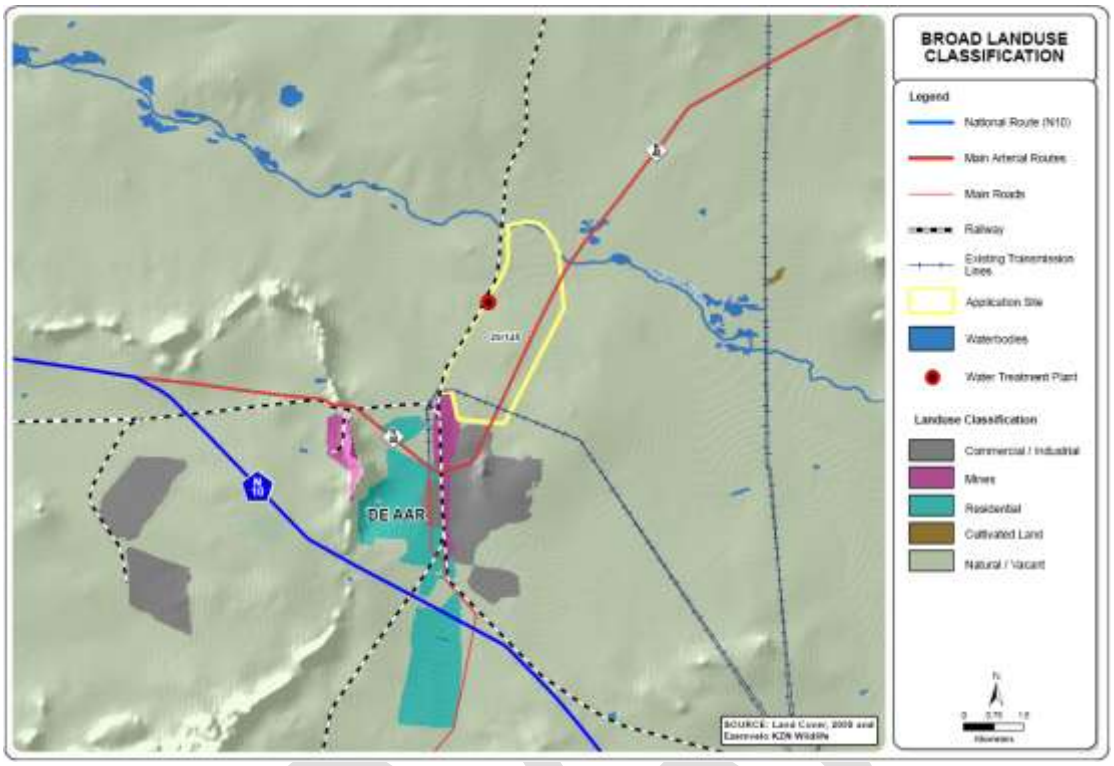

Figure 22: Landuse within the study area

Visual Implications

The largely natural visual character has been transformed in part by urban and suburban landuses, particularly to the south of the site.

6.9.2 Visual Character

The above physical landscape characteristics as well as the presence of built infrastructure influence the visual character of the study area. Visual character is defined based on the level of transformation from a completely natural setting (little evidence of human transformation), with varying degrees of transformation engendering different visual characteristics.

The overall visual character of the study area is largely natural despite the moderate presence of human transformation within the site boundaries which include; existing transmission lines, the railway line on the western site boundary, the R48 road, structures associated with the sewage treatment works, the Secure Care Centre, an artificial wetland and groves of exotic trees, as well as derelict sheds and hydroponic barns. Most of the surrounding area is dominated by natural vegetation with limited human transformation, except for the built up area of De Aar to the south of the proposed site, which is used for residential and commercial purposes. The visual character in the southern parts of the study area will differ from that in the north as a result of the urban industrial area which will increase the level of human transformation in the southern parts of the study area. Despite these

varying degrees of transformation, the overall visual character is considered to be largely natural as these elements and commercial activities do not dominate the overall relatively untransformed visual character of the area.

It should be noted that the SDF for the Emthanjeni Local Municipality has earmarked the southern section of the proposed site for industrial development. As a result the change in the natural visual character which will result from the proposed solar energy facility will be in line in with the landuse change recommended in the SDF, and therefore it is regarded as being more visually acceptable.

- Visual Absorption Capacity

The visual absorption capacity (VAC) of an area / landscape refers to the ability of the area / landscape to absorb the development without any noticeable intrusion or change to the visual character of the area. It is measured on a scale from high (an area which has a high capacity to absorb the development) to low (an area in which a development would be highly visible). It is a function of topography, landuse and land cover, with urban areas having a high VAC and natural areas having a low VAC.

The tall exotic trees and rising and falling ground within the study area, in combination with the urban industrial landuse to the south will increase the ability of the landscape to absorb the solar energy facility to some extent. The study area is, however, assigned a moderately low VAC, as the short sparse karoo vegetation would offer immaterial visual screening and introducing a solar field into this largely natural context is likely to alter the 'sense of place'.

6.9.3 Visual Sensitivity

Visual Sensitivity is expressed as the sensitivity of an area to a proposed development which could be perceived as a visual impact. It is based on the, VAC, presence of exiting infrastructure and visual character in an area, but also relates to the spatial distribution of potential receptors and the value judgement of the receptors based on the perceived aesthetic appeal of an area. It is categorised as **high** (visually intrusive, negatively perceived by receptors), **moderate** (receptors present, limited negative perception) or **low** (little opposition, not negatively perceived).

The table below explores in more detail the inputs into categories of visual sensitivity:

Table 4 - Environmental factors used to define visual sensitivity classes

Visual Sensitivity Category	Visual Absorption Capacity	Presence and size of Existing Infrastructure	Presence of Sensitive Receptors	Visual Character	Other factors influencing visual sensitivity
High	Low	Absent or at very low densities	Present	-Natural / largely natural -Rural / pastoral	- Areas of natural vegetation (conserved) -Practice of economic activities

					(esp. tourism) which place value on the scenic / beauty character of the area
Moderate	Moderate	Present – not high densities	Present	-Rural / pastoral -Urban	
Low	High	Present – high densities, often a very large or tall	Absent	-Urban -Industrial	

As discussed above, the study area has a natural visual character with existing infrastructure scattered throughout the site and a relatively low VAC. Although the area is not considered important from a tourism perspective, residences of the small rural town of De Aar will be potential visual receptors as the solar energy is likely to be perceived negatively within the context of the largely natural landscape. Due to these factors the area is associated with a high visual sensitivity.

6.10 Heritage

6.10.1 Archival findings

Evaluation of archaeological work completed on the Perseus Hydra Transmission line that runs to the east of the study area have produced some ground truthed information on archaeology to be expected in the study area.

Initial desktop studies completed created a map indicating that area exposed to sheet erosion produced more Stone Age finds as deflated site was exposed during erosion (Figure 23).

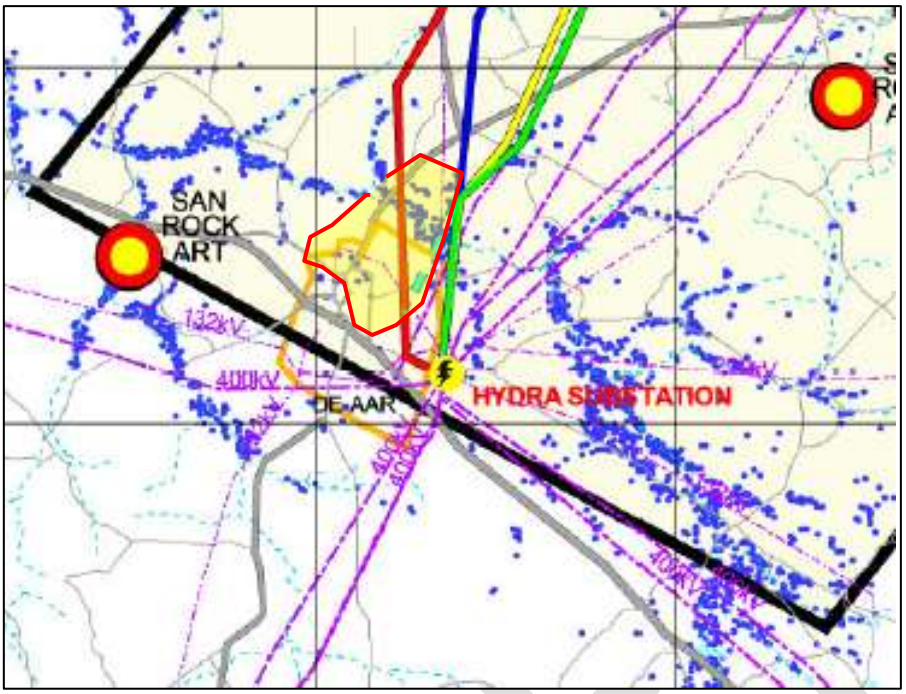

Figure 23 – Area around De Aar indicating San Rock Art finds – Blue spot indicate areas of sheet erosion (Red outline study area) (Van Jaarsveld, 2006)

Previous field work by PGS Heritage & Grave Relocation Consultants, provided some valuable information on the archaeology and palaeontology of the general area to the east of the proposed development area where the Perseus Hydra line traverses the study area.

- Palaeontology

  During the 2010 survey a find of silicified wood were found just outside the study area and is of high palaeontological interest as expressed by palaeontologists contacted around the find (Figure 24).

  The palaeontological desktop study done for the proposed Solar park indicated that, the Ecca and Beaufort Group sediments in the general vicinity of the study area generally have a moderate to high palaeontological sensitivity. Given the limited effective palaeontological potential of rocks in the region due to nearby dolerite intrusions, the comparatively small footprint of the proposed developments and the shallow excavations envisaged here, no further palaeontolgical mitigation is recommended for this development. Should substantial fossil remains be exposed during construction, however, the ECO should alert SAHRA so that appropriate action (e.g. recording, sampling or collection) can be taken by a professional palaeontologist.

Figure 24 – Silicified wood found just outside the current study area

- Archaeology

  The PGS (2010) revealed numerous find spots from single low concentration Stone Age finds (Figure 25) in eroded areas to larger significant Middle Stone Age Scatters (Figure 26) in the sections of the study area impacted by the Perseus Hydra Transmission line.

Figure 25 – Low density scatter of MSA finds

Figure 26 – Area scattered with eroded MSA artefacts

- Historical Context

  De Aar Junction played key strategic role during the South Africa War (Anglo-Boer War) and specifically two battles: the Battle of Stormberg and the Battle of Colenso. It acted as both the supply strategic place between Cape Town and the west central regions of South Africa through the Karoo, which remained devoid of any battles during the war. It is located central western region of the country, South Africa.

  The 1:250,000 Reconnaissance Topographical Map of Philipstown (surveyed 1910 and drawn in 1913) (Figure 27) indicates that the Brak River was previously known as the Carolus Poort River.

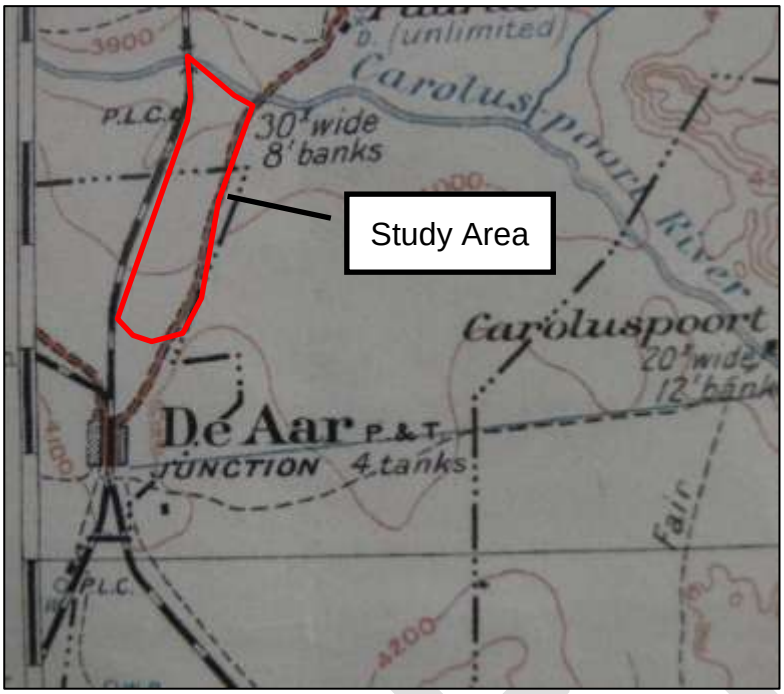

Figure 27 – 1907 Map of De Aar area (Study area in red)

6.10.2 Palaeoentological Heritage

The fossil heritage recorded within each of the main sedimentary rock successions represented within the solar park study region northeast of De Aar is outlined here. A summary of fossil heritage is provided in Table 5 below. Bedding dips of the Karoo Supergroup sediments in the study region are generally shallow. Low levels of tectonic deformation and cleavage development are expected here, favouring good fossil preservation. However, extensive dolerite intrusion has compromised fossil heritage in the Ecca sediments due to resulting thermal metamorphism.

- Fossils within the Tierberg Formation

The fossil record of the Tierberg Formation has been reviewed in detail by Almond (2008a). Rare body fossil records include disarticulated microvertebrates (*e.g.*fish teeth and scales) from calcareous concretions in the Koffiefontein sheet area (Zawada 1992) and allochthonous plant remains (leaves, petrified wood). The latter become more abundant in the upper, more proximal (prodeltaic) facies of the Tierberg (*e.g.* Wickens 1984). Prinsloo (1989) records numerous plant impressions and unspecified "fragmentary vertebrate fossils" within fine-grained sandstones in the Britstown sheet area. Dark carbonaceous Ecca mudrocks are likely to contain palynomorphs (*e.g.* pollens, spores, acritarchs).

The commonest fossils by far in the Tierberg Formation are sparse to locally concentrated assemblages of trace fossils that are often found in association with thin event beds (*e.g.*distal turbidites, prodeltaic sandstones) within more heterolithic successions. A modest range of ten or so different ichnogenera have been recorded from the Tierberg Formation (*e.g.*Abel 1935, Anderson

1974, 1976, Wickens 1980, 1984, 1994, 1996, Prinsloo 1989, De Beer *et al*., 2002, Viljoen 2005, Almond 2008a). These are mainly bedding parallel, epichnial and hypichnial traces, some preserved as undertracks. Penetrative, steep to subvertical burrows are rare, perhaps because the bottom sediments immediately beneath the sediment / water interface were anoxic. Most Tierberg ichnoassemblages display a low diversity and low to moderate density of traces. Apart from simple back-filled and / or lined horizontal burrows (*Planolites, Palaeophycus*) they include arthropod trackways (*Umfolozia*) and associated resting impressions (*Gluckstadtella*), undulose fish swimming trails (*Undichna*) that may have been generated by bottom-feeding palaeoniscoids, horizontal epichnial furrows (so-called *Scolicia*) often attributed to gastropods (these are also common in the co-eval Collingham Formation; Viljoen 1992, 1994), arcuate, finely striated feeding excavations of an unknown arthropod (*Vadoscavichnia*), beaded traces ("*Hormosiroidea*" or "*Neonereites*"), small sinusoidal surface traces (*Cochlichnus*), small star-shaped feeding burrows (*Stelloglyphus*) and zigzag horizontal burrows (*Beloraphe*), as well as possible narrow (<1cm) *Cruziana* scratch burrows. The symmetrical, four-pronged trace *Broomichnium* (= *Quadrispinichna* of Anderson, 1974 and later authors) often occurs in groups of identical size (*c*. 3.5cm wide) and similar orientation on the bedding plane. This trace has frequently been misinterpreted as a web-footed tetrapod or arthropod trackway (*e.g.*Van Dijk *et al*. 2002 and references therein). However, Braddy and Briggs (2002) present a convincing case that this is actually a current-orientated arthropod resting trace (cubichnion), probably made by small crustaceans that lived in schools of similar-sized individuals and orientated themselves on the seabed with respect to prevailing bottom currents. Distinctive broad (3-4cm), strap-shaped, horizontal burrows with blunt ends and a more-or-less pronounced transverse ribbing occur widely within the Tierberg mudrocks. They have been described as "fucoid structures" by earlier workers (*e.g.*Ryan 1967) by analogy with seaweeds, and erroneously assigned to the ichnogenera *Plagiogmus* by Anderson (1974) and *Lophoctenium* by Wickens (1980, 1984). Examples up to one metre long were found in Tierberg mudrocks near Calvinia in 1803 by H. Lichtenstein, who described them as "eel fish". These are among the first historical records of fossils in South Africa (MacRae 1999). These as yet unnamed burrows are infilled with organized arrays of faecal pellets (Werner 2006). Sandstone sole surfaces with casts of complex networks of anastomosing (branching and fusing) tubular burrows have been attributed to the ichnogenus *Paleodictyon* (Prinsloo 1989) but may more appropriately assigned to *Megagrapton* (Almond 1998). These so-called graphoglyptid burrows are associated with turbidite facies from the Ordovician to Recent times and have been interpreted as gardening burrows or *agrichnia* (Seilacher, 2007). Microbial mat textures, such as *Kinneyia*, also occur in these offshore mudrocks but, like the delicate grazing traces with which they are often associated, are generally under-recorded.

- Karoo Dolerite Suite

The dolerite outcrops in the central-eastern part of the study area are in themselves of no palaeontological significance. These are high temperature igneous rocks emplaced at depth within the Earth's crust so they do not contain fossils. However, as a consequence of their proximity to large dolerite intrusions in the Great Escarpment zone, some of the Ecca and Beaufort Group sediments in the broader study region will have been thermally metamorphosed or "baked" (*ie*. recrystallised, impregnated with secondary minerals). Embedded fossil material of phosphatic composition, such as bones and teeth, is frequently altered by baking – bones may become blackened, for example - and

can be very difficult to extract from the hard matrix by mechanical preparation (Smith & Keyser 1995). Thermal metamorphism by dolerite intrusions therefore tends to reduce the palaeontological heritage potential of Beaufort Group sediments. In some cases (*e.g.* fossil moulds of mesosaurid reptiles and palaeoniscoid fish) baking may enhance the quality of preservation of Ecca fossils while other fossil groups (*e.g*. carbonaceous remains of plants, organic-walled palynomorphs) are more likely to be compromised.

- Quaternary to Recent superficial deposits

The central Karoo "drift deposits" have been comparatively neglected in palaeontological terms. However, they may occasionally contain important fossil biotas, notably the bones, teeth and horn cores of mammals as well as remains of reptiles like tortoises. Good examples are the Pleistocene mammal faunas at Florisbad, Cornelia and Erfkroon in the Free State and elsewhere (Wells & Cooke 1942, Cooke 1974, Skead 1980, Klein 1984, Brink, 1987, Bousman *et al.* 1988, Bender & Brink 1992, Brink *et al*. 1995, MacRae 1999, Meadows & Watkeys 1999, Churchill *et al*. 2000 Partridge & Scott 2000). Other late Caenozoic fossil biotas from these superficial deposits include non-marine molluscs (bivalves, gastropods), ostrich egg shells, trace fossils (*e.g.* calcretised termitaria, coprolites), and plant remains such as peats or palynomorphs (pollens) in organic-rich alluvial horizons (Scott 2000) and diatoms in pan sediments. In Quaternary deposits, fossil remains may be associated with human artefacts such as stone tools and are also of archaeological interest (*e.g.* Smith 1999 and refs. therein).

Table 5: Summary of fossil heritage in the De Aar area

GEOLOGICAL UNIT	ROCK TYPES & AGE	FOSSIL HERITAGE	PALAEONT-OLOGICAL SENSITIVITY	RECOMMENDED MITIGATION
Superficial deposits ("drift")	Alluvium, colluvium (scree), pan sediments *etc* NEOGENE / QUATERNARY TO RECENT	Sparse remains of mammals (bones, teeth), reptiles, ostrich egg shells, molluscs shells, trace fossils (calcretized termitaria, rhizoliths), plant remains, palynomorphs, diatoms stone artefacts	LOW	Any substantial fossil finds to be reported by ECO to SAHRA
Karoo Dolerite Suite (Jd)	Intrusive dolerite sills & dykes EARLY JURASSIC	NONE	ZERO	None Baking of country rocks by dolerite intrusions may variously compromise

				fossil heritage or enhance fossil preservation
Tierberg Formation (Pt) ECCA GROUP	Dark basinal, prodelta and submarine fan mudrocks with minor sandstones EARLY TO MIDDLE PERMIAN	Locally abundant trace fossils, petrified wood, plant debris, microvertebrates	MEDIUM	Any substantial fossil finds to be reported by ECO to SAHRA

6.11 Socio-economic

6.11.1 Site Location and Description

The De Aar site is located within the Emthanjeni Local Municipality of the Pixley ka Seme District of the Northern Cape. The approximate location of the De Aar site is reflected in Figure 28 below.

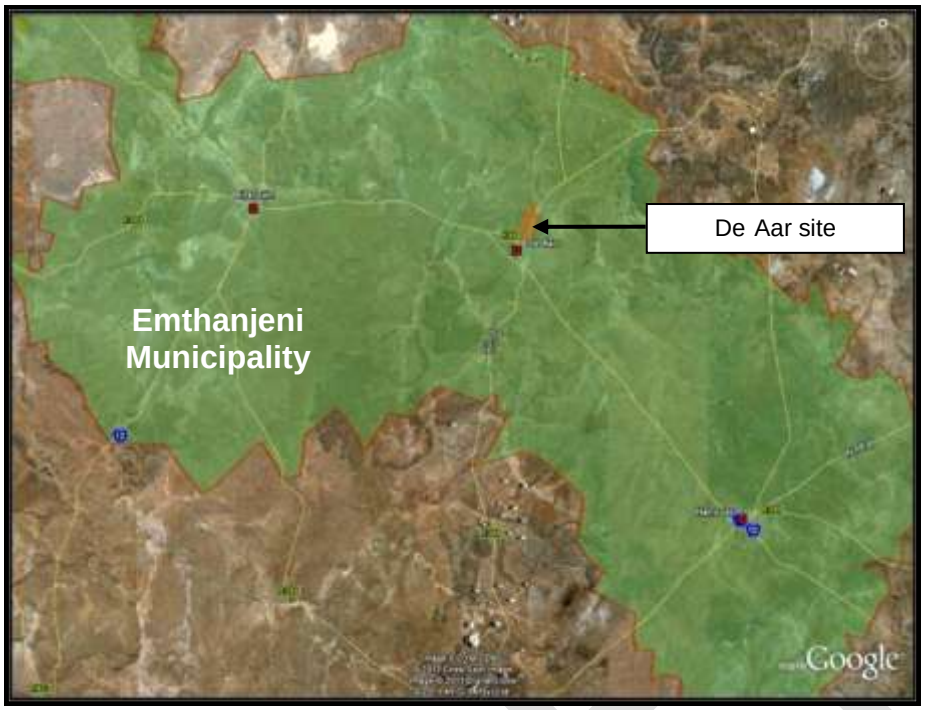

Figure 28**:** Proposed De Aar site within the Emthanjeni Local Municipality

At 362,591.4km^2 the Northern Cape has the biggest land mass of all the provinces and covers approximately 29.7% of South Africa's total land surface. Apart from its western border that is bounded by the Atlantic Ocean, the province is mostly landlocked: Namibia lies to the north-west, Botswana to the north, and the Western Cape to the south.

The province was home to two cross-boundary municipalities (the Ga-Segonyana District Municipality and the Phokwane Local Municipality) that overlapped with the Northwest Province, but in 2006 these municipalities were incorporated into the Northern Cape. This incorporation lead to an increase in the province's total population by approximately 180,000 people and had a significant impact on the province's services backlog in terms of water, sanitation, housing and electricity.

By the year 2007, the total population size of the province was estimated to be around 1.1 million people, which represents a population increase of approximately 66,000 people from 2001, when the last census was conducted. Based on the population size of 2007, the province has an extremely low population density, estimated at around 3 persons per square kilometre. However, it can be expected that the population density will increase in the urban areas, e.g. in the Sol Plaatje Local Municipal area (Kimberley) the population density stands at approximately 129.5 people per square kilometre.

According to the Northern Cape Province Fifteen Year Review (2009), the main economic contributors are mining and agriculture, despite the fact that the mining industry does not absorb as much labour as the agricultural sector. The Northern Cape's contribution to the Gross Domestic Product (GDP) showed an average growth rate of 4.1% per annum during the period 1995 to 2006. The Fifteen Year Review further stipulated that the agricultural sector within the province grew faster than the national

average, in part due to the provincial government's policies in terms of the transformation of the agricultural sector.

One of the most significant driving forces behind the transformation of the agricultural sector is the Land Reform Programme as the provincial government adopted the national target of redistributing at least 30% of the productive agricultural land within the province to historically disadvantaged communities by the year 2014. In the Northern Cape alone a total of 2,883 land claims were lodged with the Land Claims Commission, of which a total of 552,084ha have successfully been transferred to the beneficiaries by January 2008.

The Northern Cape Province Growth and Development Strategy (NCPGDS) identified the need to focus on the following issues within the province:

- Sector specific strategies that defines where public and private sector intervention is essential and valid;
- Key macro-level involvement and cooperation required from national line ministries to strengthen provincial initiatives;
- Interventions and opportunities at programme and project level;
- The development of a comprehensive provincial Spatial Development Framework (SDF) and strategy;
- Accessing the necessary financial resources to finance growth and development within the province;
- The identification of institutional delivery mechanisms; and
- The establishment of monitoring and evaluation systems and procedures.

The NCPGDS further indicated that poverty reduction is the most significant challenge faced by the provincial government and its growth and development partners. Addressing this issue also implies that the following societal problems have to be addressed:

- Reducing the backlog in basic needs such as water, sanitation and housing;
- Improving basic services such as health, education and social services;
- Reducing the HIV/AIDS prevalence rate;
- Creating employment opportunities;
- Reducing the crime rate; and
- Empowering vulnerable groups.

In addressing these and other issues, the Northern Cape Provincial Government considered the national development targets, the millennium development goals and the resolutions taken at the World Summit on Sustainable Development. From these the provincial government developed its own set of targets, which included the following:

- Maintaining an average annual economic growth rate of 4-6%;
- Halving the unemployment rate by 2014;

- Reducing the number of households living in absolute poverty by 5% per annum;
- Improving the literacy rate by 50% by 2014;
- Reducing the infant mortality rate by two thirds by 2014;
- Reducing the maternal mortality rate by two thirds by 2014;
- Providing shelter to the whole population by 2014;
- Providing clean water to everyone in the province by 2009;
- Reducing the crime rate by 10% by 2014;
- Stabilizing and then reversing the HIV/AIDS prevalence rate by 2014;
- Redistributing 30% of the province's productive agricultural land to previously disadvantaged individuals by 2015;
- Conserving and protecting 6.5% of the province's valuable biodiversity; and
- Providing adequate infrastructure to enable economic growth and development by 2014.

6.12 Tourism

6.12.1 Tourism in the Northern Cape

Ecotourism is the primary tourist attraction to the province. Tourists are primarily enticed to visit the province due to its tranquil and unpolluted natural environment (KPMG, 2005). The Northern Cape Province offers distinct features such as vast tracts of open spaces, scenic landscapes, diverse wildlife, ancient cultures and rich heritage which provide an unparalleled tourism experience. Overall accessibility and remoteness to tourist attractions have proved to be two major limiting factors for tourism growth in the province (KPMG 2005).

In the last quarter of 2004, the province captured only 2.5% of foreign tourists to the country representing the lowest percentage of foreign tourists in terms of provincial distribution. Africa and the Middle East (58.4%) and Europe (37%) accounted for the highest number of tourists visiting Northern Cape Province (Strategic Research Unit, 2004).

Most foreign tourists visit the Big Hole in Kimberly with the Augrabies Falls attracting the second highest number of tourists. The Namaqualand flowering region attracted 20.6% tourists, while nature/game reserves and Flea/crafts markets attracted 15.7% and 15.1% of the tourists respectively. The vast majority of tourists visiting the Northern Cape came for Holiday purposes (68.6%), 10.3% for shopping and 5.3% for business purposes (KPMG 2005).

In 2005, 2.6% of foreign tourists to the South Africa visited the Northern Cape. And in the last quarter of 2005, 2.9% of foreign tourists were captured in the Province. In the same year, the Province captured the least amount of tourism revenue with only 1% of foreign tourism receipts (excluding capital expenditure). Total Foreign Direct Spend (TFDS) (excluding capital expenditure) was only R 0.8 billion (Strategic Research Unit, 2005).

In 2007, the Northern Cape Province attracted 2.5% of foreign tourists (Strategic Research Unit, 2007). By 2008, the figure had dropped to 1.3% and by 2009 only 1.2% of foreign tourists visited Northern Cape Province (Strategic Research Unit, 2010). Countrywide, these are the lowest proportions of tourists visiting a province (Strategic Research Unit, 2007; Strategic Research Unit, 2009).

The number of nights spent by foreign tourists in Northern Cape decreased from 1.4% in 2007 to 0.9% in 2008. The province captured 0.9% of bed nights and only R 0.7 billion was earned in total foreign revenue in 2009. Majority of foreign tourists visit for leisure and business purposes (Strategic Research Unit, 2009).

6.12.2 Tourism in and Around the Proposed CSP and PV Plants

The proposed development falls within Pixley ka Seme District Municipality in Emthanjeni Local Municipality. Emthanjeni is the largest local municipal in Pixley ka Seme District Municipality. Emthanjeni Municipality contributed 22.8% of the provincial Gross Value added in the tourism sector within the Northern Cape in 1999 (Emthanjeni IDP, Tourism Strategy, 2010/ 2011).

Although there are several potential tourist attractions in the local municipality, they are in such a poor state that they reduce the capability of the municipality to become a tourist destination (Emthanjeni IDP, Tourism Strategy, 2010/ 2011). For example, in De Aar, the House of Olive Schreiner (the famous feminist author) which is a provincial heritage site needs to be renovated. Furthermore, the Garden Of Remembrance which was erected in honour of the British soldiers killed during the Anglo-Boer War is currently in a state of total disrepair (Emthanjeni IDP, Tourism Strategy, 2010/ 2011). These and others (listed in the “tourism supply” section below) need to be maintained.

In terms of tourist routes, there are no major tourist routes near the study area. The R48 from De Aar town, running to the south of the study area, links to the N10. The N10 links to major tourist routes such as the N12 (the diamond route) and the N1 (the Great Karoo Highway which is also part of the Mohair Route. However these tourist routes are far away from the study area. That is, the N10 joins the N12 about 49km to the west of the study area. Furthermore, the N10 joins the N1 approximately 61km to the southeast of the Study area.

The Tourism Trends and Land use, Tourism Supply and Tourism Demand in the study area are elaborated below. Where information could not be obtained on a local scale, provincial data is represented in this section.

- Tourism Trends and Land use

The study area of the proposed CSP and CPV/ PV Plants borders the town of De Aar to the south. There are no tourism routes near the study area, however there are a number of attractions and

activities in De Aar. Details on these are presented in the "tourism supply" section below. The study area is characterised by the following land uses:

- Most of the study area is dominated by vast open areas of natural vegetation, areas covered by shrublands.
- There is a water treatment plant that belongs to Emthanjeni Municipality in a small section in study area (farm 145 portion 29).
- Further south outside the boundaries of the study area (farm 145 portion 29) is a built up land for (commercial)
- There is a cultivated land in a section of farm portion 12/145 to the east of the study area.
- Also, there is open land with boundaries extending towards the N10 Road in farm portion 2/145 (to the west of the study area).
- The R48 provincial road traverses the area near the eastern boundaries.

- Tourism Supply

  - Tourism Activities/ Attractions

Most tourism activities/ attractions in the study area (within a 25km radius) are concentrated in the town of De Aar, these include:

i. Birding: Lesser Kestrel communal roosts in the town, with numbers of these birds peaking in December and January.
ii. An important Bird Area (IBA) which covers De Aar, Philipstown and Hanover is a potential tourist attraction. It holds important populations of two worldwide threatened species, several biome-restricted species and important populations of other arid-zone birds.
iii. Paragliding: There is a well established School offering pilot training.
iv. Golf course at the De Aar Country club
v. Weather station: This unique tourist attraction is the only one of its kind in the region.
vi. The De Aar Town Hall: It is one of the oldest buildings in De Aar and remains a beautiful architectural design. The Second World War cannon as well as the memorial are also on the same premises. It houses some municipal offices including the Tourism Office.
vii. Ammunition Museum: This is the largest ammunition depot in the southern Hemisphere
viii. Garden of Remembrance: It was erected in honour of the British soldiers who were killed during the Anglo-Boer War. Also situated here is the Memorial Cemetery.
ix. House of Olive Schreiner: This is one of the key tourists' attractions in the Emthanjeni Local Municipality. Olive Schreiner was the feminist author and she lived and wrote some of her major works in this house. She lived in De

Aar from 1907 to 1913. This house now serves as a restaurant and a provincial heritage site.

x. Deelfontein Cemetery with graves from the Anglo Boer War.
xi. St Paul's Anglican Church: It was built in 1892 during the Anglo Boer war and was frequented by the British soldiers stationed in De Aar; it has a beautiful stained glass window that commemorates the soldiers who died during the war. This building is a provincial heritage site and is ideal to house the Museum.
xii. Adventurer and outdoor activities such as, hunting, horse riding, donkey cart rides, hiking, bird watching, abseiling and stargazing.

(Ref.: Pixley Ka seme District Municipality; The Rich Heart of the Karoo, www.northerncape.org.za and Africa's Northern Cape; Official travel guide, 2010/11, www.northerncape.org.za)

Nevertheless, the 2010/2011 Emthanjeni IDP, Tourism Strategy reports that most of the above tourism features lack good maintenance therefore reducing the capability of the municipality in becoming a tourist destination (Creative Harvest, 2010). The tourism strategy provides details per potential attraction in De Aar:

i. The Garden of Remembrance is currently in a state of total disrepair.
ii. The De Aar Town Hall: This building and structures need restoration and renovation.
iii. The Weather Station: Is one of the major attractions of Emthanjeni but is not well known even by the local residents. As such it should be properly marketed and promoted. As part of promoting the station the entrances as well as the pathways should cater for the disabled. In addition, the access road leading to the station should be tarred to allow better access especially during and after rainy weather.
iv. The House of Olive Schreiner: This building is a provincial heritage site and urgently needs renovation as it can be a major tourist attraction.
v. Paragliding: Municipal support is necessary in popularizing this attraction to local residents.
vi. The Railway Station: De Aar railway station used to be the second most important railway junction in the Southern hemisphere. The municipality should consider developing a Museum dedicated to the Railways. This could be a major draw card for train enthusiasts (Creative Harvest, 2010).

- Accommodation Facilities

There are several accommodation facilities is in the town of De Aar including hotels, Guest houses, Bed and Breakfast facilities. These accommodation facilities are important to the tourism in the area. According to several Northern Cape travel guides there are approximately 25 accommodation facilities in De Aar. However, only eight facilities were reached for telephonic interviews. The total number of

beds in the eight facilities is 204 and business and passing through tourists are the main guests (Pers. Comm. 2010).

- Tourism Demand

Statistics provided by the South African Tourism Strategic Research Unit show that the Northern Cape is the least visited province in South Africa and that this percentage dropped from 1.3% in 2008 to 1.2% in 2009. However the number of bed nights spent in the Province increase by 31.5% between 2009 and 2010 (Statistics South Africa 2009).

On a domestic level (domestic tourists), Northern Cape is the least preferred province for trips in general. The province generated 2.1% of all tourist arrivals and also had the lowest proportion of overnight trips i.e. 2.2%. Up to 2.0% of domestic tourists made day trips to the province (Statistics South Africa 2009).

- Purpose of Visit by Domestic Tourists

Visiting friends or Relatives (VFR) was the main reason for both domestic day and overnight trips taken between December 2008 and February 2009 (Statistics South Africa 2009). 45.5% of overnight trips to the province were for VFR (which is the highest percentage). This is followed by Leisure/ vacation/ holiday at 32.7% (Statistics South Africa 2009).

- Length of Stay by Domestic Tourists

Between, December 2008 and February 2009, most domestic visitors (40%) spent one to three nights in Northern Cape. Also, 32.4% spent four to seven nights. While14.1% of visitors spent 8 to14 nights, 6.9% spent 15 to 21 nights. Very few visitors (6.7%) spent over 22 nights (refer to Table 6) (Statistics South Africa 2009).

Table 6: Main destination by length of stay for domestic overnight trips (Statistics South Africa 2009)

Destination	1-3 nights	4-7 nights	8-14 nights	15-21 nights	22+ nights	Average stay (number of nights)
Northern Cape	40%	32.4%	14.1%	6.9%	6.7%	8.8

- Type of Accommodation for Domestic Overnight Trips

Staying with friends and family is the overall principal type of accommodation for overnight domestic trips. Most domestic visitors (71.3%) to Northern Cape stayed with family and friends. This was followed by those who stayed in campsites (7%). Meanwhile 5.7% of visitors to the province stayed in guest house/ guest farm accommodation. Bed and Breakfast facilities indicated the fewest visitors i.e.

4.3% (Statistics South Africa 2009). Occupation of hotels, lodges, caravan parks and hostel/ backpackers were used in small proportions.

- Expenditure Patterns

Data on the expenditure on the most recent person trips (2009) taken to Northern Cape indicates that over R90 million during day trips was spent on food and beverages, domestic transport, recreation and culture, shopping as well as other. During overnight trips, over R409 million was spent on accommodation, food and beverages, domestic transport, recreation and culture, shopping and other during overnight trip spending. This was the lowest amount of all provinces. The cost of accommodation and the longer duration was the biggest contributory factor of overnight trips. Shopping as well as domestic transport were important expense items in Northern Cape (Statistics South Africa 2009).

- Accommodation Facilities Occupancy

The proposed site will be located within the "Rest of Northern Cape" tourism region. Tourism demand in the area of the development relates primarily to the outdoor and wildlife aspects (Statistics South Africa, 2004). Between January 2004 and February 2004 the "Rest of Northern Cape" tourism regions experienced increases in tourism demand in terms of room occupancy and bed occupancy for hotels as well as total hotel income (Table 7).

Table 7: Tourism demand in the 'Rest of Northern Cape' tourism region between January 2004 and February 2004 (Statistics South Africa, 2004)

Tourism region	**Room occupancy rate**	**Bed occupancy rate**	**Total hotel income**
Rest of Northern Cape	+1,8%	+0,5%	+2,0%

According to managers and owners of several accommodation facilities near the study area, the occupancy rate of accommodation facilities ranges from 30% to 100% (Pers. comm. 2010). For most of these accommodation facilities, the busiest times are during the week mostly between Monday and Thursday whereas weekend and holiday seasons are not busy (pers. comm. 2010, Owner of Herberg Lodge). Generally, the months of December, January and February indicate the lowest occupancy rates while March to November indicate the highest occupancy rates. This suggests that business-related tourism is important to suppliers of tourism accommodation in the De Aar area.

- Business Tourism

Business tourism reflects the tourist who visits an area purely to do business. Any other tourism activities such as sight-seeing or game viewing for example, are secondary. The market for business tourism is not as large as that for leisure tourism (South African Tourism, Business Tourism Strategy 2008). At a local scale, there is no identified business tourism in the area. However the 2005 statistics

indicate that at a provincial scale, business tourism accounts for only 2.8% of tourists to the province (South African Tourism, 2005). Nevertheless, the length of stay of business tourists was notably higher than leisure tourists which made up the vast majority of the tourists to the province. Most business tourists came from Africa (i.e. Botswana and Namibia) and the Middle East (15.5%).

- Leisure Tourism

When both international and domestic tourists are considered, leisure tourism accounts for the majority of the tourists to the province (KPMG, 2005). Over 83.3% of foreign tourists visit the regions for leisure purposes (Strategic Research Unit 2005). Leisure tourism is made up of a number of sub-groupings, which include ecotourism (game viewing, photographic safaris, family holidays on game farms etc), adventure (4x4 routes and hiking trails) and hunting. Other activities include: sport (golf) and visiting restaurants. Leisure tourism is the leading sub-sector in the Emthajeni Local Municipality (Creative Harvest, 2010).

i. Ecotourism

Ecotourism or photographic safaris (as opposed to hunting) has been the main attraction to the Northern Cape Province for a long period. However, the De Aar area is not a prominent ecotourism destination.

ii. Adventure tourism

Adventure activities such Paragliding, hunting, horse riding, donkey cart rides, hiking, bird watching, abseiling and stargazing are also present in De Aar. De Aar is one of only two sites for paragliding in the Northern Cape (the other being Kuruman) and well known attraction internationally. The town has a well established School that offers pilots training and tandem flights with a bird's eye view of the Karoo landscape. In terms of birding, Lesser Kestrel numbers in De Aar peak at more than 10, 000 birds in December and January.

- Passing Through

Tourism in the area may be attributed to tourists passing through the area via the N10 and R48 on their way to popular tourist destinations along routes such as N12 (the diamond route) and N1 which is the main arterial route between Cape Town and Gauteng (also part of the Mohair Route).

- Future Tourism in and Around the Study Area

The 2010 Emthanjeni Local Municipality Tourism Strategy Report outlines projects that are planned to be implemented in the next few years. These projects are categorised (referred to as objectives) as follows (Creative Harvest, 2010):

- Short Term Objectives: 2010 – 2013: The projects under this category include:
  i. Data Collection and tourism information co-ordination
  ii. Creating Demand (marketing and branding)
  iii. Establishing of Special Purpose Vehicle (SPV) for value chain co-ordination
  iv. Heritage Restoration

v. Institutional Arrangements
vi. Development of Tourism Infrastructure
vii. Identification and development of new attractions

- Medium term objective from 2013 to 2016 encompassing MICE (Meetings, Incentives, Conferencing and Events) tourism. This sub-sector should be targeted for growth in Emthanjeni.
- Long term objectives from 2016 to 2020 entailing general business and retail tourism.

The following section presents details of activities planned for the next three years starting 2010 (short term objectives) and targeted to improve leisure tourism in Emthanjeni Municipality.

- Short Term Objectives: Projects planned for the Emthanjeni Local Municipality between 2010 and 2030.

  - Data Collection project is aimed at better management of tourism information and will be achieved by:
    i. Establishing a database for tourism information
    ii. Designing a data collection instrument
    iii. Collecting feedback from stakeholders on a monthly basis
    iv. Inclusion of collected information in a database
  - Creating demand: This project is aimed at transforming Emthanjeni into a prime tourist destination for local economic development. The project will:
    i. Integrate marketing with the branding project and utilise integrated media and communication plan employing spread of media tactics including digital, electronic, print, etc.
  - Special Purpose Vehicle (SPV): The objective of this project is to establish a special purpose vehicle for proper co-ordination of the tourism value chain and management as well as to encourage a wider participation of stakeholders. The project will be undertaken by facilitating a founding meeting with all the tourism stakeholders.
  - Heritage reconstruction project is aimed at improving tourists attractions so as to increase tourism demand for the local municipality. The project will involve the following:
    i. The reconstruction of the Khoisan heritage and other African cultural heritage that exist in the Municipality
    ii. Formalising the history of the indigenous people of the area and emphasise it in the history of the Municipality to highlight diverse and rich heritage (the Malay history, Xhosa history)
    iii. Tracing and restoration of museum artefacts from private ownership
    iv. Restoration of the museum structures in Britstown and Hanover.
    v. Establish a new museum in De Aar concentrating on the steam locomotive
  - Institutional Arrangement: This project will prioritize tourism through improving institutional arrangement including better Human Resource, planning, and budgeting allocation. This will be achieved through:
    i. Designing appropriate structure to drive tourism development

ii. Developing a better planning process
iii. Adequate budget allocation coupled with tourism planning.

- Development of Tourism Infrastructure: Prioritize the improvement of tourism infrastructure to increase tourism demand for the destination Municipality. The project entails:
  i. Establishment of a new tourism information office in De Aar
  ii. Establishment of satellite tourism offices in Hanover and Britstown
- Identification and Development of new tourist attractions such as, merino route, springbok route, Khoisan and rock art route, camping sites and hiking trails, re-inventing the Springbok Festival or Karoo Festival and adventure sport among others (Creative Harvest, 2010).

The objectives imply a strong base for that future tourism in the study area.

7 PUBLIC PARTICIPATION PROCESS

Public participation is the cornerstone of any EIA. The principles of NEMA as well as the EIA Regulations govern the EIA process, including public participation. The Public Participation Process (PPP) for the proposed development has been conducted according to Guideline 4 of the EIA Regulations These include provision of sufficient and transparent information on an ongoing basis to stakeholders to allow them to comment, and ensuring the participation of previously disadvantaged people, women and the youth.

The public participation process is primarily based on two factors; firstly, ongoing interaction with the environmental specialists and the technical teams in order to achieve integration of technical assessment and public participation throughout. Secondly, to obtain the bulk of the issues to be addressed early on in the process, with the latter half of the process designed to provide environmental and technical evaluation of these issues. These findings are presented to stakeholders for verification that their issues have been captured and for further comment.

Input into the public participation process by members of the public and stakeholders can be given at various stages of the EIA process. Registration on the project can take place at any time during the EIA process up until the final EIA report is submitted to DEA. There are however set periods in which comments are required from Interested and / or Affected Parties (I&APs) in order to ensure that these are captured in time for the submission of the various reports. The comment periods during the EIA phase were implemented according to Guideline 4 of the NEMA (107/1998), Environmental Impact Assessment Regulations in terms of section 24(5).

The EIA regulations emphasise the importance of public participation. In terms of the EIA regulations, registered interested and/or affected parties –

- may participate in the application process;
- may comment on any written communication submitted to the competent authority by the applicant or environmental consultant;
- must comment within the timeframes as stipulated by the EIA Regulations;
- must send a copy of any comments to the applicant or Environmental Assessment Practitioner (EAP) if the comments were submitted directly to the competent authority; and
- must disclose any direct business, financial, personal or other interests that the person has in the application being granted or refused.

The following actions were taken upon receiving comments/queries/issues:

- The contact details provided were entered into the project database for use in future notifications.
- Confirmation of receipt of comments.
- Addressed comments in the Issues & Response Report.

7.1 Overview of the Public Participation Process to date

The public participation process for the EIA was initiated in October 2010. On commencement of the EIA phase, the EIA Newsletter was distributed to all registered I&APs during March 2011.

The process that was followed during the Scoping Phase of the project will be repeated during the EIA phase. The major difference would be that the public now have an opportunity to comment on the findings of the specialist studies and the final layout of the project.

On-going consultation with key stakeholders (e.g. provincial, district and local authorities, relevant government departments, local business etc.) and identified I&APs ensured that I&APs are kept informed regarding the EIA process.

7.2 Consultation and Public Involvement

As in the scoping phase, telephonic discussions and focus group meetings will be held with key stakeholders and other relevant I&APs in order to identify key issues, needs and priorities for input into the proposed project. Special attention will be paid to the consultation with possibly affected landowners and communities within the study area to try and address their main concerns.

An advertisement has been placed in the local newspaper, the Echo, to advertise the public meeting and availability of the draft Environmental Impact Report. Site notices have also been placed within the town of De Aar notifying the public of the public meeting and availability of the report.

7.3 Proof of Notification

Appendix 5 includes all proof of notification of Interested and Affected Parties;

- Site notice text (Appendix 5A)
- Proof of advertisements in the newspapers (Appendix 5C)
- EIA Newsletter (Appendix 5B)
- Correspondence to registered I&APs and key stakeholders (Appendix 5D)

7.4 Focus Group Meetings

A Focus Group Meeting (FGM) will be held in June 2011 in De Aar. This will take place during the review period of the report and will coincide with the public meeting. FGMs are smaller meetings with specific groups or organisations who have similar interests in or concerns about the project. This process is ongoing and will continue throughout the EIA process.

Table 8: Focus Group meeting

Venue	Interested Parties	Date	Time
TBA	TBA	TBA	TBA

Minutes of this meeting will be compiled and forwarded to all attendees for their review and comment (Appendix 5E). The primary aim of these meetings is to:

- disseminate information regarding the proposed development to I&APs
- provide I&APs with an opportunity to interact with the EIA team and the Mainstream Renewable Energy representatives present.
- supply more information regarding the EIA process;
- answer questions regarding the project and the EIA process;
- receive input regarding the public participation process and the proposed development.

7.5 Key Stakeholder Workshop

A Key Stakeholder Workshop will take place during the review period of the EIR and stakeholders.

The Key Stakeholder Workshop will be held in order to provide stakeholders with any additional information regarding the proposed development, to present the environmental findings of the impact-phase studies and to invite stakeholders to submit their comments on the EIR as well as to raise any further comments and/or concerns that they may have.

This meeting will take place in Kimberley in order to allow for provincial stakeholders to attend.

Table 9: Key Stakeholder Workshop

Venue	Date	Time
TBA	TBA	TBA

The draft minutes will be compiled and forwarded to all attendees, and the final minutes will be included in the Final EIR that will be submitted to the Competent Authority (Appendix 5E).

7.6 Public Meeting

A Public Meeting will also be held during the review of the Draft EIR. The meeting will take place as follows:

Table 10: Public Meetings / Open Days

Venue	Date	Time
De Aar Town Hall	8 June 2011	17h00

This meeting has been advertised in the Echo and invitation letters will be sent by mail and e-mail to all registered I&APs on the project's database.

Furthermore, posters advertising the Public Meeting have been displayed at the public venues as advertised as well as various public places frequented by the public i.e. cafés. (Proof of the advertisement will be included Appendix 5C in the final report).

The Public Meeting will be held in order to provide I&APs with information regarding the proposed development, present the impact phase environmental findings and invite I&APs to raise any further comments and/or concerns that they may have.

Draft minutes of this meeting will be compiled and forwarded to all attendees, and the final minutes will be included in the Final EIR that will be submitted to the Competent Authority (Appendix 5E).

7.7 Public review of Environmental Impact Report

The Draft EIR was made available for review at the following venues from the 27th of May 2011 to the 27th of June 2011.

- De Aar Public Library
- De Aar Tourism Office
- Emthanjeni Municipal Offices

All comments received on this report have been incorporated into the Issues and Response Report.

7.8 Issues and response report

Issues, comments and concerns raised during the public participation process have been captured in the Issues and Response Report (I&RR) – Appendix 5F. This I&RR provides a summary of the issues raised, as well as responses which were provided to I&APs. This information will be used to feed into the evaluation of social impacts.

8 SPECIALIST STUDIES FINDINGS

The following specialist studies were undertaken as per the Plan of Study for EIA:

- Biodiversity
- Surface Water
- Groundwater
- Noise
- Visual
- Heritage (including palaeotology)
- Socio-economic (incorporating tourism)

The findings of these studies are presented below.

In addition to these studies, a stormwater management plan and waste management plan have been included in order to address these mitigation measures. A brief comment on geotechnical conditions has also been included.

8.1 Biodiversity

The full Biodiversity Assessment is included as Appendix 6A.

The site is located within the Nama Karoo Biome which occurs on the central plateau of the western half of South Africa. The vegetation is dominated by dwarf karoo shrubland with grasses being relatively rare within the area. Fire is rare in this biome due to the low fuel load. The Nama Karoo has very few rare or Red Data species.

8.1.1 Northern Upper Karoo

This vegetation type is characterised by flat to gentle topography. It consists mainly of shrubland dominated by dwarf karoo shrubs, grasses and *Acacia mellifera* with some other low tree species.

Small trees include *Acacia mellifera* and *Boscia albtrunca*. Taller shrubs are dominated by the following species: *Lycium cinereum, Rhigozum trichotomum*. Low shrubs occurring include *Chrysocoma ciliata, Gnidia polycephala, Pentzia calcarea, Rosenia humilis, Amphiglossa triflora, Aptosimum marlothii* and *Asparagus glaucus*. The herb layer is dominated by *Chamaesyce inaequilatera, Convolvulus sagittatus, Dicoma capensis, Gazania krebsiana, Hermannia comosa, Indigofera alternans, Lessertia pauciflora, Radyera urens* and *Sesamum capensa.*

The vegetation type is considered to be Least Threatened with large expanses remaining. None of the vegetation has been conserved in statutory conservation areas. Approximately 4% has been cleared for cultivation or transformed by building of dams.

8.1.2 Invasive Alien Plants

Two major alien invasive species were noted within the study area, namely Match poplar, cottonwood (*Populus deltoides*) and Black or red ironbark (*Eucalyptus sideroxylon*)

Populus deltoides grows up to 35m high and its leaves are bright yellow. The species mostly invades riverbanks and marshes. It is a proposed declared invader in South Africa (Henderson, 2001).

8.1.3 Floral environment

Table 11: Dominant species noted on site

Scientific Name	**Common Name**	**Additional information**
Shrubs and trees		
Prosopis glandulosa	Mesquite	Declared invader Category 2
Eucalyptus sideroxylon	Black or red ironbark	Declared invader Category 2
Populus deltoides	Match poplar	Proposed declared invader
Eriocephalus ericoides	Kapok bush	
Felicia muricata	Bloublommetjie	
Asparagus sp.		
Crysocoma cilliata	Bitterbos	
Aptosium spinescens	Rolvarkie	
Lycium oxycarpum	Wolwedoring	
Lessertia annularis	skaapertije	
Aloe Broomii	Bergaalwyn	
Gomphrena celasioides	Bachelor's button	
Phaeoptilum spinosum	Brosdoring	
Eberlanzia ferox	Doringvygie	
Pentzia incana	Ankerkaroo	
Rhigozum obovatum	Granaatbos	
Atriplex lindleyii	Blasiebrak	
Indigofera sp		
Sonchus wilmsii	Milk thistle	
Helichrysim sp		
Geigeria ornitivia	Verneerbos	
Cucumis sp		
Grasses		
Enneapogon cenchroides	Nine-awned grass	

Eragrostis echinochloidea	Tick grass	
Phragmites australis	Common Reed	
Pennisetum Clandestinum	Kikuyu	Proposed declared invader
Tragus berteronianus	Common carrot seed grass	
Eragrostis lehmanniana	Lehman's love grass	
Stipagrostis uniplumis	Silky bushman grass	
Cynodon dactylon	Couch grass	
Eragrostis capensis	Heart-seed love grass	
Chloris virgata	Feathered chloris	
Fingerhuthia africana	Thimble grass	
Cenchrus ciliaris	Blue buffalo grass	
Aristida adscensionis	Annual three awn	
Aristida diffusa	Iron grass	

Table 12: Endemic species documented within the study area

Family	Species	Threat status	SA Endemic
AIZOACEAE	*Tetragonia fruticosa* L.	LC	Yes
APOCYNACEAE	*Huernia humilis* (Masson) Haw.	LC	Yes
ASPARAGACEAE	*Asparagus striatus* (L.f.) Thunb.	LC	Yes
ASPHODELACEAE	*Haworthia venosa* (Lam.) Haw. subsp. tessellata (Haw.) M.B.Bayer	LC	Yes
ASTERACEAE	*Helichrysum asperum* (Thunb.) Hilliard & B.L.Burtt var. asperum	LC	Yes
ASTERACEAE	*Osteospermum leptolobum* (Harv.) Norl.	LC	Yes
MESEMBRYANTHEMACEAE	*Oscularia deltoides* (L.) Schwantes	LC	Yes
SCROPHULARIACEAE	*Selago albida* Choisy	LC	Yes

In terms of GN 1187 published under the National Environmental Management: Biodiversity Act on the 23rd of February 2007 none of the species documented within the study area are considered to be protected in terms of this legislation.

8.1.4 Mammals

Various mammal species are likely to occur within the study area. Appendix 6A comprises a list of mammals that are likely to occur in study area with the assigned level of threat facing each particular species. A map was used to correlate the occurrence of the Red Data species with their approximate occurrence within the study area. According to Friedman & Daly, (2004), the majority of species within the study area are listed as species of least concern. However, a few species are such as Spotted-necked Otter (*Lutra maculicollis*), South African Hedgehog (*Atelerix frontalis*) Brown Hyaena (*Hyaena brunnea*) and Geoffroy's Horseshoe Bat (*Rhinolophus clivosus*) are listed as Near Threatened and have been recorded in the study area. Suitable habitat for the Otter is not present on the site and

anthropogenic activities on the site make it unlikely for the hedgehog or hyaena to be present. No roosting habitat is available on the site for bat species however foraging may take place,

The larger mammal species recorded for the study area are no longer present as these species are usually isolated to protected areas. This includes species such as the Black Rhino (*Diceros bicornis bicornis*). Other more common mammals which are likely to occur include the Black footed cat (*Felis nigripes*), Aardwolf (*Proteles cristatus*) and Aardvark (*Orycteropus afer*).

Evidence of porcupines (*Hysterix africaeaustralis*) was prominent on the site during the field inspection with several large burrow systems and fresh middens.

No small mammal species were trapped during field surveys possibly due to: (a) unfavourable and constant grazing by cattle, sheep and goat or (b) unfavourable weather conditions. Grazing influences the existence of small mammals in the area. According to Bergstrom (2004), the presence of livestock has a negative effect on both small mammal species richness and abundance. Moreover small mammals can be seen as indicators of environmental conditions (Linzey & Kesner, 1997). This is because changes in the environment due to heavy grazing leads to changes in the habitats for small mammals therefore affecting their abundance, survival and breeding success (Dooley & Bowers, 1996). In the North American rangelands, trampling and grazing have been shown to reduce the lower vegetation cover for small animals hence increasing their exposure to predators (Grant et al., 1982; Birney et al., 1976; Edge et al., 1995). In addition, trampling may affect the burrowing substrate for the rodents (Bergstrom, 2004).

Weather conditions during field work were unusually wet and cold for the time of year and this may have affected sampling results. Habitat assessment conducted however provides an indicative measurement of species which may or may not be present.

8.1.5 Reptiles

Several reptile species are likely to be present in the study area. Table 13 highlights these species (Branch 1998). According to the current Red Data information, only one of the species noted are Red Data listed (McLachlan, 1978). The Red Data book is currently being updated.

Habitat for these species is currently available and these are the species which are likely to be the most common on the site.

Table 13: Red data reptiles in the study area

Common name	Scientific name	South African Red Data Status
Greater Padloper	*Homopus femoralis*	
Karoo Padloper	*Homopus boulengeri*	
Leopard tortoise	*Geochelone pardalis*	
Serrated or Kalahari tent tortoise	*Psammobates oculiferus*	
Marsh or Helmeted Terrapin	*Pelomedusa subrufa*	

Common name	Scientific name	South African Red Data Status
Delalande's beaked blind snake	*Rhinotyphlops lalandei*	
Schinz's Beaked Blind Snake	*Rhinotyphlops schinzi*	
Peter's thread snake	*Leptotyphlops scutifrons*	
Brown house snake	*Lamprophis fuliginosus*	
Spotted House Snake	*LLamprophis guttatus*	
Mole snake	*Pseudoaspis cana*	
Sundevall's shovel -snout	*Prosymna sundevallii sundevallii*	
Spotted or Rhombic Skaapsteker	*Psammophylax rhombeatus*	
Striped Skaapsteker	*Psammophylax tritaeniatus*	
Karoo Sand Snake or Whip Snake	*Psammophis notostictus*	
Fork-marked Sand Snake	*Psammophis leightoni trinasalis*	
Cross-marked or Montane Grass Snake	*Psammophis crucifer*	
Common or Rhombic Egg Eater	*Dasypeltis scabra*	
Herald or Red-lipped Snake	*Crotaphopeltis hotamboeia*	
Eastern tiger snake	*Telescopus semiannulatus*	
Boomslang	*Dispholidus typhus*	
Boulenger's Garter Snake	*Elapsoidea boulengeri*	
Sundevall's garter snake	*Elapsoidea sunderwallii media*	
Spotted Harlequin Snake	*Homoroselaps lacteus*	
Cape Cobra	*Naja nivea*	
Puff adder	*Bitis arietans arietans*	
Horned Adder	*Bitis caudalis*	
Dusky Spade-snouted Worm Lizard	*Monopeltis infuscata*	
Cape skink	*Mabuya capensis*	
Variegated skink	*Mabuya variegata*	
Spotted Desert Lizard	*Meroles suborbitalis*	
Namaqua Sand Lizard	*Pedioplanis namaquaensis*	
Holub's Sandveld Lizard	*Nucras holubi*	
Spotted sand lizard	*Pedioplanis lineoocellata lineocellata*	
Yellow throated plated lizard	*Gerrhosaurys flavigularis*	
Karoo girdled lizard	*Cordylus polyzonus*	
Rock or White-throated Monitor	*Varanus albigularis*	
Nile or Water Monitor	*Varanus niloticus*	Vulnerable
Ground Agama	*Agama aculeata aculeata*	
Southern Rock Agama	*Agama atra atra*	
Southern Spiny Agama	*Agama hispida*	
Karoo Dwarf Chameleon	*Bradypodion karrooicum*	
Flap neck Chameleon	*Chamaeleo dilepis*	
Bibron's Thick-toed Gecko	*Pachydactylus bibronii*	
Marico Thick-toed Gecko	*Pachydactylus mariquensis*	
Cape Thick-toed Gecko	*Pachydactylus capensis*	

No species listed in GN 1187 published under the National Environmental Management: Biodiversity Act on the 23rd of February 2007 occur within the study area.

No reptile species were trapped during field surveys possibly due to unfavourable weather conditions (rain) during fieldwork.

8.1.6 Amphibians

No suitable habitat is available for the only Red data amphibian species which is likely to be present in the study area. The African Giant Bullfrog (*Pyxicephalas adspersus*) is considered Near Threatened according to Du Preez and Carruthers, (2009). The species breeds in seasonal shallow grassy pans, vleis and other rain filled depressions in open flat areas of grassland or savanna (Du Preez and Carruthers, 2009). There is a possibility that the species may have colonised the area where water from the treatment plant has gathered. However this water is not of good quality with a high level of nitrates due to poor filtration on the site. The species abundance for amphibians is thus anticipated to be low as a result.

Table 14: Amphibian species in the study area

Scientific name	Common name	Status
Amietophrynus gariepensis	Karoo Toad	Not threatened
Amietophrynus gutturalis	Guttural Toad	Not threatened
Amietophrynus rangeri	Raucous Toad	Not threatened
Bufo vertebralis	Southern Pygmy Toad	Not threatened
Kassina senegalensis	Bubbling Kassina	Not threatened
Breviceps adspersus	Bushveld Rain Frog	Not threatened
Cacosternum boettgeri	Boettger's Caco	Not threatened
Xenopus laevis	Common Platanna	Threatened
Afrana anglolensis	Common River Frog	Not threatened
Afrana fuscigula	Cape River Frog	Not threatened
Pyxicephlus adspersus	Giant Bullfrog	Near Threatened
Tomopterna cryptotis	Tremolo Sand Frog	Not threatened
Tomopterna tandyi	Tandy's Sand Frog	Not threatened

There is no red data amphibian species recorded in the study area. No species listed in GN 1187 published under the National Environmental Management: Biodiversity Act on the 23rd of February 2007 occur within the study area.

Only one amphibian species i.e. Raucous Toad *Amietophrynus rangeri* was spotted around the site during field surveys.

8.1.7 Invertebrates

Several invertebrates were trapped in sweep nets in the study area while others were recorded around the study area (Table 15)

Table 15: List of invertebrates in the study area

Order: Family	Common name	Scientific name
Coleoptera: Carabidae	Two spotted ground beetle	*Thermophilum homoplatum*
Coleoptera: Carabidae	Starred ground beetle	*Caminara sp.*
Coleoptera: Carabidae	Unspecified	Unspecified
Coleoptera: Tenebrionidae	Tar darkling beetle	*Somaticus aeneus*
Coleoptera: Tenebrionidae	Armoured darkling beetle	*Gonopus tibialis*
Lepidoptera: Arctiidae	Crimson-speckled footman	*Utetheisa pulchella*
Neuroptera: Myrmeleontidae	Unspecified	*Neuroleon sp.*
Neuroptera: Myrmeleontidae	Unspecified	Unspecified
Dermaptera: Labiduridae	Unspecified	*Labidura riparia*
Hymenoptera: Formicidae	Bal-byter	*Camponotus fulvopilosus*
Orthoptera: Anostostomatidae (mimnermidae)	Unspecified	*Nasidius sp.*
Orthoptera: Bradyporidae	Corn Cricket, Koringkriek	*Acanthoproctus cervinus*
Orthoptera: Acrididae	Yellow wings	*Oedaleus sp.*
Orthoptera: Acrididae	Common stick grasshopper	*Acrida acuminata*
Orthoptera: Acrididae	Unspecified	*Rhachitopis sp.*
Orthoptera: Acrididae	Unspecified	Unspecified
Orthoptera: Pamphagidae	Unspecified	Unspecified
Orthoptera: Miridae	Unspecified	Unspecified
Araneae: Unspecified	Unspecified Baboon spider	Unspecified

Invertebrates are mobile in nature and are not likely to be affected by the construction of a solar power plant. No unique larval habitat is present on the site which could impact on invertebrate species. Mitigation measures to reduce habitat destruction will aid in the preservation of habitat for invertebrate species. A large amount of arachnid species are likely to be present due to the rocky nature of the parts of the site. A dead scorpion was noted on the site.

8.1.8 Avifauna

The study area is characterised by a wide range of bird species which could potentially be affected by the proposed solar power plant. The effects of solar power plants are fairly unknown due to the technology being so new. However the available literature has been consulted in order to address the issues as comprehensively as possible.

The following species were noted on site during the field investigation.

Table 16: Bird species noted on site

Roberts No.	Common Name	Scientific Name
25	Egyptian Goose	*Alopochen aegyptiacus*

Roberts No.	Common Name	Scientific Name
834	Cape Sparrow	*Passer melanurus*
27	Spur-winged Goose	*Plectropterus gambensis*
705	Levaillants Cisticola	*Cisticola tinniens*
280	Three-banded Plover	*Charadrius tricollaris*
273	Black-winged Stilt	*Himantopus himantopus*
839	Cape Wagtail	*Motacilla capensis*
288	Blacksmith Lapwing	*Vanellus armatus*
453	Hadeda Ibis	*Bostrychia hagedash*
240	Common Greenshank	*Tringa nebularia*
909	Common Waxbill	*Estrilda astrild*
223	Common Moorhen	*Gallinula chloropus*
749	Lesser Swamp-Warbler	*Acrocephalus gracilirostris*
108	White-backed Mousebird	*Colius colius*
251	Little Stint	*Calidris minuta*
106	European Bee-eater	*Merops apiaster*
186	Cape Turtle-Dove	*Streptopelia capicola*
198	Northern Black Korhaan	*Eupodotis [a.] afraoides*
226	Namaqua Sandgrouse	*Pterocles namaqua*
533	Common Fiscal	*Lanius collaris*
436	Black-headed Heron	*Ardea melanocephala*
924	Pin-tailed Whydah	*Vidua macroura*
851	African Pipit	*Anthus cinnamomeus*
710	Desert Cisticola	*Cisticola aridulus*
721	Rufous-eared Warbler	*Malcorus pectoralis*
618	Karoo Scrub-Robin	*Cercotrichas coryphaeus*
632	Familiar Chat	*Cercomela familiaris*
943	Lark-like Bunting	*Emberiza impetuani*
538	Pied Crow	*Corvus albus*
391	Booted Eagle	*Hieraaetus pennatus*
455	African Sacred Ibis	*Threskiornis aethiopicus*
30	Cape Teal	*Anas capensis*
66	Acacia Pied Barbet	*Tricholaema leucomelas*
709	Zitting Cisticola	*Cisticola juncidis*
274	Pied Avocet	*Recurvirostra avosetta*
872	Southern Masked-Weaver	*Ploceus velatus*
716	Karoo Prinia	*Prinia maculosa*
452	Glossy Ibis	*Plegadis falcinellus*
668	Barn Swallow	*Hirundo rustica*
261	Ruff	*Philomachus pugnax*
184	Laughing Dove	*Streptopelia senegalensis*
216	Black Crake	*Amaurornis flavirostra*

Roberts No.	Common Name	Scientific Name
744	African Reed-Warbler	*Acrocephalus baeticatus*
699	Grey-backed Cisticola	*Cisticola rufilatus*
679	South African Cliff-Swallow	*Hirundo spilodera*
150	Little Swift	*Apus affinis*
294	Crowned Lapwing	*Vanellus coronatus*
191	Namaqua Dove	*Oena capensis*
152	White-rumped Swift	*Apus caffer*
633	Anteating Chat	*Myrmecocichla formicivora*

The study area is located in an Important Bird Area (IBA), the Platberg- Karoo Conservancy (ZA028) which is recognized as an Important Bird Area because of the significant occurrence of two globally threatened species (Lesser Kestrel *Falco naumanni* and Blue Crane *Anthropoides paradiseus*), four nationally threatened species (including Kori *Bustard Ardeotis kori* and Ludwig's Bustard *Neotis ludwigii*) and several globally and nationally near-threatened species (including Blue Korhaan *Eupodotis caerulescens*, Black Stork *Ciconia nigra* and Secretarybird *Sagittarius serpentarius*) (Barnes & Anderson 1998). This Conservancy is an informal conversation area and is 1200000 ha.

Bird lists associated with these areas are included in Appendix 6A. A total of 132 species have been recorded for the IBA. This information was extracted by the South African Bird Atlas Project 2 (SABAP 2).

The following Red Data bird species occur within the study area.

Table 17: Red Data Bird Species (Barnes 1998)

Scientific name	Common name	Status
Ephippiorhynchus senegalensis	Saddlebilled Stork	Endangered
Gyps africanus	African Whitebacked Vulture	Vulnerable
Gyps coprotheres	Cape Vulture	Vulnerable
Torgos tracheliotos	Lappetfaced Vulture	Vulnerable
Aquila rapax	Tawny Eagle	Vulnerable
Polemaetua bellicosus	Martial Eagle	Vulnerable
Circus ranivorus	African Marsh Harrier	Vulnerable
Anthropoides paradiseus	Blue Crane	Vulnerable
Ardeotis Kori	Kori Bustard	Vulnerable
Falco naumanni	Lesser Kestrel	Vulnerable
Phoenicopterus minor	Lesser Flamingo	Near Threatened
Sagittarius serpentarius	Secretarybird	Near Threatened
Falco biarmicus	Lanner Falcon	Near Threatened

The artificial water source has also resulted in the attraction of several bird species not common to the study area.

8.1.9 Sensitive areas

It is always a recommendation that new infrastructure, where possible, follows existing infrastructure such as roads and existing electrical servitudes in order to consolidate impacts. Technically this is not always possible but it is the best option from a biodiversity perspective.

Detailed EIA phase investigations have revealed that the portion to the north of the study area, previously (during the scoping phase) anticipated to be sensitive from a biodiversity perspective, is not natural. It is an artificial wetland whose water is supplied from a municipal sewage works plant. The water within this wetland area is polluted due to insufficient treatment. According to the EIA phase wetland report, the permanent presence of this water has resulted in the establishment of hydrophytic vegetation typically associated with streams and wetlands e.g. common reed (*Phragmites australis*) and bulrush (*Typha capensis*). The area does however not illustrate soil characteristics of a wetland. Also, several species of birds were also recorded in this part of the study site.

Apart from the minor rocky ridges which are anticipated house a larger array of biodiversity, large parts of the site have been transformed by cattle and sheep grazing as well as exotic species. Construction activities for the Secure Care Centre have also expanded onto the site which has resulted in transformation surrounding this structure. It is thus these areas that will be favoured for location of the proposed infrastructure.

The river systems on the site do however remain sensitive and these areas have been demarcated as such.

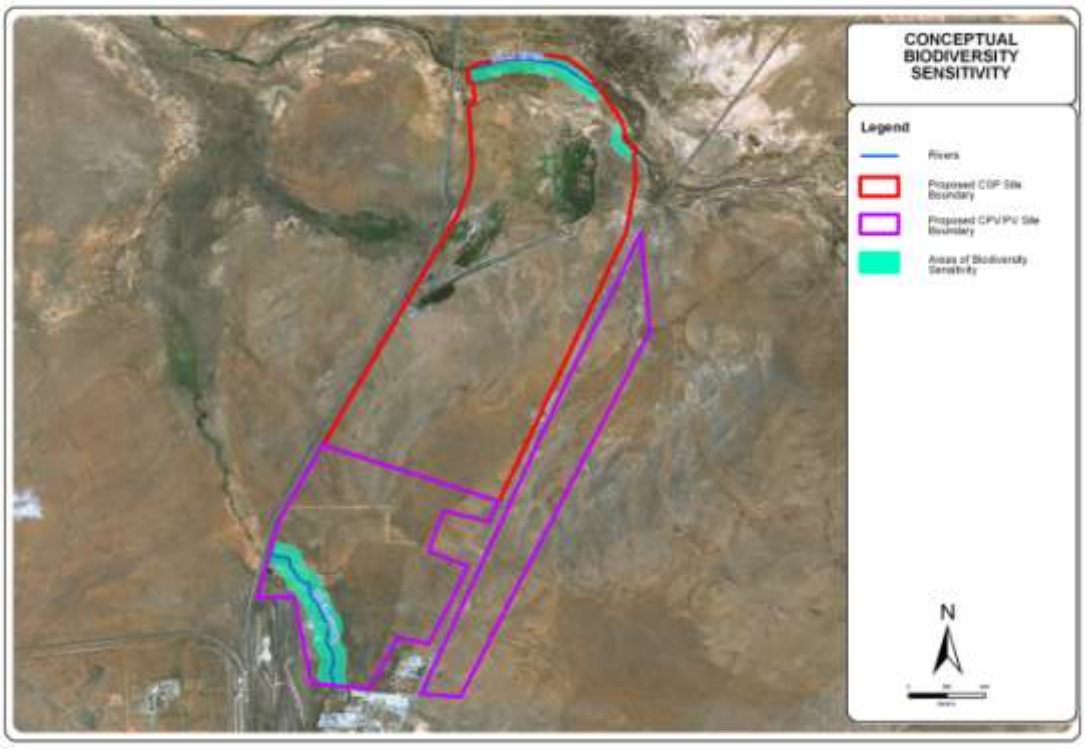

Figure 29: Biodiversity sensitivity map

8.1.10 Potential Impacts of the Proposed Development During Construction

The potential impacts of the solar power plant mainly related to loss of habitat for red data and general species; potential loss of species richness, edge effect and erosion. The impact of the proposed development cover the entire site. Surrounding vegetation will remain intact and will not be impacted upon. As such the impact is localised and if the mitigation measures are implemented, the overall impact can be reduced.

During the construction phase the following impacts are predicted in terms of each of the biodiversity groupings.

- Flora

The impacts associated with the floral environment relate to the removal of vegetation and associated loss of habitat for endemic and Red Data species. This could result in loss of species richness and increase the edge effect. The edge effect implies an increase of alien species into the area thus affecting the local species.

This being said the footprint of the proposed development in relation to the surrounding environment is extremely small. In addition the surrounding environment is extremely uniform and contains the same habitat as that of the site. The development of the plant will thus not have a major effect on vegetation loss in the larger environment.

No sensitive species have been identified on the site and large portions of the site have been transformed by anthropogenic activities such as construction and activities surrounding the sewage works. Sheep grazing has been intensive on the property which is evident from the dominance of non palatable grasses.

Whilst the installation of the parabolic troughs will require clearing and terracing, the establishment of the PV panels will not result in clearing of all vegetation i.e. a large amount of vegetation will remain between the PV panels.

- Mammals

The impact associated with the mammal population on site relates to the loss of habitat and disturbance during construction. The area does not appear to have a large mammal population due to the arid nature of the climate however ground squirrels were noted on the site. As mentioned above the surrounding area contains the same habitat into which mammal species can move during construction. The PV area will be available for recolonisation after the completion of construction.

- Reptiles

The impacts associated with reptiles relate, as with other faunal groupings, to habitat loss. Cumulatively however, a large amount of habitat surrounding the site is present into which these species can move during construction. Furthermore, with regards to the PV power plant, these species will be able to re-colonise the vegetation under the panels during operation.

- Amphibians

Due to the presence of the artificial wetland, amphibians are present in the study area. *Amietophrynus rangeri* an amphibian species was recorded on the site during field surveys. The removal of the waste water will result in a decrease in amphibian species which have colonised this area. Amphibian numbers are not anticipated to be high due to the high level of contamination that is present and the sensitivity of this species to pollution. Mitigation measures will however be out in place to ensure a search and rescue operation as the waste water area is dried up.

- Invertebrates

The study area has a remarkable invertebrate diversity. Invertebrates are fairly mobile and will be able to move away during construction to the surrounding habitat. They will be able to recolonise the areas under the PV panels after construction.

- Avifauna

Birds are the faunal grouping which is most at risk from the proposed development. Several impacts are possible which could affect bird populations within the study area.

  - Habitat loss

The incorrect functioning of the oxidation pond sewage treatment system that is in place on the site has resulted in large amounts of waste water pooling in the northern section of the proposed site. Due to the arid nature of the greater study area, this has resulted in the colonisation of the area by several bird species which are not commonly found in the area.

Species density was noted to be much higher during the drier months and much less during the wet months. In consultation with Birdlife South Africa it was determined that the site is not important at a local or regional scale due to the level of contamination that is present. The sewage water is not favourable for the bird species and is likely to result in long term effects on the bird species.

The loss of this habitat is thus not considered to be a negative impact but rather a positive one which will remove the contaminated water.

Suitable surrounding habitat is available for the bird species to move into and the dispersal of species noted during the wet season during this assessment indicates that suitable habitat exists for these species in the region.

8.1.11 Potential Impacts of the Proposed Development During Operation

No significant impacts on vegetation and habitat are expected during the operation phase of the proposed development, as long as rehabilitation of the impacted surrounding areas has taken place.

- Bird Collisions

Collisions pertaining to electrical infrastructure are a major concern with regards to birds. Through the consultation process and through limited research of such projects, it has been ascertained that birds can mistake PV panels for water from a distance resulting in their death. Currently the research has focused on Concentrated Solar Power Plants and not on PV panels. The subject has however not been studied to the extent that the impact can be quantified. Further research is required in this regard.

In addition, the risk of colliding with the overhead power lines is an associated risk. Birds often do not visualise the power lines, particularly the earth wire and hence collide with them resulting in their death. Larger species are particularly at risk such as the Kori Bustard, Blue Crane etc.

The evaporation ponds associated with the CSP plant also pose a risk to bird species as they could attract birds which would increase their risk of collision if they are gathering around the plant.

- Electrocution

Birds get electrocuted on power lines when a bird perches on electrical structure and causes an electrical short circuit by bridging the gap between live components and/or live and earthed components (van Rooyen 2004). Given the flat landscape, birds often use power lines as vantage points. Suitable mitigation measures can however be implemented to reduce this impact and discourage perching on the power lines.

- Bird impacts on power line infrastructure

Birds can also affect the functioning of electrical infrastructure as a result of bird streamers and nesting activity. The Northern Cape is known for the characteristic sociable weavers which nest on the telephone poles and other tall infrastructure. No sociable weavers nests were noted in close proximity to the study area or near De aar. However regular checks for these species must be undertaken on the electrical infrastructure associated with the plants.

Bird guards will need to be installed to ensure that birds do not roost on the towers and affect the conductors through streamers.

Should renovations/ maintenance of the power plants be undertaken, the impacts associated with the disturbance of the vegetation would be much the same as the impacts listed here for the construction phase. Mitigation measures mentioned below for the operational phase would reduce these impacts associated with vegetation removal during renovations/ maintenance and result in the unlikelihood of their occurrence.

8.2 Surface Water

The full surface water assessment is included as Appendix 6B.

8.2.1 Desktop Delineated Wetlands

Figure 30 depicts the occurrence of wetlands for the greater study area as per information drawn from the NFEPA database. This database is the most comprehensive and updated database as far as surface water features are concerned for the country and best reflects the occurrence of surface water features. In terms of the database, no wetlands occur on site. Wetlands can be identified in the surrounding areas which are classified as being flat, channeled and un-channeled valley bottom wetlands.

One river can be identified to the north of the site. The river to the North is identified as the Brak River which is indicated as being ephemeral in nature. Significantly, according to the database, the present ecological condition that was recorded in 1999 classified the river system as a Class B system that represents a river system in a largely natural state. The specific reach number that traverses the northern border of the study site is D6.

According to the satellite imagery (Google™), it is apparent that a stream flows south of the site in the south western corner. Moreover, it is apparent that wetland areas occur to the north of the site. With respect to the stream to the south of the site, this system eventually links up with the Brak River to the north making it a tributary of the Brak River. Meanwhile, the areas of suspected wetlands in the northern part of the study site are moderately sized in relation to the size of the study area and may have an influence on the proposed development. However, the field assessment will need to verify this.

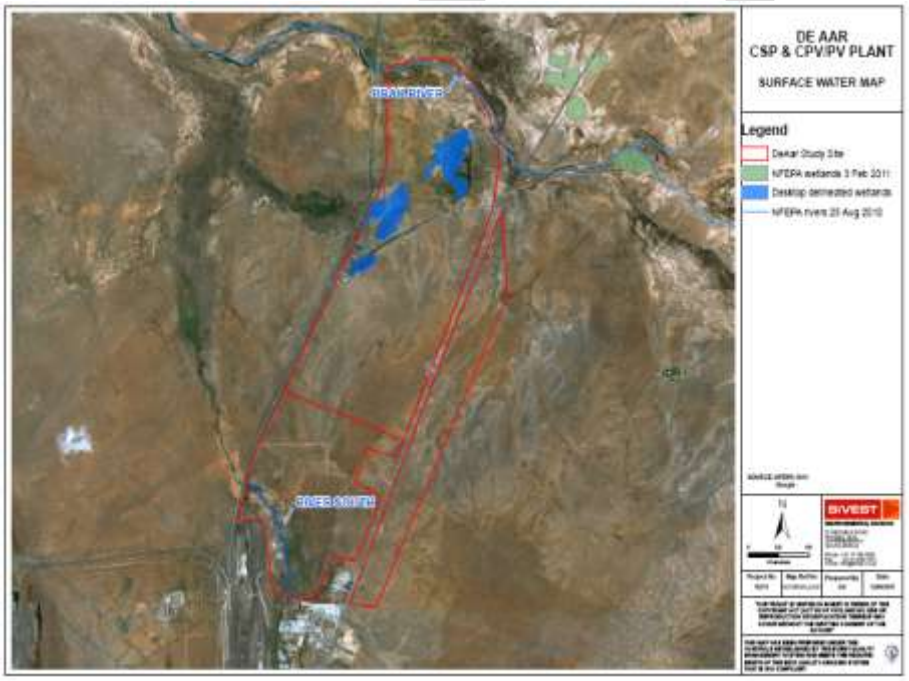

Figure 30. Desktop study of surface water features in and around the study area.

8.2.2 Field-assessed Rivers and Wetlands

The field component of the river and wetland assessment took place on from the 16th to the 18th of March 2011. The field assessment verified the presence of an extensive artificial wetland system to the north of the study site, the Brak river to the north, and a stream to the south of the study area. Each is assessed below. (Figure 31) represents an illustration of the findings.

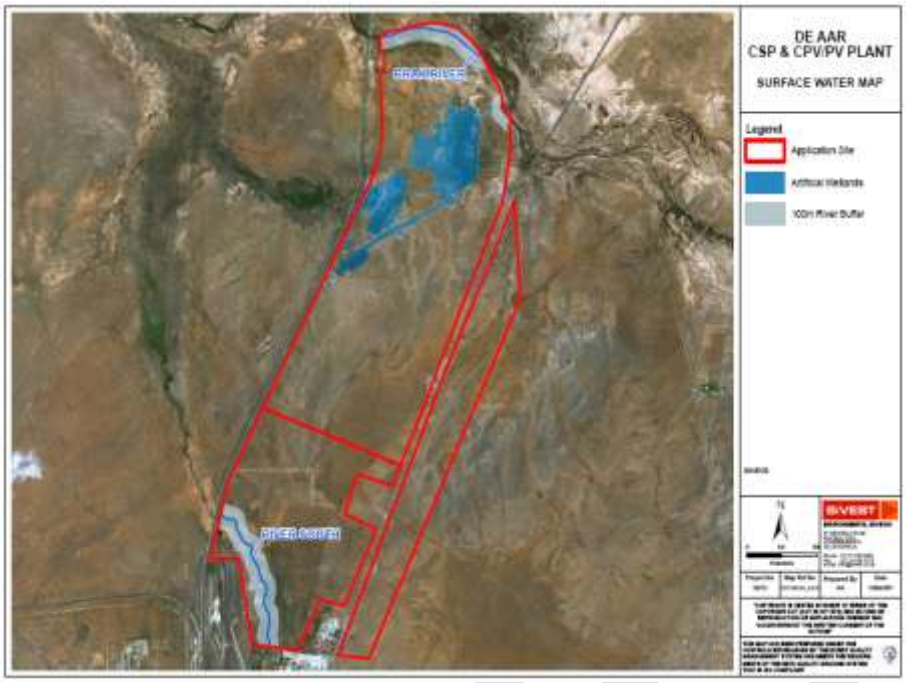

Figure 31. Field assessed streams and wetlands of the study site with applicable buffer zones.

- Artificial Wetland Terrain and Soils

Table 18**:** Photographic evidence of the wetland field assessment.

	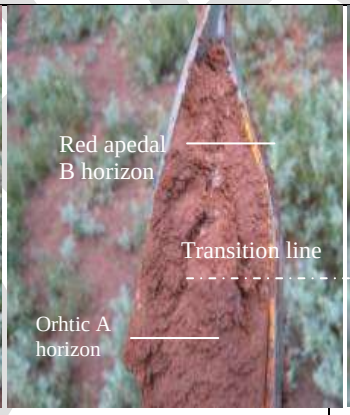	
Photo 1. Top 30cm profile of a soil sample drawn outside but nearby the artificial wetland.	Photo 2. Example of transition from orthic A horizon to red apedal B horizon.	Photo 3. Example of carbonate precipitation in the transition from the red apedal B into the soft carbonate horizon.

		
Photo 4. Top 30cm profile of a soil sample drawn from within the artificial wetland.	Photo 5. Bleached E horizon showing evidence of the removal of colloidal matter in the soils.	Photo 6. Flat terrain of the artificial wetland.
		
Photo 7. Sewage Municipal Works.	Photo 8. Water emanating from the sewage municipal works.	Photo 9. Water pipeline transporting water into landscape.
		
Photo 10. Water from pipe flowing out into shallow drainage ditches.	Photo 11. Surface water accumulation on study site in artificial wetland.	Photo 12. Example of drainage channel found beyond the sewage treatment works in the artificial wetland.

		
Photo 13. Common reed (*P. australis*) found in the artificial wetland.	Photo 14. Bulrush (*T. capensis*) found in the artificial wetland.	Photo 15. Bahia grass (*P. notatum*) found in the artificial wetland.
		
Photo 16. Black ironbark (*E. sideroxylon*) found in the artificial wetland.	Photo 17. Grey poplar trees (*P. X canescens*) found in the artificial wetland.	Photo 18. Typical vegetation community found near open surface water.

Table 18 provides photographic evidence of the field wetland assessment.

In accordance with the DWAF (2005) methodology, detailed wetland delineations were conducted taking into account all indicators. In terms of the terrain associated with the supposed wetland, the general topography can be described as predominantly flat, but sloping very gently to the north (Photo 6). Random soil samples were drawn from around the edges and within the supposed wetland. The soils drawn at the edge of the artificial wetland expressed soils that were mainly sandy in structure and red in colour. The topsoil profile of these samples can be described as an orthic A horizon (Photo 1). The underlying layer can be associated with a red apedal B horizon as the soil particles in this layer indicate weakly structured materials that embrace the kind of weathering that takes place in a well drained oxidised environment to produce coatings of iron oxides on individual soil particles (McVicar *et al*. 2006) (Photo 2). Underlying this layer, another horizon is prominent expressing similar characteristics as the red apedal B, although containing carbonate precipitates indicating that this layer can be distinguished from the layer above. Hence, this horizon is more representative of a soft

carbonate horizon (Photo 3). Combining the soil horizons one may assume that the soil profile suggests the Kimberley soil form.

The soils samples drawn from within the wetland differed markedly from the soils at the edge of the supposed wetland. The topsoil could be described once again as an orthic A horizon (Photo 4), whilst the underlying layers lack the characteristic red colour of the soils around the edges of the supposed wetland and typically express soils that represent a marked removal of colloidal matter (iron oxides, silicate clay and organic matter) as evidenced by a comparison of its properties with those of the overlying horizons (McVicar *et al*. 2006) (Photo 5). This type of soil horizon can be referred to as an E horizon. Together the soil horizons could be said to indicate the Fernwood soil form.

Importantly, in addition to the above, it must be mentioned that field observations revealed that water emanating from a municipal sewage works plant in the northern part of the site appeared to be the primary source of water supply to the otherwise drier landscape (Photos 7 to 12). Pipelines presumably originating from the municipal works route out from the plant itself into the landscape some distance beyond the plant into an open network of shallow drainage ditches. The separate wetlands identified at the desktop level were identified on site but were observed to as being interconnected and one entire system. Given the supply of water, it is possible for open areas of water to accumulate on the type of soils of the study site, as long as flow is maintained. Under these conditions, wetland vegetation can establish over areas of the landscape that are anthropogenically supplied with water creating an artificial wetland which was observed to be the case with the wetland under study. Although, this wastewater did not appear to be directly flowing into the Brak River to the north, the discharge of significant amounts of water into a wider area characterised by freely-draining soils raises a strong possibility of this effluent water seeping into the nearby Brak River. Furthermore, with characteristic sporadic and heavy rainfall in the area (albeit restricted to the rainy season) the possibility of overland flow from the artificial wetland directly into the Brak River is high, considering the relatively limited amount of ground cover between the river and the wetland.

In light of the evidence provided above, it is apparent that the wetland of the northern area of the study site is artificial. It is therefore not a natural occurring wetland. In the context of the development, the artificial wetland is being maintained by polluted water, thereby impacting on the naturally occurring hydrological systems in the immediate area (i.e. the Brak River). The artificial wetland therefore constitutes an anthropogenic impact to the landscape and its sub-components. The wetland will not require a buffer zone. In contrast remediation measures will be required to rehabilitate the natural state of the environment.

- Artificial Wetland Vegetation

Given the prevailing climate and the fact that the soils of the area generally express free drainage, it is commonsensical that the surface water resources of the study area would be seasonal or intermittent at least. In this context, the occurrence of surface water in the northern part of the site is unusual. The presence of large areas of surface water in this part of the site is primarily due to the discharge of wastewater into this area. The permanent presence of this water has resulted in the establishment of hydrophytic vegetation typically associated with streams and wetlands. Vigorous growth of vegetation

associated with overland water flow has produced what can be termed as an artificial wetland area dominated by typical wetland obligate vegetation. It must be stressed that this surface water is not naturally-occurring. The obligate vegetation species identified mainly include common reed (*Phragmites australis* – Photo 13) and bulrush (*Typha capensis* – Photo 14). Dominant grass species communities comprised bahia grass (*Paspalum notatum* – Photo 15). Alien tree species also exploited the artificial water supply and dense stands of black or red ironbark (*Eucalyptus sideroxylon* - Photo 16) and grey poplar trees (*Populus X canescens* - Photo 17) were present. Photo 18 illustrates the occurrence of a typical community within the artificial wetland.

- Brak River Characteristics

Table 19 contains the photographic evidence of the Brak River assessment.

The Brak River (Photo 19) is a non-perennial river which is a tributary of the Orange River and is significant as such. At the time of the field assessment, the river was in flow. The channel structure of the Brak River is relatively incised near the banks. The width of the Brak River is relatively wide (approximately 10 to 30 metres). Vegetation cover spanned the width of the channel comprising predominantly of common reed (*P. australis* – Photo 20). The adjacent land to the Brak River consisted of mainly shrub species. A distinct riparian zone was therefore not discernible. Nonetheless, the boundaries of river systems in South Africa maintain crucial links with the terrestrial environment and need protection. A buffer zone of 100metres has been applied to this river system based on the field assessment and taking into consideration the information pertaining to the state of the river (Class B: Largely natural) provided by the NFEPA database.

- Southern Stream Characteristics

Table 19 contains the photographic evidence of the stream assessment of the Brak River tributary south of the site.

The stream south of the study site is non-perennial. The channel structure of the stream entering the southern boundary is relatively broad and grades gently into the landscape (Photo 21). At this section of the stream, a thin band along the bank of the stream could be identified as a riparian zone comprising small trees and shrubs. As the stream exits the study site to the south west, it is steep at the banks making a sharp transition between the adjacent upland terrestrial area (Photo 22). Here, a distinct riparian zone is not evident making the transition between terrestrial land and the stream sharp. Where the banks of the stream become steep, the erosive characteristics of the stream are evident. Here the soil profile can be seen.

The vegetation characterising the stream, trees and shrubs aside, were mainly in the forms of various grasses. Commonly, mats of couch grass (*Cynodon dactylon*) extended from the riparian zones into the stream itself. Rescue grass (*Bromus catharticus*) was also prevalent along the stream banks (Photo 23). Certain rushes were observed as well (Photo 24). Overall, the stream system was relatively diverse. Given its linkage to the Brak River and the importance of maintaining the quality of the system as a whole, a buffer zone of 100 metres has been applied.

Table 19: Photographic evidence of the stream assessment of the Brak River and the Brak River tributary stream south of the site.

		
Photo 19. Channel structure of the Brak River.	Photo 20. Common reed (*P. australis*) in the Brak River.	Photo 21. Southern stream channel structure.
		
Photo 22. Section of the southern stream where the banks become steep.	Photo 23. Vegetation in and along the southern stream. Rescue grass (*B. catharticus)* in the foreground, couch grass (*Cynodon dactylon*) in the background in the river.	Photo 24. Rush species along the stream active channel.

8.2.3 State and Functionality of Rivers and Wetlands Assessed

Minor activities noted to have been taking place on the study site were commonly in the form of cattle, goat and sheep pastoral grazing. A road extended into the southern stream. Major impacts (to the Brak River) however, related to the effluent stemming from the municipal sewage works on the study site. Importantly, although the waste water provides a water source to the landscape providing for an artificial wetland system that in itself acts as a water source and provides habitat to organisms in the area, it is not naturally occurring and therefore constitutes an anthropogenic impact to the study site. No other impacts were observed to have a notable impact on the surface water features of the site. Table 20 summarises the current impacts, condition and functions of each river only and not the wetland assessed since it is viewed as an impact to the study site. Overall, each stream can be said to

be in a moderate to moderate to good condition based on the physical characteristics. The state and quality of the water of the hydrological systems are beyond the scope of this assessment.

Table 20: Functional state of the rivers assessed in the field.

Wetland	Condition	Primary Functions
Brak River	Moderate to good – Current impacts include minor grazing and trampling impacts. Although, dominance of mono-specific stands of common reed.	Habitat, biogeochemical cycling, sediment trapping, flood attenuation, vegetation provides food source for resident herbivores (sheep and cattle).
Southern Stream	Moderate – Current impacts include limited grazing and trampling impacts. Disturbance of vegetation. Roads extending into the stream.	Habitat, biogeochemical cycling, sediment trapping, flood attenuation, vegetation provides food source for resident herbivores (sheep and cattle).

8.2.4 Nature of the Potential Impacts associated with the Proposed Development during construction

There are a number of different types of impacts that may be associated with the proposed development. These impacts are rated in the impact rating table below. The determination of the effect of an environmental impact on an environmental parameter (in this instance, rivers) is determined through a systematic analysis of the various components of the impact. This is undertaken using information that is available to the environmental practitioner through the process of the environmental impact assessment. The impact evaluation of predicted impacts was undertaken through an assessment of the significance of the impacts.

- Inappropriate construction activities

This umbrella term broadly encompasses activities such as (but not limited to) physical destruction of rivers and streams caused by humans, excavation and degradation of rivers and streams by construction machinery, use of rivers and streams for sanitary facilities and ablutions, construction of access roads through rivers and streams and lastly, dumping of materials and litter into wetlands. The simple prevention of such inappropriate activities can be achieved by limiting access to rivers and restricting construction activities within the proposed development areas. The impact rating below takes these factors into account.

- Construction pollution risks

Construction activities make use of fuels, oils, and other soluble substances (cement) which are necessary for the operation vehicles and in order to produce building materials. These liquids in addition to human feacal and urine waste pose a pollution risk to nearby rivers which can impact on

the water and sediment quality of these sensitive systems. Mitigation measures that prevent these substances entering the river systems will be necessary during the construction phase.

- Clearing vast areas of vegetation

Vegetation cover provides soils with stabilization. The roots of vegetation prevent soils from being eroded away via wind or water run-off. The nature of the proposed development will require that vast areas of vegetation will need to be cleared for the CSP plants. When left exposed, soils may potentially be eroded away and the onset of erosion can begin. Erosion in arid climates, such as in De Aar can be difficult to rehabilitate since vegetation might not establish very quickly due to the general lack of water supply. The eroded areas can therefore extend into the rivers near the proposed construction areas. Moreover, once vegetation has been cleared, any run-off generated can initiate erosion that may equally extent into the wetland areas. Several mitigation measures will be required to prevent such impacts.

- Wastewater pollution into nearby river systems

The release of pollution from the municipal sewage works is causing environmental pollution not only on the site itself but in to nearby river systems (Brak river and tributary south of the site leading into the Brak River – affected further north between the southern stream found on site and its confluence with the Brak River). The cumulative effect is that pollution is being supplied to the system in the local area and therefore, is impacting on areas around the site. It is imperative that the wastewater treatment plant cease with the release of effluent into the river systems on site. Where this impact is mitigated in the construction phase, the remediation process can begin with the rehabilitation of land that currently operates as an artificial wetland. Ultimately, a rehabilitation plan will be required. Firstly, it is critical that effluent outflow into the environment is ceased. Secondly, a rehabilitation plan for the area currently known as artificial wetland will need to be designed and implemented. In depth studies pertaining to the current state and quality of sediment affected by the effluent release will be required in order for specific rehabilitation measures to be designed. Additionally, a vegetation rehabilitation plan will be needed to remove all exotic vegetation and to re-instate natural vegetation once the properties of the soil have been re-stabilized. The importance of the mitigation of the current impact is emphasized in light of the overall health of the Brak River. As indicated, the last study conducted on the river reported that system was in a largely natural state. Continuation of this impact can negatively affect that state of the river. It is crucial that degradation of the river systems in South Africa is prevented. Here an opportunity exists to improve the health of the Brak River system.

8.2.5 Nature of the Potential Impacts associated with the Proposed Development during operation

- Stormwater run-off

The impact of stormwater run-off is associated with the types of structures and surfaces that will need to be established for the proposed development. Hard impermeable surfaces and foundations are to be laid over the extent of the proposed development areas to facilitate the CSP and CPV/PV

structures (CSP and CPV/PV plants, substations etc.). Flat and hard surfaces aid the acceleration and generation of run-off which can impact on nearby hydrological systems through the onset of erosion at the interface between the proposed development and the hydrological systems. Please refer to Appendix 6F for the stormwater management plan that has been compiled for the site.

- Oil pollution risks to rivers

Pollution risks that are associated with the proposed development centre on the leakage and spillage of oils from both the transducers of the substations and those of the CSP solar fields.

In terms of the oil spillage from the transducers, if oil were to leave the substation site it could be transported by stormwater into the adjacent river systems, thus polluting not only the water but the soils as well causing possible groundwater and soil contamination in addition to water quality impairment.

The CSP solar field, including the troughs and the associated piping, contains a synthetic oil, typically Therminol (VP-1). The toxicity associated with therminol and the presence of hydrocarbons in its makeup makes it an environmental pollutant. Due to its form as a liquid, therminol, if spilled, could seep in to the ground underneath the solar field, potentially interacting with any shallow groundwater, thus potentially causing soil and groundwater pollution. If transported by runoff, therminol could enter into any wetlands adjacent to the solar field, thus causing damage to the resource and any associated biota. For these reasons, therminol is associated with significant environmental risk and potential impact and strict mitigation measures will need to be identified in its use in the solar field.

- Wastewater pollution risks to nearby rivers

Evaporation ponds are proposed to be located adjacent to the solar field to receive waste water. This waste water is likely to be polluted. If these evaporation ponds are improperly sealed, or overflows, the waste water could seep into the ground and potentially interact with groundwater, becoming a groundwater pollutant to nearby rivers. If the wastewater were to overflow or leak at the surface, the waste water could directly pollute nearby rivers. It is therefore crucial that evaporation ponds are adequately maintained and regularly checked.

8.3 Groundwater

The full groundwater assessment is included as Appendix 6C.

8.3.1 Water sampling

The site was visited by a team from Metago Environmental Engineers in early February 2011, and a total of five water samples were taken (Table 21).

Table 21: Water samples taken at De Aar

Point	Site	Latitude	Longitude	water use type	water level (mbgl)	EC (mS/m)	pH	Sample taken?
De Aar 1	De Aar	024.01'39.3"	30.36'24.7"	BH	4,2	-	-	No
De Aar 2	De Aar	024.03'20.7"	30.36'19.8"	BH	-	-	-	No
De Aar2 sampling point	De Aar	024.02'24.8"	30.36'02.1"	Reservoir, water from point above	-	1080	7,6	Yes
De Aar sewage outflow	De Aar	024.01'38.3"	30.36'17.7	Sewage outflow	-	1490	8,2	Yes
De Aar sewage inflow	De Aar	024.01'27.8"	30.36'22.5"	Sewage inflow	-	1630	7,8	Yes
De Aar 3	De Aar	x-3168669	y-0022313	BH	3	-	-	No
De Aar4	De Aar	024.00'42.8"	30.35'17.2"	BH	2,19	-	-	Yes
De Aar 5	De Aar	024.01'30.5"	30.37'24.6"	BH	13,94	-	-	No
De Aar 6	De Aar	024.01'30.5"	30.37'34.6"	BH	7,63	870	7,4	Yes
De Aar7	De Aar	024.03'25.7"	30.35'08.4"	BH	-	-	-	No

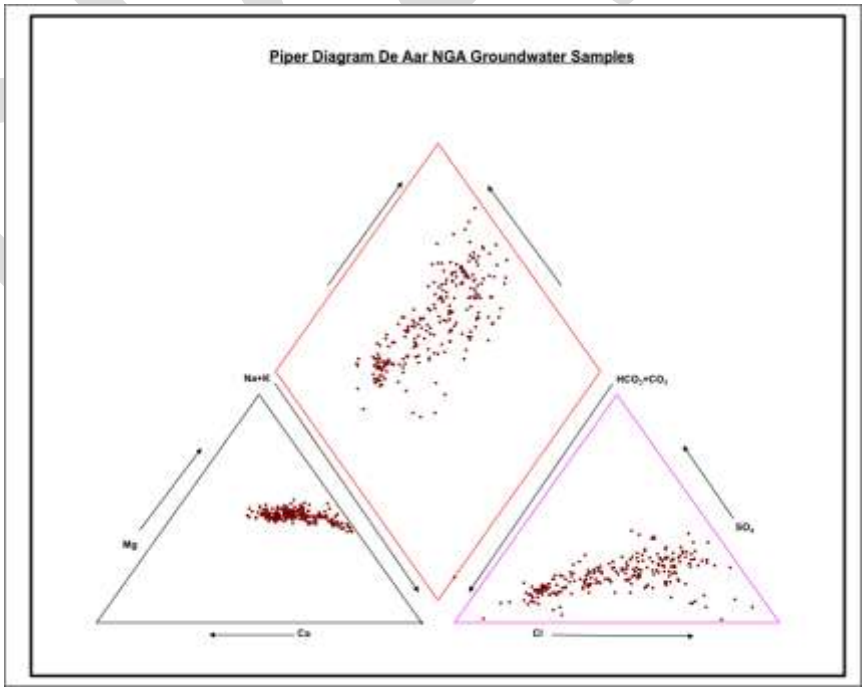

Figure 32: Trilinearplot of groundwater samples for the De Aar area

According to the water sample results (major constituents, and an ICP scan). The pH values and total dissolved solids (TDS) are within SANS 241 recommended limits for a Class 1 Water (SANS, 2006), apart from sample DA4 that has a TDS value of 1826 mg/L. The chloride ion concentration for sample DA4 (449 mg/L) is also outside of the SANS Class 1 guideline value of < 200 mg/L. The effect of water treatment at the De Aar treatment works can be seen by comparing sample 2148 (De Aar Inflow) with sample 249 (De Aar Outflow) – reductions in suspended solids, turbidity, biological and chemical oxygen demand, and other constituents. In terms of minor constituents (ICP scan), the only element that appears to exceed SANS 241 guidelines is aluminium (Al) in samples KMS2, DA6, and De Aar inflow.

Table 22: Water sample analysis results

Analyses in mg/ℓ (Unless specified otherwise)	**Sample Identification**					
	KMS 02	DA 2	DA 4	DA 6	De Aar Inflow	De Aar Outflow
Sample Number	2144	2145	2146	2147	2148	2149
pH – Value at 25°C	7.0	7.9	7.5	7.5	7.3	7.6
Electrical Conductivity in mS/m at 25°C	20.2	115	278	97.1	191	178
Total Dissolved Solids at 180°C *	354	820	1 826	672	974	886
Suspended Solids at 105°C *	91	1.0	3.0	147	234	52
Turbidity in N.T.U	267	0.6	1.4	70	157	44
Free Residual Chlorine as Cl_2 *	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Bicarbonate as HCO_3 *	98	522	492	293	878	741
Chloride as Cl *	17	76	449	128	170	164
Sulphate as SO_4	15	84	318	83	91	86
Nitrate as N *	<0.2	6.7	0.3	8.3	<0.2	<0.2
Total Organic Carbon as C [s]	13	8.3	5.5	5.0	28	11
Biochemical Oxygen Demand as O_2 *	<10	<10	<10	<10	318	69
Chemical Oxygen Demand as O_2 (Total) *	49	<10	36	16	437	178
Free & Saline Ammonia as N *	<0.2	<0.2	<0.2	<0.2	54	42
% Balancing	97.4	96.3	99.4	97.1	95.3	96.1

8.3.2 Potential Impacts during Construction and Decommissioning

Potential impacts on groundwater during the construction and decommissioning phases include the following:

- Deterioration of groundwater quality, potentially due to the following:
  - Spillage of hydrocarbons (e.g. fuels), or other liquid contaminants (e.g. Therminol).
  - Leaching of temporary material stockpiles and waste dumps.
  - Removal of soil cover, allowing rapid migration of surface contaminants into the sub-surface.

8.3.3 Potential Impacts during Operation

Potential impacts on groundwater during the operational phase include the following:

- Deterioration of groundwater quality, potentially due to the following:
  - Spillage of hydrocarbons (e.g. fuels), or other liquid contaminants (e.g. Therminol).
  - Leaching from stockpiled solid materials (e.g. salt used for heat storage).
  - Disposal of solid waste at the site.
  - Disposal of wastewater (including sewage) at the site.
- Lowering of the water table in the vicinity of the site, since the volume of municipal wastewater disposed off to the site may change. Note that "artificial" mounding of groundwater in the area is already likely to have taken place, as a consequence of the disposal of treated wastewater to land.

8.4 Noise

The full noise assessment is included as Appendix 6D.

8.4.1 Noise measurements

The noise measurement samples were taken in accordance with the procedures specified in SANS 10103. The measurement parameter was the A-weighted equivalent sound pressure level, (L_{Aeq}), and each measurement sample had a duration of approximately 15 minutes. This was deemed to be sufficiently representative of the temporal characteristics of the ambient noise at each measurement point.

During each measurement notes were taken of the subjective impressions of the sources that contributed to the measured ambient noise level.

8.4.2 Sample calculations

The typical sound power emission levels of the equipment given in Table 23 were used to calculate the A-weighted sound pressure level, LPA, as a function of distance from the source, assuming all the equipment to be concentrated at one point. This is, of course, a considerable exaggeration, but it does allow an indication of the worst possible scenario.

Table 23: Equipment Noise Emissions (as provided by Mainstream)

Equipment Description	Sound power level, dB re 1 pW, at octave band centre frequency, Hz									dBA
	32.5	63	125	250	500	1000	2000	4000	8000	
Steam Generator (enclosed)	86	86	85	82	84	83	82	78	70	85
Boiler Feed Pumps	85	87	90	91	92	88	83	84	80	92

Heat Transfer Fluid Pumps	86	87	90	91	92	89	85	86	80	92
Circulating Water Pumps	85	97	90	91	92	87	83	85	80	90
Start-Up Boiler (inlet attenuated)	85	85	86	87	85	83	80	78	70	85
Cooling Tower	121	122	121	118	114	112	108	109	107	118

The noise propagation was calculated in accordance with the procedures specified in SANS 10357:2004 *'The calculation of sound propagation by the Concawe method'* assuming an average temperature of 25 °C, relative humidity of 40%, barometric air pressure of 95 kPa and neutral atmospheric conditions.

The results were projected onto the assumed baseline ambient noise level and presented as a graph of the resulting ambient noise level as a function of distance from the source.

8.4.3 Assessment of the measurement results

The results of the noise measurements were assessed in terms of the guidelines provided in SANS 10103.

8.4.4 Noise study results

- Description of the site environment

The topography of the terrain is mostly flat, and there will be no acoustical screening by natural obstacles between the noise sources and potential noise sensitive receivers.

The ground conditions are described as sandy with knee-high grass and shrubs. This will provide some absorption of noise energy as it propagates from source to receiver and a 'soft ground' factor of 50% was used for calculating noise propagation at this site.

The closest noise sensitive receptor at the De Aar site is the De Aar Juvenile Secure Care facility (location point on map labelled De Aar058). Construction of this facility was completed recently although it has apparently not yet been taken into service. It is understood that this facility is an institution which will house young people awaiting trial, who are in the custody of the Department of Social Development. This facility lies adjacent to the planned PV area and about 300m from the closest point of the planned CSP area.

- De Aar noise measurement results

The results of the ambient noise level measurements at De Aar are presented in Table 24

Table 24: De Aar noise measurement results

Measuring point	L_{Aeq} (15 min) dBA	Comments
De Aar050	31.9 (Night)	Alongside R48 road. Night time. Distant insects and frogs audible.
De Aar050	38.4 (Day)	Alongside R48 road. Day time. Rustling vegetation and distant vehicle audible.
De Aar51	35.1 (Night)	Alongside R48 road. Night time. Distant insects and frogs audible.
De Aar51	56.6 (Day)	Alongside R48 road. Day time. Vehicle passing 30m away.
De Aar52	36.5 (Night)	Alongside R48 road. Night time. Rustling vegetation.
De Aar52	57.4 (Day)	Alongside R48 road. Day time. Vehicle passing 30m away.
De Aar58	37.8 (Night)	Alongside R48 road, at turnoff to Juvenile Secure Care Centre. Night time. Insects and frogs audible.
De Aar58	62.4 (Day)	Alongside R48 road, at turnoff to Juvenile Secure Care Centre. Day time. Vehicles passing 30m away.
De Aar53	38.7 (Night)	Alongside R48 road, opposite industrial area (abbatoir), Night time.
De Aar53	57.0 (Day)	Alongside R48 road, opposite industrial area (abbatoir), Day time. Vehicles passing.
De Aar54	45.9 (Night)	Off R48 Road, near road tunnel, in industrial area opposite WP Engineering Works. Night time. Cars passing.
De Aar54	57.0 (Day)	Off R48 Road, near road tunnel, in industrial area opposite WP Engineering Works. Day time. Cars and lorries passing.
De Aar55	46.5 (Night)	In De Aar residential area. Corner Celliers and Hoop Streets. Night time. Distant music and vehicle traffic.
De Aar55	50.8 (Day)	In De Aar residential area. Corner Celliers and Hoop Streets. Day time. Vehicle traffic.
De Aar57	50.6 (Day)	Sewage plant, machinery off
De Aar57	77.1 (Day)	Sewage plant pump running
De Aar57	99.3 (Day)	Sewage plant pump running, valve open
De Aar59	32.7	

The interpretation of the results given in Table 24 show that:

- The ambient noise levels vary from a night time low of 31.0dBA to a daytime high of 62.4 dBA. At the sewage processing plant, with no machinery running, the level was 50.6 dBA and with machinery operational, increased to a high of 99.3 dBA.

- Estimated general ambient noise level

For the purpose of calculations it is suggested that a general baseline ambient noise level of 31dBA be accepted. This value is 0.9 dBA below the lowest measured value of 31.9 dBA measured at location DeAar050 and conforms with a conservative approach of recognising that the area under investigation is mostly rural in nature, has few human sounds, and is therefore usually quite quiet.

- Sample calculation results

The sample calculation results are given in (Figure 33).

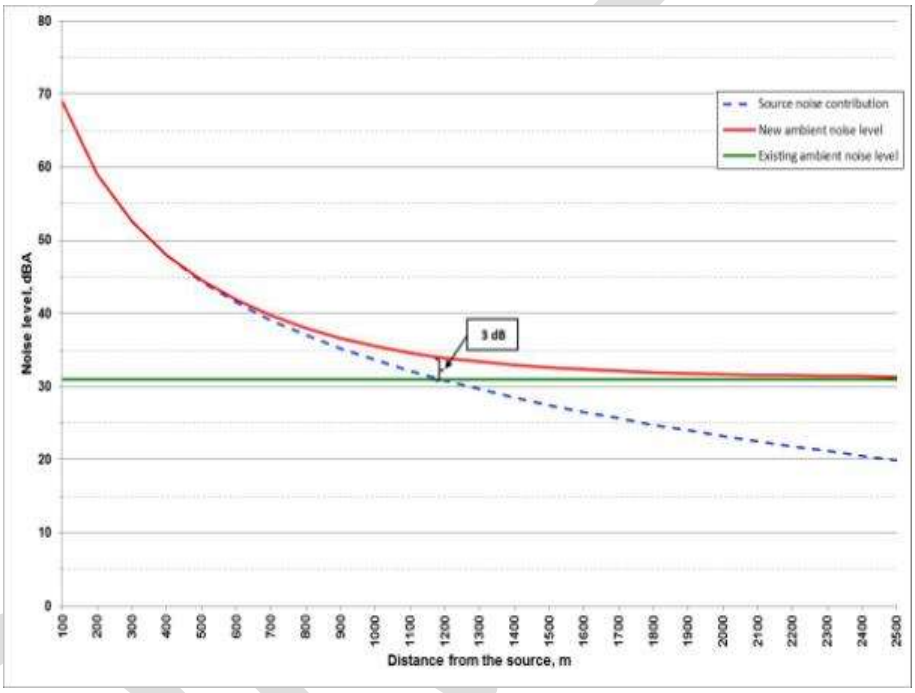

Figure 33: Graph of the calculated noise levels as a function of distance from the source.

The results in Figure 33 show that, given the assumptions described in Section 6.7.3 of the Specialist Visual Report, the increase in ambient noise level will exceed 3 dB, i.e. become significant, at distances closer than 1 200 m from the source.

Further analysis of the results has shown that the cooling tower provides by far the greatest noise contribution to the noise level at any specific point.

8.4.5 Expected noise sources during construction phase

The noise emission levels during the construction of a CSP would be similar to those for a conventional power plant of the same scale (in the case of De Aar, about 100MW). Since detailed schedules and working hours have not been made available, it may be assumed that construction activities will only take place during the hours of daylight, i.e. approximately between 06:00 and 18:00.

The main sources of noise during construction will be:

- Diesel powered earthmoving equipment used for the clearing and levelling of the terrain.
- The compacting of soil and construction of the platforms at building sites.
- General construction noise caused by activities that cannot be placed into a specific category.
- The transport of materials to the site.

8.4.6 Expected noise sources during operational phase

At the time of this study the operational processes and equipment have not finally been decided upon. For instance, the alternatives for the condenser which will be used, i.e. cooling towers or a totally enclosed system, are still being considered. However, the developer has provided the noise emission levels of typical key equipment installed at a CSP (Table 25).

During the operational phase the equipment is expected to operate continuously and produce steady noise emissions for most of the time. Periodic short-term noise level increases can occur during plant start-up or shutdown, during load transitions, or during opening of steam relief valves to vent pressure.

Table 25: Equipment Noise Emissions (as provided by Mainstream)

Equipment Description	**Sound power level, dB re 1 pW, at octave band centre frequency, Hz**									**dBA**
	32.5	63	125	250	500	1000	2000	4000	8000	
Steam Generator (enclosed)	86	86	85	82	84	83	82	78	70	85
Boiler Feed Pumps	85	87	90	91	92	88	83	84	80	92
Heat Transfer Fluid Pumps	86	87	90	91	92	89	85	86	80	92
Circulating Water Pumps	85	97	90	91	92	87	83	85	80	90
Start-Up Boiler (inlet attenuated)	85	85	86	87	85	83	80	78	70	85
Cooling Tower	121	122	121	118	114	112	108	109	107	118

8.5 Visual

The full visual assessment is included as Appendix 6E.

8.5.1 Visual Receptors

For the purpose of this report, a sensitive receptor is defined as a receptor which would potentially be adversely impacted by the proposed development. This takes into account a subjective factor on behalf of the viewer – i.e. whether the viewer would consider the impact as a negative impact. An adverse impact is often associated with the alteration of the visual character of the area in terms of the intrusion of a new development into a 'view', which may affect the 'sense of place'. Thus receptors of visual impacts in areas / landscapes where the current visual character of the environment is part of the appeal of an area, and thus has a socio-economic importance, are likely to be considered sensitive receptors.

A distinction must be made between receptor locations and sensitive receptor locations – receptor locations are locations from where the proposed solar power plant may be in view, but from where the receptor may not necessarily be adversely affected by any visual intrusion associated with the facility. Receptor locations include locations of commercial activities and certain movement corridors, such as roads that are not tourism routes. Sensitive receptor locations typically include locations of human habitation and tourism activities which are likely to be adversely impacted by the proposed project.

During the EIA Phase, it was confirmed that few potentially sensitive visual receptors are present within the study area (see Figure 34). This is mainly due to the limited human settlement within the immediate vicinity of the site, and the fact that De Aar does not display a high density of aesthetically-based tourism activities.

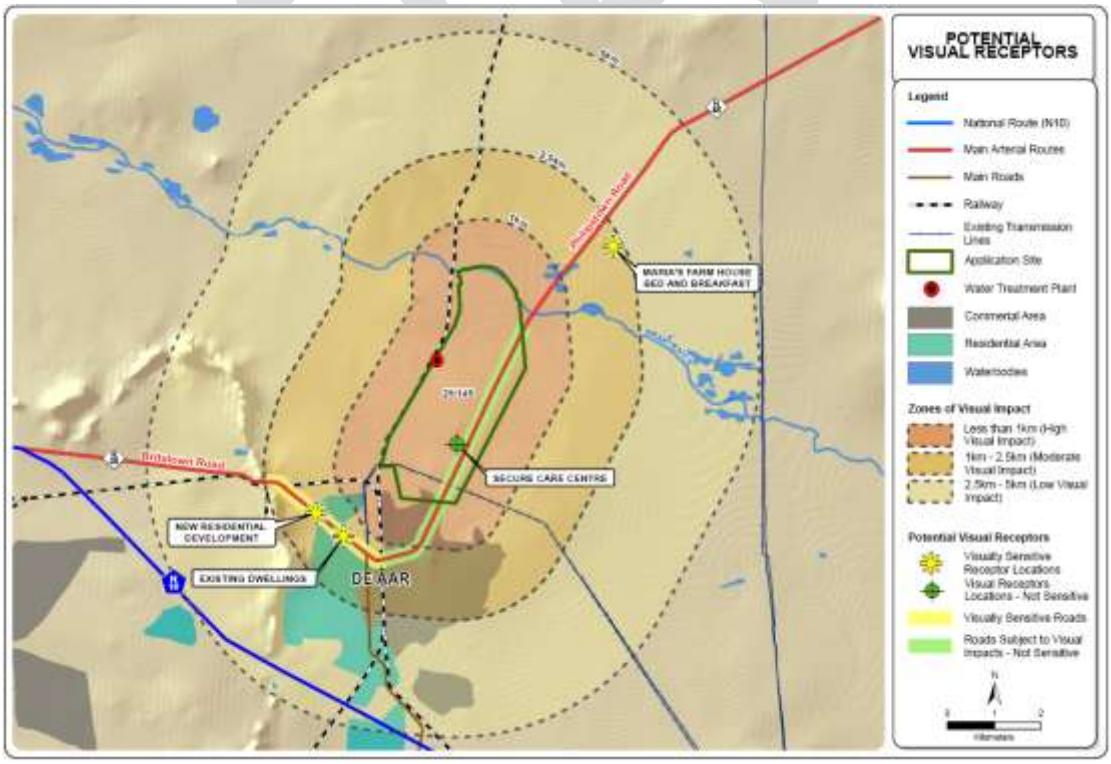

Figure 34: Visual Receptors within the study area

As depicted above, zones of visual impact have been assigned for the proposed project as the visibility of the solar energy facility will diminish exponentially over distance. Therefore the proposed solar energy facility will be more visible to receptors located within a zone of high visual impact and as a result these receptors will experience a higher adverse visual impact than those located in zones of moderate or low visual impact. All the potentially sensitive visual receptors are located within the zone of moderate visual impact and this was taken into account when rating the visual impact of the proposed project on sensitive receptors.

Based on the extensive height and scale of this project and the fact that visual exposure diminishes exponentially over distance, the radii chosen to assign the zones of visual impact are as follows:

- 0 – 1km (High Visual Impact)
- 1km – 2.5km (Moderate Visual Impact)
- 2.5km – 5km (Low Visual Impact)
- > 5km (Negligible Visual Impact)

The table below provides details of the visually sensitive receptors that were identified during the field investigation.

Table 26: Visually sensitive receptors in the study area

Name	Receptor Type	Primary Orientation	Zone of visual Impact
Maria's Farm House Bed and Breakfast	Accommodation facility	East (opposite direction of site)	Moderate Visual Impact
Exiting dwellings in De Aar	Homesteads	North-east (toward site)	Moderate Visual Impact
New residential development in De Aar	Future homesteads	North-east (toward site)	Moderate Visual Impact
Britstown road	Main arterial route	South-east / North-west (partially toward site)	Moderate Visual Impact

8.5.2 Receptor Roads

The R48 provincial road (Philipstown Road) is regarded as a receptor road where it traverses the site as most of the proposed solar energy facility will be visible from this section of road. People travelling along this road section will not necessarily be adversely affected by the visual intrusion of the solar energy facility, as this road does not form part of any major tourism routes and is mainly used by local farmers. This road passes through the industrial area in De Aar which has a visually degraded appearance and therefore motorists travelling along this section of road are likely to perceive the solar power plant as being visually compatible in this setting.

Where the R48 (Britstown road – link to the N10) passes the residential area to the north of De Aar until it reaches the hills to the west of the study area where it links up with the N10, it is regarded as a potentially sensitive section of road. The proposed solar power plant is likely to be visible to people travelling along this portion of road as the land slopes gradually down toward the study area from this point (see Figure 35). This would potentially be significant, as motorists heading east on the road (towards De Aar) come through a neck in the hills, with the first vista of the town and its environs occurring at this point. Travellers using this stretch of road will be potentially sensitive to visual impacts as it will typically be used to access the town from the N10 (a major regional route).

Figure 35: View from the R48 west of De Aar toward the application site

The visual impact from this receptor location will however be localised to a relatively short section of road, as the hills to the west of the study area will restrict the viewshed and prevent the proposed development from being viewable from the N10 (see Figure 36). As a result motorists travelling along this section of road experience a transient visual impact of the proposed solar energy facility.

Figure 36: View from the R48 showing how hills to the west of the site will restrict views of the proposed solar energy facility

8.5.3 Receptor Locations

Unlike roads, human settlements will be subject to permanent visual impacts if a proposed development is visible from them. The existing residential houses on the northern edge of De Aar located just to the south of the R48 are regarded as potentially sensitive visual receptors as they may be adversely impacted by the constant visual exposure of the proposed solar energy facility as these houses have a wide vista to the north of the town (see Figure 37). A new residential development is also proposed along the R48 to the north-west of these dwellings and is also regarded as a potentially sensitive visual receptor location as some of the houses in this development may have similar views of the proposed development.

Figure 37: Residential dwellings to the south of the R48

Extensive existing electrical infrastructure as well as isolated farmsteads and associated trees will however slightly obscure views of the study area from both the existing homesteads and the future development, which will reduce the potential visual impact of the proposed solar power plant. CPV/PV panels are proposed in the southern part of the application site and these would be the most visible to dwellings along the R48.

Maria's Farm House Bed and Breakfast is located off the R48 / Philipstown road approximately 2km to the north-east of the application site boundary. It is expected that this facility will to some extent rely on the natural untransformed quality of the area to attract visitors / guests and therefore introducing a solar power plant may potentially have negative visual impact on the Bed and Breakfast. Although it is regarded as a sensitive visual receptor, the guest house is oriented in the opposite direction of the proposed site, and therefore the proposed solar energy facility will not have a significant negative impact on it as it is orientated away from the proposed site. The visual impact of the solar energy facility on the Bed and Breakfast will be further reduced by isolated trees that will partially obscure visibility of the proposed solar energy facility from the entrance road to the facility (see Figure 39).

Figure 38: View from Maria's Farm House B&B access road toward the application site

The proposed solar energy facility will be highly visible from the new Secure Care Centre as it is located within a zone of high visual impact. The centre is not regarded to be visually sensitive as it is used to house young people who are in conflict with the law and they are unlikely to perceive an alteration to the natural character of the area negatively. Although the CPV/PV solar field surrounds this facility in almost all directions the tall concrete boundary wall (approximately 3m high) is likely to hinder views from the main building. The southern portion of the proposed site will be highly visible from the sport fields through the boundary fence, with the northern portion of the site only being partially visible as a result of the sloping topography which will limit visibility of the lower lying ground in the northern reaches of the site (see Figure 39).

Figure 39: View North North-west from Secure Care Centre boundary fence

8.5.4 Generic Visual Impacts of CSP and CPV/PV Plants

In this section, the potential visual issues / impacts related to the establishment of CSP and CPV/PV Plants as proposed, are discussed.

- Surface coverage and height

The solar field for a CSP plant consists of numerous large parabolic trough mirrors which cover an extensive area of approximately 6km². These structures rotate on an axis and can reach a height of 8m above the ground (approximate in height to 2½-storeys of a building). The solar field for a CPV/PV plant is made up of approximately 160 000 photovoltaic panel arrays and will cover an area of approximately 2km². The arrays are either at a fixed angle (PV) or on a tracking system (CPV) that can reach heights between 5m and 10m above the ground (10m being approximate in height to a 3-storey building). Both these types of solar energy facilities will be highly visible due to the large surface area they cover in combination with the considerable height of the parabolic trough mirrors and solar arrays. The visual prominence of the facility will be exacerbated if located within natural settings or on a ridge top.

- Associated infrastructure

In addition to the structures mentioned above, the building infrastructure associated with CSP Plants includes various structural components. The vertical dimensions of these components range from 10-12m high (approximate in height to a building of 4-5 storeys). This infrastructure will therefore stand out above the solar fields and magnify the visual prominence of the solar energy facility. In addition the power block required to convert the heat generated by a CSP plant into electricity reaches heights of 16m (approximate in height to a 5 storey building) and will be visible for great distances from the solar

energy facility. The visual impact of these components will be highly intrusive when located on flat sites in natural settings where there is limited tall wooded vegetation present to conceal the impact.

Electrical infrastructure associated with CSP and CPV/PV plants will include distribution substations (approximately 90m x 120m) and an overhead power lines connecting the distribution substations to the existing power line. Power lines and substations are by their nature large objects and will typically be visible for great distances. Distribution power lines consist of a series of tall towers (approximately 25m high) thus making them highly visible. Power lines and substations are not features of the natural environment, but are representative of human (anthropogenic) alteration. Thus when placed in largely natural landscapes, they will be perceived to be highly incongruous in this setting. Conversely, the presence of other anthropogenic objects associated with the built environment, especially other power lines or substations, may result in the visual environment being considered to be 'degraded' and thus the introduction of a new power line into this setting may be less of a visual impact than if there was no existing built infrastructure visible.

- Vegetation clearing

Both CSP and CPV/PV plants will require vegetation to be cleared. This clearing will be more intensive for CSP plants as the land will need to be graded and terraced where necessary, in order to provide a level surface for foundations. For CPV/PV plants only the taller vegetation will need to be cleared. This practice of clearing vegetation will intensify the visibility of the solar energy facility, particularly in locations where natural woody vegetation still exists, but to a lesser degree when the proposed facility is located on land that has already been cleared of woody vegetation or where woody vegetation does not occur.

- Reflection

Reflection from the parabolic trough mirrors of the CSP Plant was raised as an issue of concern by I&APs during the public participation process undertaken in the Scoping Phase of the EIA, however this is not regarded to be a visual issue. The curvature of these mirrors will focus the incoming sunlight on a central receiver thereby limiting the number of stray reflections. The glare experienced by someone observing the solar field is therefore not considered to be a visual hazard to oncoming traffic / train drivers as reflections from the solar field would be comparable to that of a body of water.

- Experiencing visual impacts

It is important to note that visual impacts are only experienced when there are receptors present to experience this impact; thus in a context where there are no human receptors or viewers present it is unlikely that no visual impacts will be experienced. The perception of the viewer/receptor toward an impact is also highly subjective and involves 'value judgements' on behalf of the receptor. It should be considered as certain receptors may not consider the development of a solar energy facility to be a negative visual impact.

CSP and CPV/PV plants can be perceived as visual impacts where areas have a natural scenic quality and where activities such as tourism are practised which are based upon the enjoyment of, or exposure to, the scenic or aesthetic character of the area. Residents and visitors to these areas may regard solar energy facilities to be an unwelcome intrusion which degrades the natural character and

scenic beauty of the area, and which would potentially even compromise the practising of tourism activities in the area. If a solar energy facility is associated with employment creation, social upliftment and the general development and progression of an area, it may not be associated with any negative visual impacts and even have positive connotations. It should be noted that solar energy facilities are considered to be an environmentally sustainable option of generating electricity, and this may positively alter the viewer's perceived experience of the visual impact.

The presence / existence of other anthropogenic objects associated with the built environment may not only obstruct views but also influence the perception of whether a solar energy facility is a visual impact. In industrial areas where structures, buildings and other infrastructure exist, the visual environment could be considered to be 'degraded' and thus the introduction of a solar power plant into this setting may be considered to be less of a visual impact than if there was no existing built infrastructure visible. In this case value may not be placed in the aesthetic quality of the landscape, and the solar energy facility may not necessarily be considered to be visually intrusive.

- Viewing distance

Viewing distance is a critical factor in the experiencing of visual impacts, as beyond a certain distance, even large developments such as a solar power plant tend to be much less visible, and are difficult to differentiate from the surrounding landscape. The visibility of an object is likely to decrease exponentially with increasing distance away from the object, with maximum impact being exerted on receptors at a distance of 1000m or less. The impact decreases exponentially as one moves away from the source of impact, with the impact at 2000m being a quarter of the impact at 1000m away (see Figure 40). At 5000m away or more, the impact would be negligible.

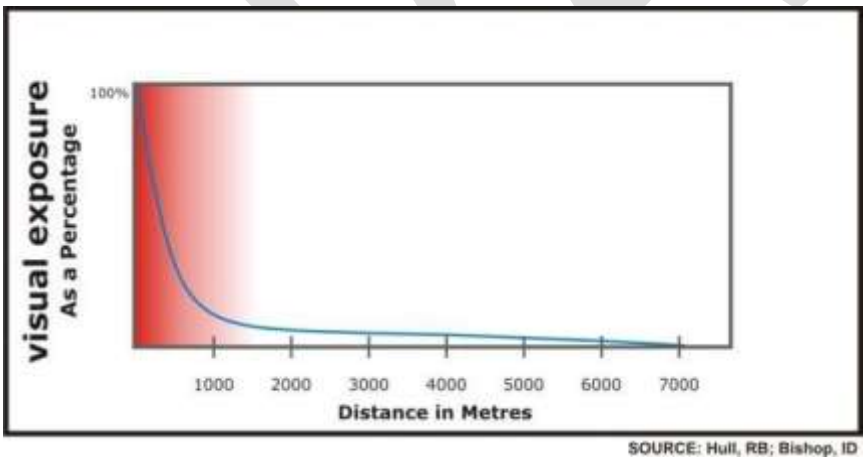

Figure 40: Diagram illustrating diminishing visual exposure over distance

8.5.5 Visual Receptor Rating

In order to assess the impact of the proposed solar energy facility on the sensitive receptor locations listed above, a matrix that takes into account a number of factors has been developed, and is applied to each receptor location.

The matrix has been based on a number of factors as listed below:

- Distance of receptor away from the proposed development (distance banding)
- Primary focus / orientation of the receptor
- Presence of screening factors (topography, vegetation etc.)

These factors are considered to be the most important factors when assessing the visual impact of a proposed development on a sensitive receptor. It must be remembered that the experiencing of visual impacts is a complex and qualitative phenomenon, and thus difficult to accurately quantify; thus the matrix should be seen as a representation of the likely visual impact at a receptor location. The matrix should be viewed in combination with the visualisation images below to gain an understanding of the likely visual impact associated with the proposed solar power plant.

An explanation of the matrix is as follows.

Table 27: Rating matrix used to assess the impact of a development on visually sensitive receptors

Factor	**Classes and Scores**		
Distance of Receptor away from proposed development (distance banding)	0-1km Score: 3	1-2.5km Score:2	2.5-5km Score:1
Primary Focus / orientation of receptor	'Arc of view' directly towards proposed solar energy facility Score:3	'Arc of view' partially towards proposed solar energy facility Score:2	'Arc of view' in opposite direction of proposed solar energy facility Score:1
Presence of Screening Factors	No screening factors – solar field highly visible Score:3	Screening factors partially obscure solar field Score:2	Screening factors completely block any views towards solar field Score:1

Categories of impact:
High Visual Impact = 3
Medium Visual Impact = 2-3
Low Visual Impact = 1-2

As discussed above (Viewing distance) the distance of the viewer / receptor location away from the solar power plant is the most important factor in the context of the experiencing of visual impacts. The highest rating has thus been assigned to receptor locations that are located within 1km of the proposed solar energy facility. Beyond 1km, the visual impact associated with a solar power plant is likely to be somewhat insignificant, and any receptor location beyond 2.5km from the proposed

development has been allocated into the lowest class. Receptors beyond 5km from the proposed solar energy facility have not been rated as the impact will be negligible.

The orientation of a receptor becomes important in many cases, as the receptor location is typically oriented in a certain direction, e.g. with views towards a certain area / part of the landscape from a highly frequented area like a porch or garden. The visual impact of a solar field could be potentially much greater if intruded into such a view, and thus the highest rating has been given to a situation where the solar energy facility would be directly within an 'arc of view / orientation' – i.e. the 180^{o} panorama in a certain direction.

The presence of screening factors is equally as important as the distance away from the facility. Screening factors can be vegetation, buildings, as well as topography. For example a grove of trees located between a receptor location and a proposed development could effectively hinder a large portion of the solar field from the receptor. Topography (relative elevation and aspect) plays a similar role as a receptor location in a deep or incised valley will have a very limited viewshed and may not be able to view an object that is close by, but not in its viewshed. The opposite would apply to tall objects crossing a ridge, which would be highly visible.

The visual impact on each visually sensitive receptor has been calculated by scoring each factor according to the scores in the above matrix and thereafter calculating an average score which provides an indication of the impact category.

The table below presents the results of the visual impact matrix.

Table 28: Visual impact rating of visually sensitive receptors

Receptor Location	Distance	Orientation	Screening	Visual Impact
Maria's Farm House Bed and Breakfast	2	1	2	**Low**
Exiting dwellings in De Aar	2	3	2	**Medium**
New residential development in De Aar	2	3	2	**Medium**
Britstown road	2	2	3	**Medium**

The visual impact of the proposed solar energy facility will have a medium visual impact on most of the visually sensitive receptors, other than Maria's Farm House Bed and Breakfast. As a result the most of the visual impact of the proposed solar energy facility will be experienced from the area to the south of the proposed site, and this will be taken into account when assessing the CSP site alternatives.

8.5.6 Visual Modelling

Visualisation modelling undertaken for the proposed solar energy facility from key sensitive receptor locations has been undertaken to provide a realistic picture of how the visual environment may be affected and to strengthen the findings of the visual impact assessment.

These models were created of views toward the proposed site from dwellings on the northern edge of De Aar, the Britstown road (R48) travelling toward De Aar from the west and the site entrance off the Philipstown road (R48) travelling towards De Aar from the north. These photo sites were chosen in order to illustrate how views from visually sensitive receptors will be transformed by the proposed development once erected. Although the Philipstown road is not regarded as a visually sensitive location, this view was modelled to illustrate the visual impact of the solar energy from a relatively close distance. The view from Maria's Farm House Bed and Breakfast was not modeled as this facility is not orientated toward the proposed solar energy facility and as a result primary views from this facility will not be affected. A model was not created from the new residential development in De Aar as it is situated in close proximity (approximately 750m) to the existing dwellings in De Aar and therefore people residing on the northern edge of this development will experience typically similar views as modelled in View 1.

The following assumptions and limitations are of relevance for the visual models:

- The CSP solar field has been modeled according to alternative 2 as this represents the worst case scenario, in terms of the proximity of this alternative to majority of the identified visually sensitive receptors.

- The visual models represent a visual environment that assumes all vegetative clearing will be restored to its current state after the construction phase. This is however an improbable scenario as the groves of tall trees in the northern reaches of the site are likely to be removed which will reduce the accuracy of the models generated.

- Detailed layout plans have not been finalised and therefore certain infrastructure associated with the facility may not be included in the models and the layout of the solar field as depicted may change.

- View 1 – North-east from the residential dwellings in De Aar

This photo site is situated on the R48 opposite the existing residential dwellings in De Aar approximately 1.5km to the south-west of the application site boundary. This view is indicative of what people residing in dwellings to the north of De Aar would see when looking in a north-easterly direction (see Figure 41 and Figure 42). As depicted below, existing electrical infrastructure and isolated farmsteads with their associated groves of trees will obscure visibility.

Figure 41: Existing panoramic view toward proposed solar energy facility from the dwellings in De Aar

Figure 42: Visually modelled post-construction panoramic view toward proposed solar energy facility from the dwellings in De Aar

- View 2 – East from the R48 travelling toward De Aar)

This photo site is situated on the R48 approximately 2.5km to the west of the proposed application site. This view is indicative of what motorists travelling along the R48 toward De Aar from the N10 will see as they pass through the neck in the hills and the town and its surrounds first become visible (see Figure 43 and Figure 44). Most of the proposed solar energy facility will be visible as the ground slopes gradually down toward the application site from this point.

Figure 43: Existing panoramic view toward proposed solar energy facility from the R48

Figure 44: Visually modelled post construction panoramic view toward proposed solar energy facility from the R48

As depicted above, a large portion of the proposed solar energy facility will be visible from this point as the ground slopes gradually down toward the application site and there are no screening factors present. The solar energy facility will have a moderate visual impact on motorists travelling along this road as it is situated relatively far away.

8.5.7 Night-time Impacts

The visual impact of lighting on the nightscape is largely dependent on the existing lighting in the surrounding area, as the night scene in areas where there are numerous light sources will be visually degraded by the existing light pollution and therefore additional light sources are unlikely have a significant impact on the nightscape. It is thus important to identify a night-time visual baseline before exploring the potential visual impact of the proposed solar energy facility at night.

The area surrounding the proposed solar energy facility is largely undeveloped and as a result there are few existing light sources present. The visual environment is therefore characterised by a relatively

dark night scene with low levels of light pollution. The main source of light within the study area is the town of De Aar to the south of the application site (see Figure 45).

Figure 45: View south-west from the R48 (Philipstown Road) toward De Aar at night

Operational and security lighting at night will be required for the proposed solar energy facility and the two substations proposed within the development footprint. The type and intensity of lighting required was unknown at the time of writing this report and therefore the assessment is based on the effect that additional light sources will have on the ambiance of the nightscape and impact on visually sensitive receptors.

The lighting required for the proposed project will intrude on the nightscape and create glare, which will have some significance as it will contrast with the dark backdrop of the surrounding area. Although the area is not generally renowned as a tourist destination, the natural character of the area will increase its sensitivity to the operational and security lighting at night.

Existing views toward the proposed site from sensitive receptor locations at night are characteristic of a dark night scene with limited light sources present, other than isolated low intensity lighting from the sewer treatment plant and the Secure Care Centre within the boundaries of the proposed site, as well as security lighting on the northern edge of the commercial area in De Aar. (see Figure 46 and Figure 47). As a result the operational and security lighting from the proposed solar energy facility will impact on the visually sensitive receptors by extending the existing light footprint further north.

Figure 46: Existing light impact from the Secure Care Centre

Figure 47: Existing light impact from the Water Treatment Plant

8.6 Heritage

The full heritage assessment is included as Appendix 6F.

8.6.1 Field work findings

A follow up visit to the study area was conducted in March 2011 with the aim of conducting an archaeological survey of the development area and giving particular attention to the areas identified during the Scoping phase as being potentially sensitive. Due to the size of the total study area field work focused on the areas identified in the layout as the foot print areas of the development.

The study area for this project covers approximately 740 hectares in total. Due to the nature of cultural remains, with the majority of artefacts occurring below surface, an intensive foot-survey that covered the study area was conducted. A controlled-exclusive surface survey was conducted over a period of 2 days on foot by two archaeologists of PGS.

The site is predominantly covered in Karoo bossies, falls within Karoo Biome and it is generally flat (Figure 48). Towards the Brak River the vegetation cover changes to more riverine with some large exotic tree thickets (Figure 49).

Figure 48: Type of grass cover at the site (note the flatness of the landscape)

Figure 49: Type of vegetation cover closer to Brak River

8.6.2 Archaeological Sites

The survey yielded eight archaeological sites of which 7 fall directly in the development area and the eight just outside (Figure 50).

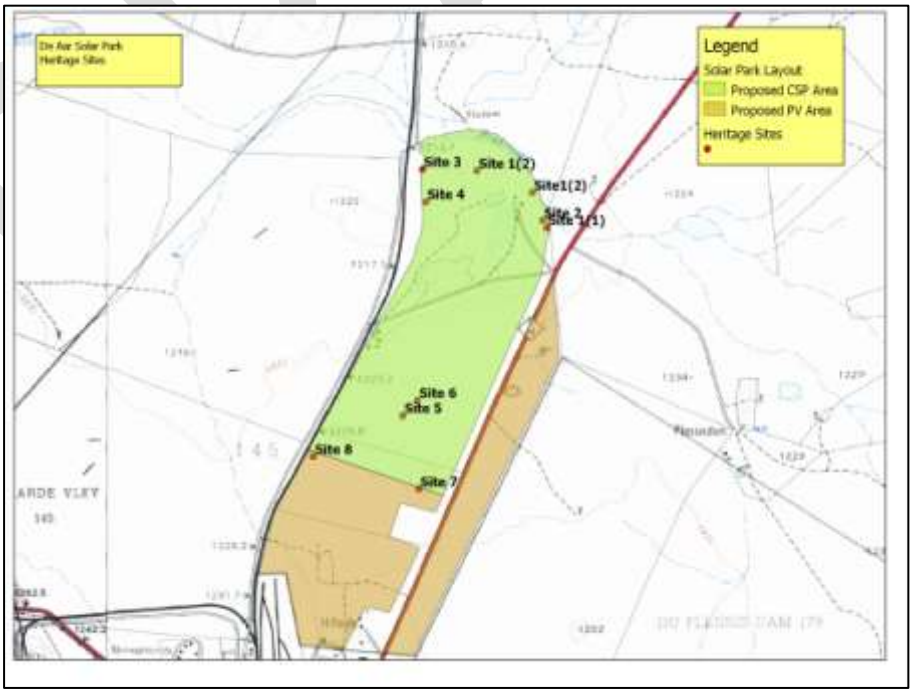

Figure 50: De Aar Solar Park Heritage Sites

- Site 1

A medium to high density scatter of Middle Stone Age (MSA) tools consisting of cores and blades was identified (± 5-10 artefacts in 10m x10m) (Figure 51). The site was situated on the summit and the slopes of a small hill overlooking the Brak River at the northern extent of the study area. The artefacts were identified scattered all over the slopes of the small hill (Figure 52). The scatter of artefacts extended to the north to the banks of the Brak River and to the east beyond the extent of the study area. The spread of artefacts ended towards the south at the edge of an orchard which was placed in a floodplain which extended further to the west.

The scatter of stone tools extended further to the west of the small hill across the undisturbed sections of the floodplain and along the course of the Brak River. The alluvial deposits of the floodplain covered most of the artefacts on the floodplain. Small clearings in the floodplain were exposed by erosion and further scatters of stone tools were visible. These scatters of stone tools were of a low density (± 2-5 artefacts in 10m x10m).. A small quarry was found on the western slopes of the small hill (Figure 53).

Figure 51: MSA cores and blades

Figure 52: General view of Site 1

Figure 53: Quarry in the area of Site 1 exposing MSA material

The quarry activities disturbed and destroyed a section of the extended site and further quarrying will cause even more damage and destruction.

The site is approximately 500m x300m and Graded as General Protected A and mitigation of the site will be required if impacted by the development.

The site falls within the area identified as the possible position of the evaporation dams for the project. Mitigation of the impact of the development on the site will entail:

- Surface sampling
- Monitoring during construction

- Site 2

The remains of four circular stone walled enclosures were identified here (Figure 55). The enclosures were found on the summit of the same small hill described at **Site 1**. The largest enclosure measured approximately 3m in diameter and the walls were approximately 0,75m high and 0,5m thick (Figure 54). The other three enclosures were similar in size and measured approximately 2m in diameter and the walls were approximately 0,5m high and 0,5m wide. Interconnecting sections of packed stone walls were found in between the enclosures. The enclosures were most probably used as goat/sheep pens. A few bricks, fragments of cement and a few metal artefacts (such as cans and wire) were also identified associated with the enclosures.

The layout and arrangement of the structures indicates possible linkages with herder activity and could also later have been utilised in historical times by other groups. The site can provide significant information on the pastoral activities in the area dating back to the Later Stone Age (LSA).

Figure 54: Stone enclosure on hill

Figure 55: View of interlinked enclosures

The site is approximately 20m in diameter and graded as **General Protected A** and mitigation of the site will be required if impacted by the development.

The site falls within the area identified as the possible position of one of the CSP Alternatives for the project. Mitigation of the impact of the development on the site will entail:

- Preservation of the site in situ and fencing of the site during construction, if this is not possible;
- Documentation of the site layout and test excavations to determine the cultural context before an application for a destruction permit can be lodged with SAHRA.
- Monitoring during construction

- Site 3

The foundations and the remains of an old railway station were identified at this location approximately 50m east of the existing railway line (Figure 56). The demolished structure measured approximately 15m x 15m and building rubble and other metal artefacts (such as cans and wire) were found scattered around. The remains of the structure were identified amongst a cluster of Eucalypti trees. The structures are located in the area of the map indicated just west of the study area with the abbreviation ”P.L.C”, and most probably dates to 1910.

Figure 56: View of old railway structure

The site is situated just outside the north-western border of the project and will not be affected by the project.

Site size: Approximately 40m x 40m.

- Site 4

A low density scatter of MSA blades and scrapers was identified here (± 2-5 artefacts in 10m x10m) (Figure 58). The artefacts were identified in a clearing which was by sheet erosion (
Figure 57). This site was identified in the alluvial floodplain and formed part of the extended spread of artefacts as described in Site 1.

Figure 57: View of site with exposed soil in foreground

Figure 58: MSA tools found on site

The site is approximately 40m in diameter and graded as **General Protected B** and is of low significance. It is recommended that site monitoring be done if any construction takes place in the vicinity of this site.

- Site 5 and 6

Unidentified circular shaped mounds of packed rocks were identified at both sites (Figure 59 and Figure 60). The function, origin and age of this mound of rocks are unknown. The mound of rocks measured approximately 4m in diameter and no other artefacts or features were found associated with the mound of rocks. It could possibly be the remains of a stone walled enclosure which was demolished.

Figure 59: Stone structure at Site 5

Figure 60: Stone structure at Site 6

The sites are rates as **General Protected B** and are of medium to low significance.

The sites falls within the area identified as the possible position of one of the CSP Alternatives for the project. Mitigation of the impact of the development on the site will entail:

- Preservation of the site in situ and fencing of the site during construction, if this is not possible;
- Documentation of the site layout and test excavations to determine the cultural context before an application for a destruction permit can be lodged with SAHRA.
- Monitoring during construction

Site size: Approximately 4m in diameter.

- Site 7

The foundations and the remains of a small stone-built structure were identified here (Figure 61). The remains of the structure were found on the summit of a small elongated hill. The foundations of the structure were square in shape and measured approximately 4m x 4m. A flat rock on the eastern side of the structure had a smoothened surface which indicated that it was used. An unknown, but repetitive action across the surface of this rock caused it to be smoothened. No other artefacts or features were found associate with the identified structure.

Figure 61: remains of stone structure at Site 7

Identifying the use of the site is difficult and only deductions can be made from its position. The structure is situated on a small hill overlooking the road from De Aar to Philipstown, as such the structure could have been a fortification during the South African War that guarded the access road to

De Aar. The shape of the structure is possibly the remains of a type of block house referred to as the Rice Blockhouse (Figure 62) that was constructed with a double row corrugated iron sheeting which was then filled with rocks (shingle) as protection.

Figure 62: Rice pattern blockhouse with barrbed wire fencing

The site is approximately 10m in diameter and provisionally **graded as 3B** of local significance and must be preserved where possible.

The sites falls within the area identified as the possible position of one of the PV Solar Field Alternatives for the project. Mitigation of the impact of the development on the site will entail:

- Preservation of the site in situ and fencing of the site during construction, if this is not possible;
- Further research into the structure will be required through, documentation of the site layout and test excavations to determine the cultural context before an application for a destruction permit can be lodged with SAHRA.
- Monitoring during construction

- Site 8

The remains of a circular stone walled enclosure were identified here. The enclosure was found on the edge of a ridge which overlooked the railway line (Figure 63). The stone walled enclosure measured approximately 10m in diameter and the walls were approximately 0,5m high and 0,5m thick. No other artefacts or features were identified associated with the enclosure.

Figure 63: Remains of stone walling with railway track in background

Identifying the use of the site is difficult and only deductions can be made from its position. The structure is situated on a small hill overlooking the rail line from De Aar to Britstown, as such the structure could have been a fortification during the South African War that guarded the rail line to De Aar. The shape of the structure is possibly the remains of a type of block house referred to as the Rice Blockhouse (Figure 62) that was constructed with a double row corrugated iron sheeting which was then filled with rocks (shingle) as protection.

The site is approximately 15m in diameter and provisionally **graded as 3B** of local significance and must be preserved where possible.

The sites falls within the area identified as the possible position of one of the PV Solar Field Alternatives for the project. Mitigation of the impact of the development on the site will entail:

- Preservation of the site in situ and fencing of the site during construction, if this is not possible;
- Further research into the structure will be required through, documentation of the site layout and test excavations to determine the cultural context before an application for a destruction permit can be lodged with SAHRA.
- Monitoring during construction

8.6.3 Potential Impacts during Construction

ISSUE	Impact on archaeological sites
POTENTIAL	Unidentified archaeological sites and the discovery of such sites during

IMPACTS	construction can seriously hamper construction timelines. Destruction of identified archaeological sites during construction
EMP	Management measures to be included in the EMP for chance finds Recommended mitigation measures for each site to be adhered to

ISSUE	**Impact on palaeontological sites**
POTENTIAL IMPACT	Unidentified palaeontological sites and the discovery of such sites during construction can seriously hamper construction timelines.
EMP	Management measures to be included in the EMP for chance finds

ISSUE	**Impact on historical sites**
PREDICTED IMPACT	No sites identified during field work
EMP	Management measures to be included in the EMP for chance finds.

ISSUE	**Impact on graves and cemeteries site**
POSSIBLE IMPACT	Unidentified graves and cemeteries and the discovery of such structures during construction can seriously hamper construction timelines.
EMP	In the event that these graves and cemeteries could not be avoided a grave relocation process needs to be started. Such a process impacts on the spiritual and social fabric of the next of kin and associated communities. Management measures for such finds must be included in the EMP

8.6.4 Potential Impacts during Operation

Same as construction

8.7 Socio-economic

The full socio-economic assessment is included in Appendix 6F.

In order to address the overall objective of this study, it was necessary to compile a detailed description of the study area. The subsections below presents the baseline profile (status quo) of the receiving environment in terms of the various socio-economic processes (cf. Vanclay, 2002). It is believed that the baseline profile would be maintained to a large degree (not taking into account variables outside of the project) in the event that a 'no go' option was implemented.

The various subsections discuss the respective change processes and the potential impacts that could be experienced by the receiving environment as a result of the construction and operation of the proposed PV and CSP plants, transmission power lines, water pipelines and other associated infrastructure. The section has been structured as followed:

- Geographical Processes;
- Demographical Processes;
- Economical Processes;
- Institutional and Legal Processes; and
- Socio-Cultural Processes.

8.7.1 Geographical Processes

The Emthanjeni Municipality, in compiling its Spatial Development Framework (SDF), decided to strengthen the municipality's institutional arrangements and structures in support of the Northern Cape's priorities and programmes. The SDF was therefore based on the following principles that will guide the municipality's decision making in terms of spatial planning and land use management:

- Priority will be given to the upgrade and development of new and existing areas with the greatest economic potential;
- Infrastructural developments must be balanced with the ecosystem to ensure the sustainable use of natural resources;
- Integration must take place along the main transport corridors, notably the N1, the N10 and the N12, prioritized from areas with the greatest need for development towards areas with the greatest economic potential;
- Investment should not only focus on actual infrastructural development, but rather on people development through skills training, as it will enable people to move to areas of greater potential;
- Development investments should focus on the diverse needs of all people, including the elderly, people with disabilities, child-headed households, single-headed households and migrant families;
- The type of development should be appropriate to the area of development, e.g. lower cost housing developments should target areas with higher levels of lower income groups; and
- Development should ideally take place in nodes or along identified development corridors as this will increase accessibility and maximize the economies of scale.

These principles culminate in the municipality's objectives around land use management, which is as follows:

- The availability of an acceptable level of infrastructure and services within the municipal area;
- Improved capacity for service delivery;

- The creation of an integrated settlement pattern within the municipal area;
- A well structured network system that facilitates easy movement;
- Efficient links between pertinent nodes, products and services;
- The development and implementation of an effective land use management system;
- Facilitating access to land for development; and
- Adhering to sound environmental practices whilst protecting environmentally sensitive areas.

The IDP further states that although the area is currently not characterised by development, there are a number of possibilities for development under investigation. Of these the most important economic activities relate to agricultural land use with the future possibility of processing products in the area. In addition, the potential for game farming has also been identified in the IDP as a possibility for future development.

The municipality further states that it would like to be in a position where it can provide assistance to emerging farmers – currently the municipality provides land to emerging farmers, but believe that more assistance is required to enable these farmers to meet their targets. In addition the municipality applied for additional land from the Department of Rural Development and Land Reform as a result of the high demand for commonage farming areas. The area applied for measures a total of 2 669.2 hectare, but it is unclear from the IDP where exactly this portion of land is located.

As far as could be ascertained, the De Aar area does not have any economically viable mineral deposits. However, recent studies indicated the possibility of uranium deposits in the Hanover area, but this can only be verified once all the studies have been completed (IDP).

8.7.2 Demographical Processes

The Emthanjeni Municipality covers a geographical area of 11 390 km^2 and is located in the south-eastern section of the Northern Cape Province. The municipality is landlocked and is bordered by the Renosterberg Municipality to the northeast, Umsobomvu Municipality to the east, the Ubuntu Municipality to the south, the Kareeberg Municipality to the west, and the Northern Cape District Management Area 07 to the north and northwest.

- Population Characteristics

In 2001, Emthanjeni had a total population of 35 540 people. The population size increased by some 2 685 people between 2001 and 2007, so that, in 2007, the population size was estimated at around 38 225 people. This represents a population increase of around 7.5% over the 6-year period between 2001 and 2007. The population density in 2001 was around 3.1 persons per km^2, which increased to approximately 3.4 persons per km^2 in 2007. However, the population density is based on the overall municipal profile and therefore it can be expected that the population density in urban areas, such as De Aar, would be much higher than that of the rural areas.

Emthanjeni has a fairly young population and in 2007 just over a quarter of the population (29.8%) were below the age of 15. The economically active population group (defined by StatsSA as the ages between 15 and 65) accounts for close on two thirds (65.2%) of the total population. It is noteworthy that the biggest increase in the population size between 2001 and 2007 was in the economically active population (by some 2 737 people), which might be indicative of a growing economy in which more employment opportunities are offered that serve as a catalyst for the growing population.

In 2001, just over half of the population (58.1%) belonged to the Coloured population group, followed by Black African at 29.3%. During the next 6 years the Coloured population group increased, so that in 2007, it accounted for only 61.3% of the population. During the same time the Black African population group decreased to 26.0% of the total population. The White and Indian/Asian population groups remained relatively unchanged at around 10% (White) and 0.1% (Indian/Asian). There are slightly more females (52.9%) than males (47.1%) in the municipal area. Interesting to note is that the majority of people who entered the area were female (2 748 females against 1 909 males), but is unclear why this phenomenon occurred.

In 2001, Emthanjeni had a total of 8 833 households[1], with an occupancy rate of approximately 4.0 persons per household. As could be expected with the influx of people, the number of households in the area also increased so that in 2007, the area had a total of 9 490 households, leaving the occupancy rate unchanged at 4.0 persons per household.

Table 29 below provides an overview summary of the population demographics of the local municipal area in relation to South Africa, the Northern Cape and the Pixley ka Seme District.

Table 29: Summary of Population Characteristics

	South Africa	**Northern Cape**	**Pixley ka Seme District**		**Emthanjeni**	
	2001[2]	**2007**	**2001**	**2007**	**2001**	**2007**
Area size (km^2)	1 219 912	361 830 (29.7% of SA)	102 766 (28.4% of the NC)		11 390 (11.1% of the PKSDM)	
Total population	48 502 063	1 058 060 (2.2% of SA)	164 529	166 845 (15.8% of the NC)	35 540 (21.6% of the DM)	38 225 (22.9% of the DM)
Population density (people per km^2)	39.8	2.9	1.6	1.6	3.1	3.6
Total households	12 500 610	264 654 (2.1% of SA)	41 893	43 288	8 833	9 490
Avg. persons per household	3.9	4.0	3.9	3.9	4.0	4.0
Predominant Population Groups	Black African (79.5%)[3]	Coloured (50.0%)	Coloured (62.4%)	Coloured (66.4%)	Coloured (58.1%)	Coloured (63.1%)

[1] A household is defined as: *"One or more people occupying a housing unit as their usual place of residence. The occupants may be a single family, one person living alone, two or more families living together, or any other group of related or unrelated people who share living arrangements"*.

[2] Census 2001 data (2007 data not readily available)

[9] Census 2001 data

	South Africa	Northern Cape	Pixley ka Seme District		Emthanjeni	
	2001[2]	2007	2001	2007	2001	2007
	-	Black African (39.8%)	Black African (26.9%)	Black African (24.2%)	Black African (29.3%)	Black African (26.0%)
Predominant Gender	Female (50.8%)[9]	Female (50.9%)	Female (51.4%)	Female (51.9%)	Female (52.0%)	Female (52.9%)
Predominant Age Group	Working age (62.9%)	Working age (65.1%)	Working age (61.4%)	Working age (63.6%)	Working age (62.4%)	Working age (65.2%)

- Education Profile

One of the driving forces behind social change is educational attainment, which in turn is linked to poverty levels as there appears to be a correlation between the level of educational attainment and income levels. People with higher educational levels tend to be economically better off, and therefore contribute more to the reduction of the unemployment rate. Educational attainment is also linked to poverty in the sense that funds are required to further studies, therefore people living in less favourable economic conditions tend to be unable to further their education, which in turn holds them in a downward poverty spiral. An overview of the educational profile for the local municipal area is provided in (Figure 64).

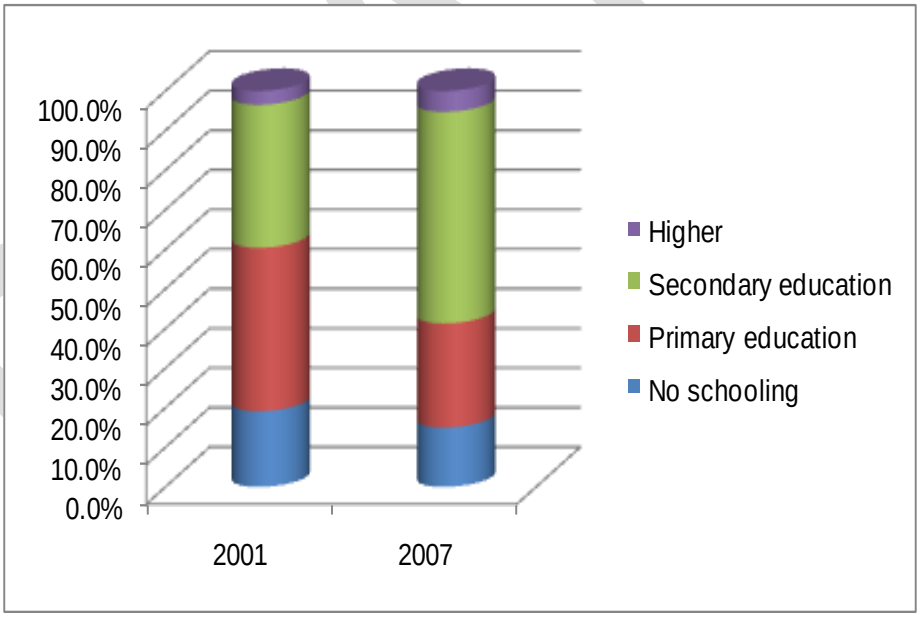

Figure 64: Overview of the Education Profile of the Emthanjeni municipality (2001 and 2007 compared)

In 2001, close on a fifth (19.1%) of the population had no form of schooling. Coupled with those individuals who only completed some form of primary education (a further 41.3%), this means that, in 2001, close on a third (60.4%) of Emthanjeni's population had limited educational skills, which in turn would hinder their employability on the general job market. During the same period approximately a

third of the population (36.1%) completed some form of secondary education, which could enhance their employability. Only 3.5% of the population went on to obtain a tertiary qualification.

The situation only improved marginally between 2001 and 2007: the number of people who had no form of education decreased slightly from 19.1% to 15.0%, those who completed some form of primary or secondary education now accounted for the majority of the population (79.7%). Those individuals who obtained some form of tertiary education also increased to 5.3%.

8.7.3 Economic Processes

- Economic Policies of Importance

Government authorities at a National, Provincial and District level have formulated a range of economic policies in order to enable economic growth in South Africa. A review of these policies is necessary in order to determine how the project may support or detract from policy objectives. The most important policies are listed in Table 30 below:

Table 30: Summary of Economic Policies of Importance

Policy Name	Description	Implications for the Project
Accelerated and Shared Growth Initiative for South Africa	AsgiSA resulted from Government's commitment to halve unemployment and poverty by 2014 and achieve approximately 5% GDP growth; Was formally launched in February 2006; Main Constraints to economic growth: Volatility of the currency, the national logistics system, shortages of skilled labour, barriers to entry, limits to competition, the regulatory environment and deficiencies in state organization; The Joint Initiative on Priority Skills Acquisition (Jipsa) was established a month later to address the scarce and critical skills needed to meet AsgiSA's objectives.	The Northern Cape has consistently not achieved high growth and therefore the AsgiSA social objectives are likely not to be realised. Any projects in the province likely to assist in accomplishing AsgiSA goals will be welcomed.
The Broad-Based Black Economic Empowerment Act	The BBBEE Act was gazetted in 2004 to establish a legislative framework for the promotion of black economic empowerment. The BBBEE Codes of Good Practice were gazetted in 2007 providing guidance on how levels of empowerment are to be	The project must fulfil the requirements contained in the codes of good practice and report on BEE initiatives in the seven areas specified.

Policy Name	Description	Implications for the Project
	measured in organisations and what this means in terms of trading with all state organs. The seven areas of measurement are: ▪ Equity Ownership ▪ Management Control ▪ Employment Equity ▪ Skills Development ▪ Preferential Procurement ▪ Enterprise Development ▪ Socio-economic Development	
Regional Industrial Development Strategy	The RIDS builds upon the principles set out in the National Spatial Development Perspective (2003) and contains guidelines and policies appropriate to meeting the differing development needs of the various economic regions in South Africa. The document contains information on a number of regional growth initiatives such as special economic zones and industry clusters	The establishment of a solar plant may open the door for the development of an entire industry cluster, supporting objectives of this policy.
Northern Cape Provincial Growth and Development Strategy	The NCPGDS provides direction and guides development planning in the Province. The NCPGDS has identified the following main developmental objectives: ▪ Growth, diversification and transformation ▪ of the provincial economy; ▪ Improving the efficiency and effectiveness of provincial government state institutions; ▪ Poverty reduction through social development; ▪ Developing availability of human and social capital; ▪ Improving infrastructure quality and availability to support social and economic development	The project assist with the implementation of the NCPGDS in the following ways: It introduces new economic diversity to the area. It will lead directly to poverty reduction and employment of local employment is prioritised.

Due to the integrated nature of the South African economy and the heavy reliance of rural areas on urban centres for goods, services and labour, it is important to consider macroeconomic forces which may have an impact on South Africa as a whole.

- Return of energy and resources demand

The 2nd quarter 2010 GDP results indicate an increase of 3.2% quarter on quarter annualised (StatsSA, 2010), which may be indicator of gradual local and worldwide recovery from the recent economic recession. This recovery probably signals a return of the demand for resources and energy from both the developed world as well as large middle income countries such as Brazil, India and China. The trend can be seen by the gradual increase in the price of export Coal to above $60 per ton and the substantial increase of the oil price (bent crude per barrel) from $50 in the April 2009 to $79 in September 2010. Although a second reduction in economic activity (a so called double-dip recession) has not been ruled out, there are increasing signs that growth has returned, albeit in the form of a longer and slower growth path (as opposed to the strong growth experienced in the period 2000-2008). Additionally, continuous population growth makes long term resource and energy growth inevitable.

South Africa will experience renewed interest in developing all economically viable energy sources to capitalise on energy demand. Energy sources which may have been marginally profitable during the economic downturn may return to profitability in the near future if the current trends continue and global resource demand recovers fully.

- Security of Power Supply

In the period immediately after the supply shortage and 2007/2008 power blackouts, Eskom announced a number of new power generation facilities including new coal-fired power stations, refurbishment of mothballed stations and oil, diesel or gas powered turbines in order to ensure appropriate supply and the needed reserve margin. In the intervening period several of these projects have experienced delays as the economic recession has lead to reductions in demand pressure. However, with possible recovery looming the situation may change in 2010/2011 and demand growth may resume. Short to medium term electricity supply security is instrumental in securing economic growth and investor confidence (IHS Global Insight, 2009).

The project has the potential of “securing” economic activity by assisting in removing supply constraints if Eskom generation activities result in a supply shortfall. When supply is constrained it represents a limitation to economic growth. When a supply reserve is available, it represents an opportunity for economic growth.

- International focus on clean energy

The development of renewable energy feed-in tariffs and recent comments by the International Monetary Fund (IMF) regarding a preference for financing cleaner energy are likely to influence the energy sector. These developments could lead to an increase in activity by independent power producers (IPPs) focusing on clean energy, creating a competitive environment for electricity provision. They may also increase public resistance to traditional generation methods, leading eventually to policy shifts and further economic incentives for cleaner energy such as tax advantages

and rebates. These incentives are currently being expanded in Europe and the US and South Africa may follow with similar initiatives.

Renewable power producers (such as those found in the project areas) may face competition in the long term from each other and resistance from Eskom as an increasing number of renewable IPPs attempt to provide energy to the grid and provide off-grid solutions. However, IPPs may benefits from better economic viability due to increasing economic policy incentives for renewable energy, if such incentives are fully implemented in South Africa.

Information below on the regional and local economic sectors was sourced from the Pixley ka Seme District Municipality (DM), Enthanjeni Local Municipality (LM) and Statistics South Africa (StatsSA).

The Northern Cape is comparatively sparsely populated as a province, which usually translates into low economic output when compared to population centres. Gross Domestic Product figures support this notion and the Northern Cape contributed only 2.3% of national GDP in 2008 (StatsSA, 2009). This contribution is in turn dominated by the mining industry which contributes 27% of the total Gross Geographic Product (GGP) of the province of R52 billion. The contribution of mining to GGP in the province fluctuated in the period 1995-2008 with a low of 19% in 1996 and a high of 28.9% in 2002. Trade/hospitality, financial/ business services and government are other sectors of importance, contributing between 11% and 13% each. These contributions have remained fairly stable throughout the period 1995 to 2008.

Historically economic growth in the province has usually been lower than national growth figures and this occurred again in 2008 when the provincial GGP growth was 2.1% compared to the South African GDP growth of 3.7%.

According to the Emthanjeni LM Integrated Development Plan (IDP) the major economic sectors within the area of Emthanjeni Municipality are as follows:

- Services sector (Community);
- Manufacturing;
- Retail;
- Agriculture;
- Transport; and
- Tourism.

The Emthanjeni LM area is increasingly becoming the main supply centre for country-wide distribution of Karoo venison. Emthanjeni LM area contains several facilities for meat processing including thee abattoirs in De Aar area, one of which supplying venison internationally. The area also exports significant quantities of wool, both as a primary product as well as a by-product of animal processing.

The main town in the LM area, De Aar, has historically been a major service centre for rail transport activities; however, a decline in railroad related business has moderated growth in other sectors such

as agricultural commodities. The revitalisation of the rail transport, industrial development and the identification of De Aar as a renewable energy hub are economic priorities for the future.

The Pixley ka Seme DM Integrated Development Plan (IDP) indicates that a small local population, a lack of a major local economic centre or industry in the district and a lack of infrastructure represent the biggest challenges to development. A small population limits the ability to profit sustainably from local consumers, and the lack of an industry limits the ability of businesses to develop around big industrial or commercial customers. A lack of infrastructure limits economic growth as it reduces the ability of businesses to access major markets in a cost effective manner. Furthermore, the DM area and the Northern Cape Province is currently experiencing population decline, putting a severe constraint on available local skills for growth and development.

According to the above documentation the economic development strategies and future target areas of the DM area focuses on the development, diversification and stabilization of the regional economy by:

- Developing and supporting agriculture that will increase autonomy of local communities and better food security in each region, especially in the case of land obtained by previously disadvantaged communities or individuals.
- Development of mineral resources (specifically Uranium) in the area, and creation of enterprises that would beneficiate agricultural and mineral resources locally, ensuring value is created in the region rather than elsewhere. Examples would be the processing of fruits into other products.
- Developing the tourism industry and maximising tourism resources, especially in light of their non-expendable nature if well managed. Three areas of strong potential that have been identified are mining or history-related tourism, eco-tourism and adventure tourism.
- Encouraging local skills development initiatives to support the above economic interventions, including the development of new local institutions of learning that can supply the skills needed specifically in that region.
- Encouraging entrepreneurial endeavours in line with the opportunities above and providing support, advice and funding where possible.
- Maintaining and expanding infrastructure (especially rail infrastructure) to ensure better access to the respective regions.
- Promoting projects for which a sparsely populated area with an arid climate would be an advantage. Examples would be the historical tourism and sustainable energy.

This is in line with development plans in other regions in the province as the strengths and opportunities across the Northern Cape are similar.

The project will contribute to local economic progress by supporting industry development in line with provincial and regional goals and ensuring advanced skills are drawn to the Northern Cape. The project will likely encounter widespread support from government, civil society and businesses, all of whom will see potential opportunities for revenues, employment and business opportunities locally.

- Local Employment

With regards to the De Aar site local employment seems to be better than both district level employment and that of the province, with a lower level of economic non-participation. This may be due to the exported unemployment to large centres, resulting in a higher locally employed population.

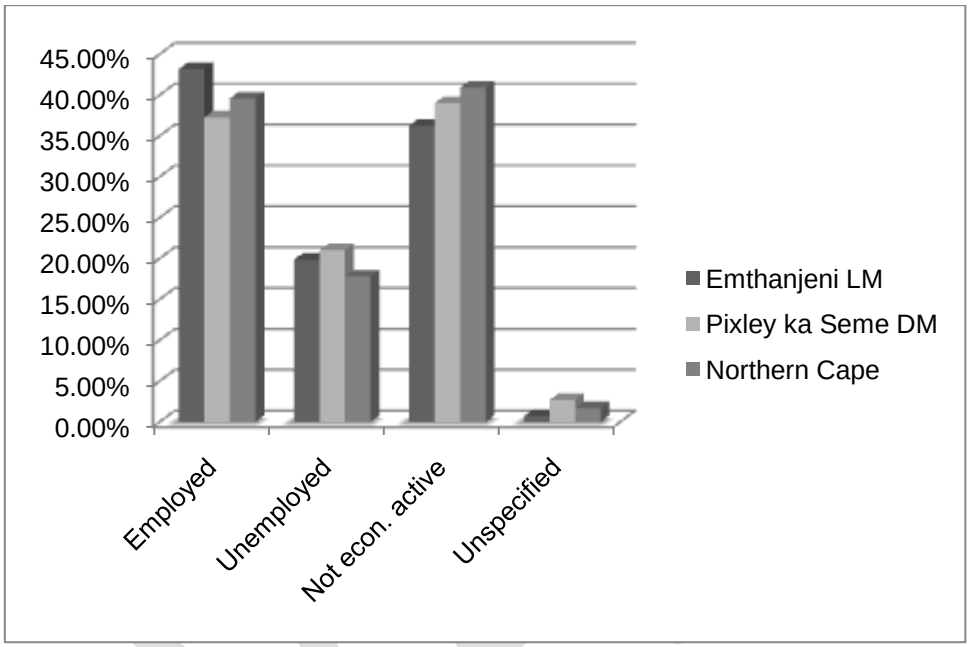

Figure 65: Regional and local employment for the De Aar Site amongst those aged 15 to 65

- Regional and Local Income Profile

Additional evidence of the employment patterns discussed above is also apparent from the comparison of local, regional and provincial income figures. At the De Aar site access to income is seems to be slightly better compared to provincial levels, although there was an extremely low response rate to income questions locally which makes interpretation of results difficult. There seems to be a lack of opportunity for the highly skilled, which may explain the very low percentage of respondents earning in the category R12 801 or more per month.

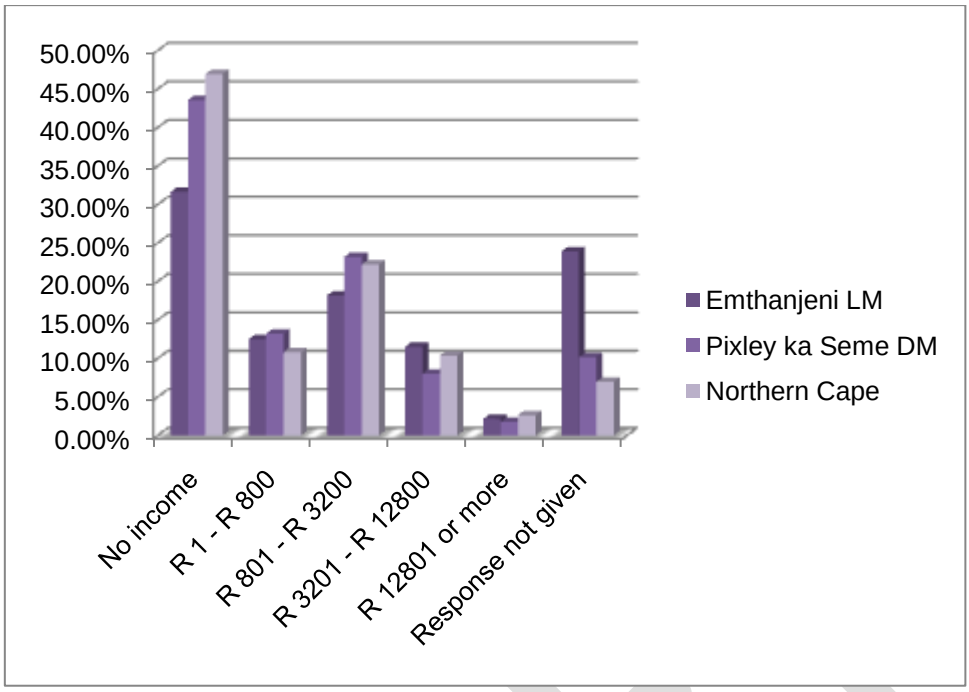

Figure 66: Regional and local monthly income for the De Aar site amongst those aged 15 to 65

There may be wide local interest in the project as many will see it as an opportunity to secure better sources of income. The project will probably increase the number of local residents in all income categories during construction, and the number of residents in higher income categories (R3 200 and above), during the operations phase.

- Site Economic Activity

The De Aar site seems to have been used in for crop cultivation and stock grazing in the past as several watering points can be found on the property. There are also areas which seem to be used as holding pens (kraals) for livestock. The type of livestock is unknown. Several structures that seem to be commercial or industrial in nature are also found on the southern and northern borders of the properties in question.

Loss of access to land for cultivation and grazing purposes is likely to be the main local negative economic impact that must be investigated. There appears to be possible local economic benefit due to the proposed project as well in the form of increased business opportunities that require businesses to be in close proximity to the site.

- Institutional and Legal Processes

Table 31 below provides an overview of the municipal services of the Emthanjeni area in relation to the Pixley ka Seme District and the Northern Cape Province as a whole. No data could be obtained for the overall municipal service delivery in South Africa.

Table 31: Overview of Municipal Service Delivery

	South Africa	Northern Cape	Pixley ka Seme District		Emthanjeni	
	2007		2001	2007	2001	2007
Energy Cooking	-	Electricity (77.2%)	Electricity (55.5%)	Electricity (78.1%)	Electricity (68.8%)	Electricity (89.8%)
Energy Heating	-	Electricity (64.9%)	Non-electrical (53.8%)	Electricity (58.7%)	Electricity (58.3%)	Electricity (74.5%)
Energy Lighting	-	Electricity (86.8%)	Electricity (75.4%)	Electricity (86.9%)	Electricity (83.9%)	Electricity (94.7%)
Refuse	-	Removed once a week (69.9%)	Removed once a week (68.8%)	Removed once a week (77.7%)	Removed once a week (86.3%)	Removed once a week (79.5%)
Sanitation	-	Equal or above RDP standard (81.6%)	Equal or above RDP standard (57.7%)	Equal or above RDP standard (77.7%)	Equal or above RDP standard (67.5%)	Equal or above RDP standard (92.6%)
Water	-	Equal or above RDP standard (80.3%)	Equal or above RDP standard (70.8%)	Equal or above RDP standard (90.6%)	Equal or above RDP standard (82.7%)	Equal or above RDP standard (93.2%)

Overall the municipal profile of the Emthanjeni area compares favourably to the district and the province. In 2007 the majority of households make use of electricity for cooking, heating and lighting purposes and in most instances, this is an improvement from the 2001-profile. The majority of households in Emthanjeni have access to water that is on par or above RDP standard (i.e. piped water within a 200m distance from the dwelling). The same holds true for other municipal services, i.e. sanitation and refuse services.

- Crime Profile

The Emthanjeni Municipal area is serviced by 3 police stations, one in Britstown, one in De Aar, and one in Hanover. According to the South African Police Service's website, the ratio of police officers in the Northern Cape as at September 2010 was 1 police officer for every 196 citizens. On a population size of 38 225, theoretically this means that there are approximately 195 police officers deployed throughout the area.

According to statistics supplied by the Crime Information Management Services of the South African Police Service[4], there was a steady decline in the crime rate of the area (measured against the above mentioned police stations' number of crimes reported for the years 2005-2010). For the purposes of this scoping study only crimes against the person (murder, sexual crimes, attempted murder, assault with grievance bodily harm, common assault, armed robbery and common robbery) and property-related crimes (burglary and theft) were considered. (Figure 67). below provides a general overview of the crime profile in the Emthanjeni area.

[4] http://www.saps.gov.za/statistics/reports/crimestats/2009/crime_stats.htm

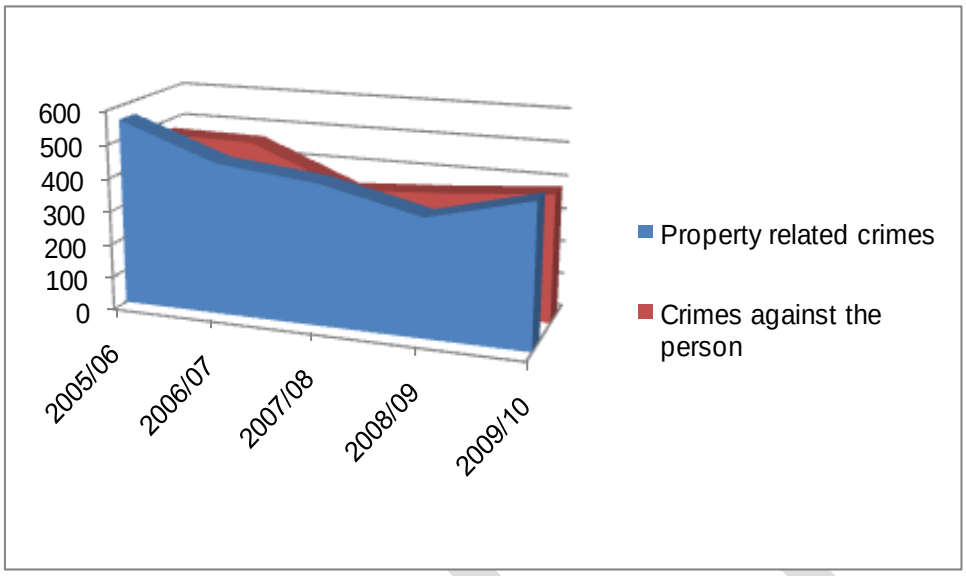

Figure 67: General Overview of the Crime profile in the Emthanjeni Municipality

During the period under review a total of 2 019 crimes against the person and 2 212 property related crimes were reported. A breakdown per police station is provided in Figure 68.

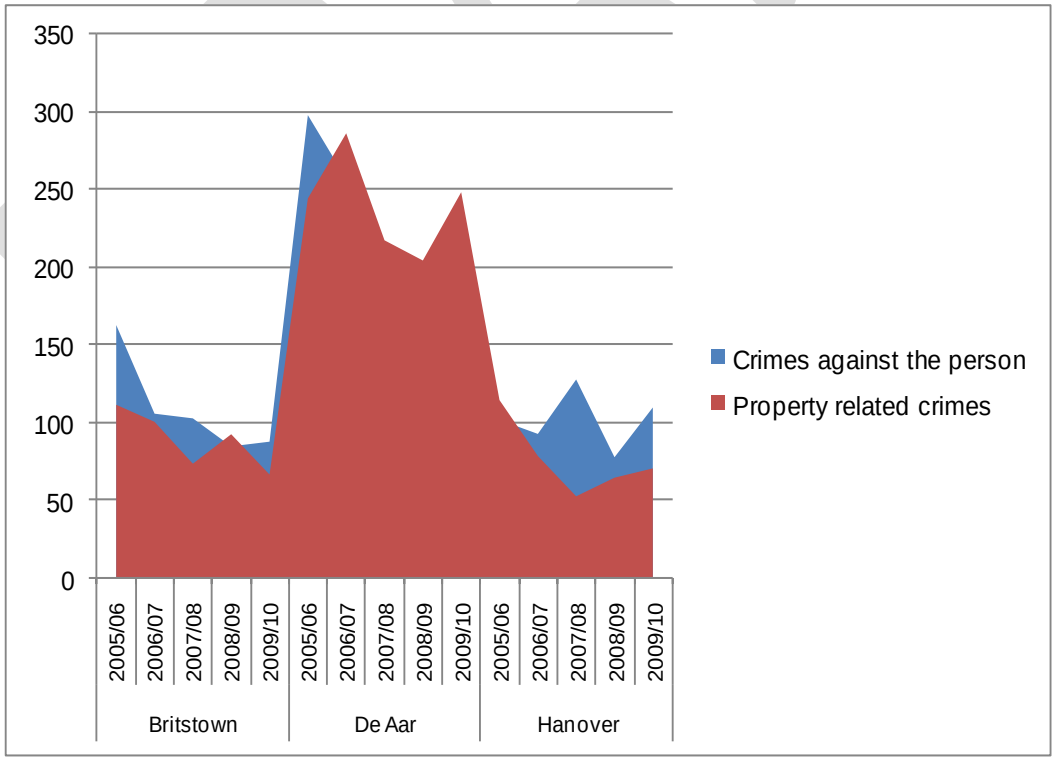

Figure 68: Crime Profile per Police Station in the Emthanjeni area

From this profile it is evident that De Aar has the highest crime rate. In all areas it seems as if the crime rate is on the decline, with the exception of Kimberley where there was an upsurge in the crime rate during the years 2008/09 and 2009/10. In general, property related crimes are much lower than crimes against the person.

According to the Emthanjeni IDP, the reduction of the crime rate within the municipality's borders remains a high priority for the municipality and its partner organisations. In this regard, the municipality is targeting specific types of crime, namely violent crimes, domestic violence, anti-social or immoral behaviour, illegal drugs and the harm caused by alcohol misuse. One of the strategies identified to reduce the crime rate is to provide alternative facilities such as leisure and sporting facilities as a means to prevent and reduce crime and anti-social behaviour.

For this purpose the municipality developed a Community Safety Plan that sets out how the municipality and its partner organisations are creating a safe and secure community by:

- Working in partnership;
- Identifying priority crimes and crime hotspots;
- Supporting sector policing; and
- Supporting the establishment and effective functioning of Street Committees in areas that experience high crime rates.

The issue is mentioned here because there is perception that crime increases in an area the moment that construction workers arrive on site. Because of this perception, occurrences of crime during the construction period are likely to be ascribed to the construction workers. This has a mental health impact, such as fear. However, it should be noted that in most instances it is not the actual construction worker who engage in criminal activities but more likely job seekers who loiter at the site in search of employment.

- Community Services

There are 6 preventative and curative health clinics in the municipal area that provide services free of charge. Three of these centres are under the jurisdiction of the municipality whereas the remaining three are operated by the provincial Department of Health. These clinics are mostly staffed by nurses who take care of screening patients. Only serious cases are referred to the doctor, of which there are 7 in De Aar. All the clinics are visited by rotating doctors on a daily basis. There is also a permanent doctor on call 24 hours a day at the Central Karoo Hospital located in De Aar. Specialists visit De Aar every 5 weeks to see patients that were referred to the specialist clinic by the community doctors. The patient load at the health clinics are estimated at around 50-80 patients per day, but it was found that patients often visit the clinics for trifling matters due to the fact that the services are free, which encourages misuse of the clinics. A new hospital is currently being constructed in De Aar in addition to the district hospital (Central Karoo Hospital). Apart from the hospital, the town has a Fire & Rescue service located in Alexander Street (approximately 2km from site).

8.7.4 Socio-Cultural Processes

As reflected in Figure 69 below, the closest towns to the De Aar site is De Aar (south and adjacent to the site), Britstown (approximately 50km west of the site), and Hanover (approximately 65km south east of the site).

Figure 69: Closest towns to the De Aar site

Brief overviews of the history of these towns are provided in the subsections below, followed by an overview of the Coloured people's, as the predominant population group in the municipal area, cultural background.

- De Aar

De Aar has a total population of 45,857 people, of which the majority are from the Coloured population group. The town houses the second-most important railway junction in South Africa, situated on the railway line between Cape Town and Kimberley. In 1899 two brothers, Isaac and Wolf Friedlander, had a trading store and hotel at this junction. Following the Anglo Boer War, the Friedlander brothers surveyed the land for the establishment of a town. A municipality was established and the first mayor, Dr Harry Baker, was elected in 1907.

The railway junction was of particular importance to the British during the Second Boer War. When the railway line was initially built, the administration bought a large part of the farm De Aar and the original plan was to name the town Brounger Junction after the general manager of the railways. The name did not survive and the town was named De Aar, a Dutch word that means “artery”, referring to the underground water supply. All the water used in De Aar is extracted from a total of 54 boreholes, mostly from Burgerville. Burgerville was a flourishing town in the early 1930s, but the town council of De Aar bought out the boreholes on which Burgerville was sited.

Present day De Aar is the main town and primary commercial distribution centre for a large area of the Great Karoo. Major production activities include wool production and livestock farming.

- Britstown

Britstown was named after Hans Brits, who accompanied Dr David Livingstone on a journey to the north. Livingstone originally came to South Africa to assist the missionary Robert Moffat at their mission at Kuruman and it was on this journey that he met Hans Brits. Shortly after, Livingstone announced his intention to travel deeper into Africa, but Brits decided against a life of exploration and returned to the Karoo. He settled on the farm Gemsbokfontein, which is where Britstown is not located. Brits arranged for a town to be proclaimed as he believed the town could serve the growing traffic along the Diamond Way with accommodation and refreshments, as well as fresh horses and fodder.

- Hanover

Hanover was established as a town in 1854 and is named after Hanover in Germany. The town is located on the farm Petrusvallei, which first belonged to a W.L. Pretorius who sold the farm in 1841 to a Jan Smook. The farm changed hands a couple of times and was finally sold to a Gert Johannes Wilhelm Gous who was the grandson of Sterren Gauche, a German who came to Africa in search of fortune. In those days local farmers travelled to Graaff-Reinet for church and communion, but eventuall petitioned the Government for a town of their own to serve as a religious, administrative and education centre.

A municipality was established with P. Watermeyer as the first elected mayor. The district boundaries were established by January 1859, the same year that the first church was completed. The first residents were instructed to build their houses parallel to the edge of the road with gardens at the back. When verandas became fashionable, these structures were allowed to encroach on the pavement, but homeowners had to pay a special tax of one shilling a year for this privilege. Modern day residents still pay this special tax, but the fee was raised to R10 in 1994. The irrigation furrows were built from The Fountain to take water to the village vegetable gardens, the system became operational in 1870 and to this day the original plots still get two irrigation turns a week, strictly according to the distribution chart that was drawn up in 1870.

The town grew rapidly and by 1881 a goal was built, although the courthouse only came in 1897. Today the original farmstead is a national monument that houses a small cultural museum that displays old bottles, clothes, glassware, kitchen utensils and implements.

- Cultural Background[5]

As reflected in the demographical profile, two thirds of the area is occupied by Coloured people. The term coloured (also known as *Bruinmense, Kleurlinge* or *Bruin Afrikaners*) refers to the ethnic group of mixed race people who possesses some sub-Saharan African ancestry, but not enough to be considered Black African under the laws of South Africa. Apart from their ancestry in sub-Saharan Africa, they also have substantial ancestry from Europe, Indonesia, Madagascar, Malaya, Mozambique, Mauritius, St. Helena and Southern Africa. In fact, genetic history studies suggest that this group has the highest levels of mixed ancestry in the world.

The coloured people of KwaZulu-Natal mostly come from British and Zulu heritage, while coloured people in neighbouring Zimbabwe mostly have a Shona or Ndebele mixing with British and Afrikaner settlers. Due to the fact that they have such a wide array of ancestry from 'naturalised' racial groups, they are referred to as 'coloured' in the southern African context. This does not mean that this racial group self-identify this way, as some prefer to call themselves 'black' or 'Khoisan' or just plainly 'South African'. Due to the historical practices of racial segregation in South Africa and neighbouring countries, governments grouped all 'mixed race' people together, which means that the apartheid government categorised this group of people under 'Coloureds'. Other ethnic groups have traditionally viewed the coloured people as a separate group. During apartheid, to maintain divisions and a race-focused society, the then government divided the main racial groups as Blacks, Whites, Coloureds and Indians.

During the apartheid era, many of the Griqua people began to self-identify as 'Coloureds' as there were certain advantages being classified as 'Coloured', e.g. Coloureds were not required to carry a *dompas*, while the Griqua, who was seen as an indigenous African group, were required to do so.

Coloured people constitute the majority of the populations of the Western and Northern Cape and mostly speak Afrikaans in the form of 'Kaapse Taal' (a creolised dialect of Afrikaans) and 'Pure Afrikaans' (formal Afrikaans).

The political rights of Coloured people varied by location and over time. During the 19th century they had similar rights to the White population, although income and property qualifications affected Coloureds disproportionately. However, in areas such as the Transvaal Republic and the Orange Free State the Coloured had few rights. The establishment of the Union of South Africa afforded Coloured

5 Information adapted from http://en.wikipedia.org/wiki/Coloured, http://www.everyculture.com/Africa-Middle-East/Cape-Coloureds-Settlement.html, http://www.everyculture.com/Africa-Middle-East/Cape-Coloureds-Kinship-Marriage-and-Family.html, and http://www.everyculture.com/Africa-Middle-East/Cape-Coloureds-Sociopolicitcal-Organization.html.

people the right to vote, but by 1930 they were restricted to elect only White representatives. In protest, they conducted various voting boycotts, which might have aided the election of the National Party in 1948 as their apartheid programme was aimed at stripping Coloured people of their already limited voting powers.

As with their Black African counterparts, Coloured people were also subject to forced removals, which lead to people being forcibly removed from traditional areas like District Six to the Cape Flats. When people were forced to move into townships and suburbs defined by the race, social problems such as alcoholism, poor health care, and a rising crime rate resulted. Not all of these negative factors have been eliminated under the new democratic system. Although Coloured people received better education than Black South Africans, their education was still inferior to that of Whites.

JG Strijdom, who was known as 'The Lion of the North' worked endlessly to further restrict the rights of Coloured people. He removed their right to vote by amending the entrenchment clause regarding the Coloured vote, known as the South African Act. Coloured people were subsequently placed on a separate voters' roll and could only elect four Whites to represent them in the House of Assembly. This decision was met with lots of resistance, amongst them the Torch Commando and the Black Sash. Many Coloured people refused to register on the new voters' roll, leading to a dramatic drop in the number of Coloured voters. During the subsequent election, only 50.2% of eligible Coloured voters voted as they had no interest in voting for white representatives, which they regarded as pointless.

In 1958 the then government established the Department of Coloured Affairs, followed by the Union for Coloured Affairs in 1959. The Union had 27 members and served as the advisory link between the then government and the Coloured people. The Constitution was reformed in 1983 to allow the Coloured and Asian minorities limited participation in separate and subordinate Houses in Parliament. This allowed the Coloured people limited rights, while their Black African counterparts were to be removed to independent homelands.

During the first democratic elections in 1994, many Coloured voters still voted for the National Party in opposition to affirmative action programmes that would give preference to non-Coloured Black people or old privileges people feared giving up under the leadership of the African National Congress. Since then the Coloured identify politics has continued to be important in areas such as the Western Cape as political parties view the area as a place where they might gain ground against the dominant ANC.

Today, the large number of Coloured people living in informal settlements and low-cost housing schemes still reflects the then government policies of racial segregation, and not one of choice or the product of culture. In the Namaqualand District, traditional Khoi mat houses can still be found where many White inhabitants chose to build in similar architectural designs.

The heterogeneous nature of the Coloured culture is reflected in the patterns of family life, kinship and marriage. For example, on the Namaqualand reserves, many families follow practices regarding descent, generation, age and sex that are recognisably Nama Khoi. The lifestyle of most middle class families in the major urban areas hardly differs from their Western middle-class family counterparts. An importance aspect of the Coloured kinship and marriage lies in people's preoccupation with class,

status and colour, which is evident in the reserve communities of the Namaqualand District where marriages are guided by preferential rules of status based on criteria such as skin colour, hair form, ethnic origin, etc. Similar patterns can be found in the urban areas, which are further complicated by indexes of association, educational achievement, political and religious affiliation, occupation and the like. Some Coloured people managed to change their racial classification to White, but this could only be undertaken successfully by higher-status people with established social networks within the White community.

Coloured people observe two main religions, namely Christianity and Islam, both of which play an influential role in the population. Religious beliefs are seen as a factor in the emergence of a strong conservative element among the Coloured people.

- Tourism

The scoping phase tourism study identified several tourism activities/ attractions mainly clustered in the town of De Aar. These include adventure and outdoor activities such as hunting, horse riding, donkey cart rides, hiking, bird watching, abseiling, paragliding and stargazing as well as a number of potential heritage/ historical attractions. Despite the presence of these potential attractions, the area is not a popular tourist destination. This is because, (as mentioned in the scoping phase tourism report), the most potential tourist attractions such as Ammunition museum, Garden of remembrance, House of Olive Schreiner, the Weather station among others are not maintained well enough to attract both local and international tourists to the area. Mr Conrad Jafta, the IDP/ LED coordinator for Emthanjeni local municipality confirmed that several heritage/ historical structures in De Aar are too poorly maintained to attract any tourists (Pers. Comm. 2011).

For example the 2010/ 2011 Emthanjeni IDP, Tourism Strategy reports on the status of some potential tourist attractions in De Aar (Creative Harvest, 2010):

- The Garden of Remembrance is currently in a state of total disrepair.
- The De Aar Town Hall needs restoration and renovation.
- The Weather Station is not well known even by the local residents.
- The House of Olive Schreiner urgently needs renovation.
- Paragliding is not popular among local residents

However, Mr Jafta added that the current draft Tourism Strategy for the Local Municipality sets out objectives which are anticipated to assist restore the heritage/ historical structures and hence tourism in the area (Pers. Comm. 2011). It is not clear at this stage how long it will take to implement the plans set out in the Tourism Strategy.

Furthermore, Mr Jafta confirmed that there are no tourists travelling along R48 which traverses the eastern portion of the study area. This road mainly leads to farmlands towards the north of De Aar. As such, no visual impacts related to tourism are expected in this portion of the study area.

All in all, considering the present status of tourism in the area and the fact that it's not clear when the plans set out in the 2011 Tourism Strategy will be implemented, the proposed CSP and CPV/ PV plants are not anticipated to have negative impacts on tourism in the general study area. Instead, the proposed development is anticipated to increase corporate demand for tourism facilities in the area.

The establishment of the solar project provides an opportunity to revive the tourism environment in De Aar. The opportunity to establish a small tourism office on the site and utilise the project as a feature to attract tourism provides a very real socio-economic opportunity. Collaboration with the Emthanjeni Local Municipality upon operation of the plant could provide a form of job creation associated with the project. .

8.7.5 Potential impacts during construction

- Demographical Changes

It is expected that the construction of the PV and CSP plants could lead to a temporary change in the number and composition of the population within the affected local area during the construction period, which in turn could lead to economic, land use, and socio-cultural change processes. In line with the results of the Scoping study, the following demographical change processes and resultant impacts were assessed:

  - Influx of construction workers; and
  - Increase in in-migration of job seekers.
  - Influx of construction workers

Table 32 below provides an overview of the estimated size of the construction team. However, the size of the team should not be confused with employment opportunities. Although the project proponent (Mainstream) endeavours to fill most of these positions with local employment, as a worse case scenario it is expected that the bulk of these positions will be filled by skilled employees appointed by the contractor. This means that a construction team consisting of a total of 750-1000 people would enter the area for a period between 24 and 30 months. It is the intention of Mainstream to follow a phased approach where the PV plant would be constructed first (entailing a construction team of 250 people), followed by the construction of the CSP plant (entailing a construction team of 500 people), as reflected below.

Table 32: Estimated employment figures for the Construction Phase

Construction Activity	**Phase 1**	**Phase 2**
PV Plant	250	0
CSP Plant	0	500
TOTAL	**250**	**500**
Employment opportunities: Women	good	good
Employment opportunities: Youth	Limited	Limited
Skills levels required	Unskilled/semi-skilled	Unskilled/semi-skilled

Ideally the project will all be conducted in one phase.

In addition to the construction team on the PV and CSP plants, another team would be active on the construction of the associated substation and power lines. This construction team is significantly smaller than the PV/CSP plant team, so that, during the height of construction there will only be 90 people on the substation site as reflected in Table 33.

Table 33: Estimated employment figures for the Construction Phase (substation)

	ESTIMATED NUMBER OF PEOPLE PER CONSTRUCTION PHASE											
On Site Activities	**Pre-Construction Phase**				**Construction Phase**							
Month	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Vegetation clearance	20	-	-	-	-	-	-	-	-	-	-	-
Bulk earthworks	-	50	50	50	-	-	-	-	-	-	-	-
Foundation team	-	-	-	-	40	40	40	-	-	-	-	-
Assembly team	-	-	-	-	-	40	40	40	-	-	-	-
Erection team	-	-	-	-	-	-	-	30	30	30	-	-
Stringing team	-	-	-	-	-	-	-	-	-	30	30	30
Commissioning team	-	-	-	-	-	-	-	-	-	-	-	-
Rehabilitation team	-	-	-	-	-	-	-	-	-	-	-	-
Management team	10	10	10	10	10	10	10	10	10	10	10	10
Subtotal	**30**	**60**	**60**	**60**	**50**	**90**	**90**	**80**	**40**	**70**	**40**	**40**

The PV and CSP plants and associated infrastructure (substation and power lines) mainly consists of electrical and non-rotating mechanical elements and therefore, in all likelihood, the contractor will bring in his own workforce – people who have the required skills, but who are normally also not from the local area. However, a construction team consists of a specified number of people (the size of the team depends largely on the type of construction required) and they enter the area with a very specific purpose. The time they spend in the area is clearly defined and often controlled as such (e.g. construction workers arrive on site in the morning and depart from the area in the evening), and due the nature of their work and the remoteness of the site, their contact with local communities during the day is expected to be limited. Once the project has been completed, construction workers who form part of a contractor's permanent workforce will move on to a next project and will seldom stay in the area. It is anticipated that although the contractor will bring his own workforce (mainly skilled), that this will be limited and that the majority of staff will be sourced locally.

- In-migration of job seekers

Unlike the regulated circumstances surrounding a construction team, the influx of job seekers is unregulated and often very difficult to control. It is also very difficult to predict how many job seekers could be expected and the extent to which they can change the size and composition of the local population, as the intensity of the effect will be influenced by the actual number of job seekers.

Given the fact that Mainstream intends to offer employment mostly to locals it is highly unlikely that job seekers who are not from the area will find employment by loitering at the construction site. Job seekers from outside the area then become a burden to the host community, as they do not have the means to sustain themselves, thereby becoming dependent on others (usually people who themselves only have limited resources). The presence of job seekers from elsewhere can also lead to the creation and/or expansion of informal settlements, as discussed elsewhere.

- Economic Changes

    - Net gain in business revenues and output due to the project

In order to build the plant and associated electricity infrastructure, goods and services must be procured both locally in the area, in South Africa and also internationally. This creates additional production, revenue streams and spending by suppliers, and eventually households across the entire economic in all sectors. This multiplier effect is often considered as important modelling tool to fully elaborate the benefits of large scale projects. New projects are therefore an economic stimulus, creating further downstream production and employment.

However, it is necessary to also consider some of the economic costs and some business revenues may also be lost due to the cessation of agricultural activities on the site. There is currently grazing of animals being conducted on a limited basis on the site. The loss in agricultural production is expected to be less than R1 million per annum (this must be verified during negotiations with the tenant).

The following table details the likely expenditure during the construction phase of the project:

Direct Procurement Expenditure	R4 billion
National Direct Procurement Expenditure (60%)	R2.4 billion
Indirect/Induced	R7.89 billion
Total New Business Revenues	R10.29 billion
Total Contribution to GDP	R2.88 billion

The project is expected to result in a direct demand for goods and services to the value of R4 billion, of which approximately 60% (R2.4 billion) will be spent on South African suppliers. During construction the purchases will mainly be in the construction and manufacturing sectors. These figures were used in a Social Accounting Matrix (SAM) model to determine the indirect and induced effects. This will result in a total (direct, indirect and induced) demand for goods (and therefore business revenues) of R10.29 billion. The total value added to the economy (measured as GDP) will be R2.9 billion.

Although the project itself is of moderate size both at a provincial level nationally and it can be seen as an important project for the local area. It is expected to create some opportunities even if the minority portion of the total construction phase expenditure will be spent on local suppliers. Due to the nature of the PV facility it is considered likely that large component of the procurement spend during the construction phase will be on overseas suppliers. For the substation use of South African suppliers is considered likely.

- Net gain in employment due to the project

The project is expected to create a limited number of job opportunities. The majority of which will be in the construction phase of the project, and there a will be an expected 750 annual job opportunities created due to the project for a duration of up to approximately one year. Conversely, a small number of job opportunities may be lost the agricultural sector due to the cessation of agriculture on the property. There will thus be an overall net gain in opportunities. The expected employment during construction is detailed below:

Measure	Construction Phase
Duration (years)	1
Direct Employment Opportunities (annual ave.)	750
Likely Employment by Skill Level	
Skilled/Highly Skilled	40%
Semi-skilled	40%
Unskilled	20%
Employment by Geographic Origin	
South African Workers	40%
Regional Workers (Northern Cape Province)	40%
Total Employment Opportunities	2644

An input-output model, adjusted for employment figures, was used to model the employment implications of the project. Considering the likely industries in which the direct employment opportunities will be created (construction and manufacturing of electrical equipment) a total of 2644 employment opportunities will be created across all industries in South Africa when the indirect and induced multiplier effects are taken into account. It is likely that 40% of these workers can be sourced within the province for employment at all levels, but particularly at the semiskilled and unskilled levels.

It must be noted that direct employment opportunities as well as the skills and location percentages were broadly estimated by the project proponent, and where no information was supplied, by the consultant. These numbers must be refined and confirmed when the feasibility study information is finalised.

- Increase in local disposable income and business revenues

An increase in revenues to local businesses and disposable income for individuals due to procurement of products and services as well as employment is expected, as local businesses and individuals will benefit from the new facility. This increase will be moderate during the construction phase and it is expected that general goods (especially consumer goods) and services such as cleaning and catering can be sourced locally during the construction phase.

- Institutional and Legal Changes

Institutional and Legal Change Processes assesses the way in which a development of this nature could change the face of service delivery in the affected area and how this change in turn could affect the quality of life of local residents. The Emthanjeni Local Municipality in its IDP has set for itself a number of goals, namely:

- Free basic service delivery to all residents should have access to sustainable free basic services.
- Provision of Infrastructure to contribute to the sustainable growth and development of the area
- Promoting the equitable creation and distribution of wealth within the municipality;
- Ensuring that all residents have a healthy environment by applying effective environmental management principles;
- The development of caring communities that promote and protect the rights and needs of its citizens, particularly the poor;
- Good governance and public participation through the efficient, effective and sustainable utilisation of resources in consultation with local communities
- Ensure communities where residents and visitors can work, live and play without threat to either themselves or their property;
- The creation of an effective, efficient, sustainable and viable municipality through sound financial management;
- Creating capacity within the municipality in meeting development objectives; and
- Contributing to a multi-sectoral response in addressing important issues that affect children, youth, women, people with disabilities, sports and recreation, eldery persons, and the HIV/AIDS issue.

In line with the Scoping study, the following institutional and legal change processes and resultant impacts were assessed:

- Displacement and/or relocation of households

As reflected in Figure 70 below, the only structures within the De Aar site appears to be structures of an industrial/commercial nature. Given the extent of the site area, it is not foreseen that these structures would have to be displaced, nor are there any residential households that would have to be relocated. The impacts associated with the displacement and relocation of households has therefore been ruled out.

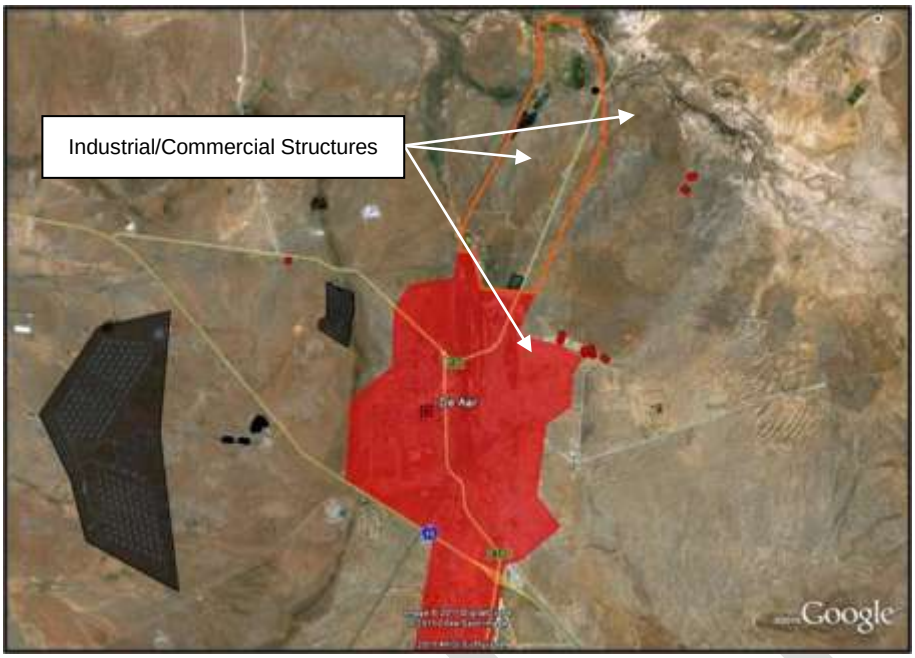

Figure 70: Location of structures on the De Aar site

- Increase in housing needs

The in-migration of a construction team consisting of approximately 840 people (worst case scenario where no local labour is sourced) will create a housing need in the Emthanjeni area (specifically in De Aar as the nearest town) and further impact on the existing housing backlog estimated at approximately 1,793 houses. The more people are sourced from the local community, the less the demand for additional housing, as local community members are already resident in the area. It is therefore of utmost importance that local labour be utilised as far as possible to negate the need for additional housing in an area that already lacks sufficient housing.

The municipality is currently in the process of drafting a Housing Policy that would clarify the municipality's stance in respect of housing delivery. It might be viable to house construction workers within the community, but that largely depends on the type of housing offered. There were projects in the past where construction workers were housed within private homes, the contractor then paid for the boarding and lodging of these construction workers at a rate of R150-R400 per person per month (MasterQ Research, 2007). If this option is implemented, it is highly recommended that the rate be increased significantly, as community members have to ensure that workers have water to drink, and that electricity is paid for (possibly through a pre-paid system). Where construction workers are housed within the local community, a few important rules has to be laid down, namely:

- No movement in the village at night.
- Be aware of alcohol abuse in the village.
- Construction workers are to be introduced to the community.
- Local shops or shebeens should be warned that they should not allow workers to buy on credit as they will be moving away after a time.

At this stage it is however unclear whether or not the whole construction team of 840 (worst case scenario, no local labour used) can be housed in private homes within the community. It might therefore be necessary to make use of a construction village for a segment of the construction team. In this regard, Table 34 overleaf provides a comparison between the different forms of accommodation for construction workers.

Table 34: Advantages and Disadvantages of the Housing Options

	ADVANTAGES		DISADVANTAGES	
ISSUE	**Local community**	**Construction village**	**Local community**	**Construction village**
Health and safety	Community is involved in matters such as HIV preventative training.	Stringent health and safety measures are in place. A Health and Safety Policy will be compiled prior to construction.	Only controlled by the contractor when workers are on site. Workers who have a disregard for their own health and safety could lead to absenteeism and a delay in the construction programme.	If not managed properly it could lead to unhygienic living conditions. A Health and Safety Policy will be compiled prior to construction.
Mobilisation	Avoid constructing a camp which takes time and effort.	Workers are accommodated at a central point which makes it easier to transport them to site.	None	None
Demobilisation	None	An exact demobilisation plan is in place. Workers clear out of the area once the project is completed.	The contractor has little control over whether or not workers leave the community once work is completed.	None
Integration with local community	Construction workers are incorporated in the local community.	The workforce represents a community of their own as they know each other, which minimises problems with outsiders.	"Outsiders" will not necessarily integrate with community. They might have a disregard for community customs, especially if workers are only in the community for a brief period. This might lead to conflict.	None
Conflict	Conflict amongst workers is probably less intense as the conflict point is dispersed.	Conflict between workers and the local community will mostly be centralised at the	Conflict can arise if workers are seen as "intruders" who take job opportunities away from the	Conflict amongst residents is more intense as the conflict point is more concentrated.

	ADVANTAGES		DISADVANTAGES	
ISSUE	**Local community**	**Construction village**	**Local community**	**Construction village**
		construction village and therefore easier to contain.	local community. Conflict points are spread over community and are not easy to contain.	
Infrastructure development	None	None	Limited sustainable development.	Infrastructure development is temporary in nature.
Local economic investment	Some resources within local community are used; local economic investment takes place. Financial benefit to local households.	Some resources within local community are used; local economic investment takes place.	Local economic investment is only temporary in nature and will be withdrawn once project is completed.	If the village is self-sustained in terms of nutrition and recreation, little or no local economic investment will take place.
Municipal services	Upgrade of sewage treatment works will benefit the local community. Lease paid to the municipality will improve revenue for service provision.	Extra load on existing municipal services is only temporary in nature.	Extra strain is placed on municipal services.	Extra strain is placed on municipal services.
Nutrition	Construction worker has to source produce from the local community, i.e. economic investment takes place. Can also create indirect job opportunities for the local community.	The contractor has control over the nutritional intake of workers. This can ensure that workers have a well balanced diet that leads to a more productive workforce.	The contractor has no real control over the nutritional intake of the construction worker.	The contractor has to budget time and money for meals.
Recreation	Construction workers might utilise recreation facilities in the	Provided for at construction village. Prevents absenteeism of	Misuse of recreational facilities might lead to conflict with	Misuse of recreational facilities might lead to conflict with fellow

	ADVANTAGES		DISADVANTAGES	
ISSUE	**Local community**	**Construction village**	**Local community**	**Construction village**
	local community, i.e. economic investment takes place.	workers who do not return to camp after a night out.	members of the local community.	construction village residents.

The IDP has identified an informal settlement in De Aar consisting of 127 shacks. An influx of unemployed works seekers can hasten the expansion of this settlement giving rise to numerous other problems. The following quote was taken from People and Places: An overview of Urban Renewal by Engelbrecht (2004), and describes the poor socio-economic conditions in informal settlements, how these conditions give rise to further degradation of its residents' quality of life and social well-being, and how it affects neighbouring areas.

"Informal settlements are often located on marginal land subject to environmental degradation and hazard. The unplanned nature, poor design and incremental growth of informal settlements complicates conventional service provision. Residents often lack basic educational qualifications, and are typically dislocated from the surrounding labour market... The informal nature of settlements, and particularly the absence of formal, demarcated roads and access points creates opportunities for the operation of illegal activities by criminal syndicates, whilst the youthful, unemployed and male demographic profile of informal settlements leads to the emergence of gangs and high levels of violent crime. The extreme social conditions, high unemployment and the absence of social amenities exacerbates social stress, which often manifests in domestic violence, rape and child abuse. The explosion of crime within informal settlements is exacerbated by the institutional vacuum created by the lack of political will and absence of sufficient, effective, and credible policing within informal settlements areas. Exclusion, unemployment, and poverty have created environments in which residents have lost their self-esteem, pride, and human dignity."[6]

The more an informal settlement continues to grow, the more socio-economic conditions will continue to deteriorate (with more people trying to access the same amount of limited resources), and the more the quality of life of other local (neighbouring) residents will be affected. However, restricting the influx of job seekers and the associated expansion of existing informal settlements is a mammoth task and often beyond the contractors' control.

- Additional demand on municipal services

Additional municipal services (such as water, sewage and waste removal) will be required at the construction site(s) and the construction village during the construction phase. According to the IDP, De Aar has a fully developed primary infrastructure that can handle the current as well as additional demand of approximately 3 MVA. However, the maintenance of electrical infrastructure has fallen behind due to a lack of funds, equipment and expertise. The IDP regards this scenario as a serious thread that should be addressed with urgency.

De Aar is dependent on groundwater for their water supply, in the form of 55 boreholes. These boreholes are scattered around the town in all directions with the furthest lying approximately 35km from town. Most of the boreholes are located on private farms and is purchased from these farmers at prices ranging from 17c to 40c per kilolitre. No water purification is done in De Aar.

[6] http://www.sacities.net/2004/UrbanRenewalPart2.pdf

De Aar has one landfill site, which is not authorised in terms of Section 20 of the Environment Conservation Amendment Act, 2003. It is, however, in the final stages of being authorised. According to the IDP the disposal site should be upgraded to comply with the minimum requirements for Waste

Disposal by Landfill. An operational plan for the De Aar landfill site has been completed and submitted to the Department of Environmental Affairs (DEA) that should be implemented to ensure the continuation and development of the site. Currently the municipality does not have sufficient equipment for delivering an effective refuse removal service as some of the waste collection vehicles are old and in a poor condition.

The sewerage plant in De Aar is currently within its prescribed limits of its permit. The permit states that purified water should be used for irrigation, which is currently not the case. The IDP states that the likelihood of polluting the nearby boreholes on Paardevlei is highly unlikely but that preventative measures should nonetheless be implemented to preclude the possibility. No studies have been done on the pollution risk on the nearby Brak River.

- Risk for social mobilization

Attitudes are formed by means of people's take on a specific issue, coupled with their past experiences associated with either the issue itself or, more likely, the way it has been dealt with by those responsible for creating the situation in the first place. A person's attitude towards a certain issue or situation can strongly influence the way in which that person views subsequent issues/situations of a similar nature. If local residents are unsupportive of either the proposed project in question or of the project proponent, it could lead to social mobilisation.

The risk for social mobilisation greatly increases if the project proponent is perceived as distrustful, i.e. if they do not deliver on their undertakings with the local residents in terms of employment creation, etc. To ensure support of the project and reduce the risk of social mobilization, the project proponent should at all times be seen to care about the residents of especially De Aar as the closest formal human settlement that will be affected by the construction and operation of the proposed PV and CSP plants. At this stage Mainstream Renewable Power has a 'clean slate' in the area, but to maintain a trusting relationship, residents need to feel that they receive some tangible benefits from the project, e.g. direct and/or indirect employment. The undertakings and mitigation/enhancement measures stipulated in the Environmental Management Plan (EMP) should be implemented effectively and with due diligence to show local residents and affected populations that their needs are important and catered for.

A number of I&APs have indicated that they expect that any job opportunities would be primarily afforded to them before such positions are advertised on an open market outside the borders of the local area. Although the risk for social mobilisation at this stage of the project is regarded as low, the situation can easily change if the needs of local residents are disregarded. If social mobilisation does occur, it could not only severely delay the construction process, but also lead to intense conflict situations that ultimately affect social well being.

- Socio-Cultural Changes

As socio-cultural processes recount the way in which humans behave, interact, and relate to each other and their environment, socio-cultural change processes in turn looks at the way in which the proposed developments can alter the interactions and relationships within the local community. In line with the results of the scoping study, conflict situations are the most important socio-cultural change process that was assessed. In addition to the Scoping study results, health and safety has been identified as an additional socio-cultural change process during the construction phase.

- Conflict

Dissimilarity in social practices refers to the different values, social standards, religious believes, etc. that there might exist between a large group of newcomers to town (such as a construction team) and that of its residents. In theory the existence of two groups with different social practices living alongside each other should not in itself be a cause for concern – it is when the one group attempts to exert power over the other group or where different cultural values are not respected, that conflict situations arise. Such conflict situations can often turn violent.

Conflict can take place on multiple levels. Firstly, inter-conflict between the construction workers and the local community in terms of job opportunities, and where the local community perceives the construction workers as competing for housing opportunities. Secondly, intra-conflict between construction workers themselves in terms of housing offered, and potentially in terms of salary packages. In a construction village conflict might be more intense due to the concentrated living and working conditions of the construction workers. Apart from these conflict situations, conflict might also exist between the local community and the project proponent, as discussed under “Risk for Social Mobilisation”.

- Health and Safety

In this context health and safety impacts focus mainly on the spread of certain sexually transmitted infections (STI), including HIV/AIDS. It is not uncommon for construction workers who are separated from their families for a period of time to establish temporary sexual relationships with members of the local community. It can also be expected that sex workers might visit the construction workers at their place of residence. The spread of STI and HIV then becomes a matter of great concern, also in view of the light that construction workers move out of the area into another area where the spread of these STI and HIV continues. To ensure that the project’s HIV preventative programmes are not counterproductive, it is important to take note of the Emthanjeni Municipality’s HIV policy in which the following strategies are emphasised:

- An effective information, education and communication strategy;
- Ensuring the accessibility and acceptability of voluntary testing and counselling (VTC) to all employees and the local community;
- Improved STI management and increased levels of condom distribution;
- Providing a support system for all who are infected or affected by HIV;

- A strategic plan that focuses on the following key areas:
    - Prevention;
    - Treatment, care and support;
    - Human and Legal rights; and
    - Monitoring and research.

Also included under health and safety is the quantity and quality of the water supply and sanitation services. If these services are inadequate and/or not managed properly, it could lead to waterborne diseases and unhygienic living conditions. These conditions will not only affect the construction workers, but can also spread to the local community, more so in the event of a construction village that is not managed properly.

A further consideration under health and safety is the perception amongst local communities (landowners) that the presence of construction workers leads to an increase in crime levels. However, it should be noted that it is most likely not the actual construction worker who engage in criminal activities but more likely job seekers who loiter in the area or at the construction site.

8.7.6 Potential impacts during operation

- Geographical Changes

The identification and assessment of social impacts arising from geographical change processes within a social context, focuses on how the proposed development might impinge on the behaviour and/or lives of landowners and/or land users in the affected area. In line with the results of the Scoping Report, the following geographical change processes and resultant impacts were assessed:

    - Sterilisation of Agricultural Land

De Aar has commonage area that is leased on a monthly basis, all of which is available to emerging farmers. However, the municipality is still in the process of placing these farmers, and as such there seems to be a level of confusion in terms of which farmer has been allocated which land parcel. Although the municipality is providing the land to emerging farmers, the municipality has indicated in their IDP that more interventions are required to effectively assist emerging farmers. In this regard the municipality has also applied for additional land from the Department of Rural Development and Land Reform as a result of the demand for commonage areas. However, Mainstream currently have a lease agreement in place with the Emthanjeni Municipality and therefore the assumption is that the site portion is excluded from the commonage area. Also, according to the municipality's Spatial Development Framework (SDF, 2007) the area earmarked for current and future agriculture land use within town is located approximately 5km south of the site on the existing agricultural holdings, as reflected in Figure 71 below.

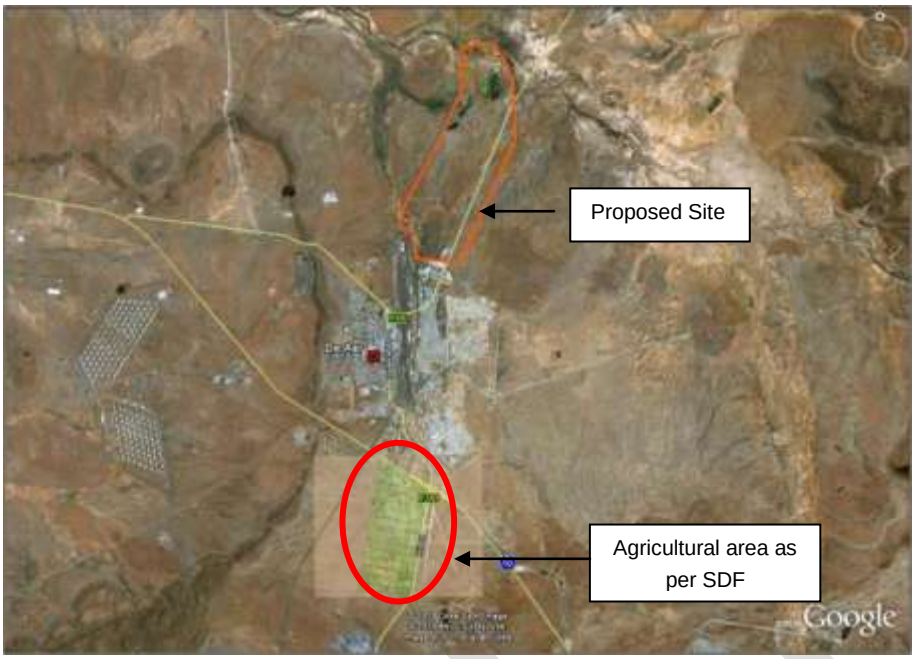

Figure 71: Agricultural land use in De Aar

Therefore, as far as could be determined there is also no agricultural activities taking place within the site area and therefore the sterilisation of agricultural land has been ruled out. As such a possible change in access to resources that sustain livelihoods has also been negated.

- Permanent Loss of Land

The development spatial trend in De Aar is largely focused on the new hospital and its associated development opportunities. The area is also experiencing an increasing demand for smaller housing units such as townhouse complexes. The following figures indicate the current and future land uses in De Aar, as per the SDF (2007).

Figure 72: Future Residential development areas

Although none of these areas affect the site directly, it does bring areas of human settlement in closer proximity to the site.

Figure 73: N10 Nodal Development

The municipality intends to develop the N10 as development corridor between Britstown, De Aar and Hanover. A business nodal development has been identified alongside the N10 where it runs through De Aar, along with a business sector alongside Van der Merwe Street where it links with the N10. This

development is largely centred on the new hospital that will be located on the N10 corner of Van der Merwe Street. The presence of the railway line prohibits the town from integrating fully and therefore the focus of development has been shifted to the N10 as it is believed that this would give the whole community the opportunity to obtain land. It is not foreseen that the proposed site would impact on this nodal development, but rather that the presence of the PV and CSP plants could potentially trigger business development along this corridor.

Figure 74: Future Industrial Development

The location of future industrial areas directly affects the site as it takes up a good portion of the southern section of the site. It is unclear how far into the future this demarcation is planned for as no development has taken place in this area apart from the main road leading into the area (Springbok Road that turns off the R48). The municipality is furthermore well aware of the proposed PV/CSP project as they were not only informed of the development via the public participation process, but also due to the fact that they, as landowners, are leasing the land to Mainstream. At this stage the implication of the planned industrial area on the site is unclear because the intention of the municipality with demarcating this area as industrial is not known. However, if the municipality does proceed with proclaiming the area as industrial, it could lessen the impact on sense of place as the presence of the PV and CSP plants would be in line with the industrial nature of the area and surrounding businesses.

Another area of the SDF that can influence the utilisation of the site is the municipality's future sport, open spaces, recreational areas and cemeteries, as reflected in Figure 75 below.

Figure 75: Existing and future sport, open spaces, recreational areas and cemeteries within De Aar

It is unclear what the area within the site will be utilised for. In all events, the nature of this impact would largely be of an economic nature and as such has been assessed in the Economic section of this report.

- Demographic Changes

As per information received from the project proponent, Mainstream Renewable Power, the operational staff component will consist of approximately 80 people. On a total population size of 26,019 people, this would represent a population increase of approximately 0.3%, which would largely be negligible. However, if the assumption is made that these would not be single households but rather families consisting of an average of 4 people (2 adults and 2 children), the indirect operational staff component could be as high as 320 people for which housing and other services (medical, education, etc.) would be required. This would also increase the population growth rate as a result of the project from 0.3% to 1.2% in addition to the natural average population growth rate of 1.3% per annum. This again would impact on housing and other services. Mainstream have indicated that they intent to employ local labour as far as possible, but this would mostly be unskilled to semi-skilled positions, constituting an estimated 30 positions for the PV Plant and 30-40 for the CSP Plant as reflected in Table 35 below.

Table 35: Estimated number of people required for Unskilled/Semi-skilled positions

		Panel Cleaning	Land Maintenance & Fire Protection	Security Services	Technical Experts
PV	**Potential employment**	10-12 cleaners, 1 team leader	4-5 garden service, 1 team leader	7-8 guardsmen, 1-2 backup response guards, 1 team leader	3
	Women	Yes	Possible	Limited	
	Youth	Yes	Possible	Limited	
	Skills level	Unskilled/semi-skilled	Unskilled/semi-skilled	Unskilled/semi-skilled	
	Sustainable	20 years +	20 years +	20 years +	
	Growth potential	High	High	High	
	Enterprise development	Yes, with SEDA	Yes, with SEDA	Yes, with SEDA	
	Upskilling	Team leader, via SEDA	Team leader, via SEDA	Team leader	
CSP	**Potential employment**	20 cleaners, 1 team leader	10 garden service, 1 team leader	7-8 guardsmen, 1-2 backup response guards, 1 team leader	3
	Women	Yes	Possible	Limited	
	Youth	Yes	Possible	Limited	
	Skills level	Unskilled/semi-skilled	Unskilled/semi-skilled	Unskilled/semi-skilled	
	Sustainable	20 years +	20 years +	20 years +	
	Growth potential	High	High	High	
	Enterprise development	Yes, with SEDA	Yes, with SEDA	Yes, with SEDA	
	Upskilling	Team leader, via SEDA	Team leader, via SEDA	Team leader	

- Economic Changes

- Net gain in business revenues and output due to the project

In order to operate the plant and associated electricity infrastructure, goods and services must be procured both locally in the area, in South Africa and also internationally. This creates additional production, revenue streams and spending by suppliers, and eventually households, creating a multiplier effect. New project are therefore an economic stimulus, creating further downstream production and employment.

The following table details the likely expenditure during the operations phase of the project:

Direct Annual Procurement Expenditure	R90 million
National Direct Procurement Expenditure (90%)	R81 million
Indirect/Induced	R277.85 million
Total New Business Revenues	**R358.85 million**
Total Contribution to GDP	**R132 million**

The project will result in moderate economic benefits during the operations phase due to the modelled expenditure levels. A direct annual expenditure of R90 million in the electricity industry will translate into R359 million total expenditures across all industries in South Africa. If a significant portion of this is spent on local suppliers the impact may be felt to a substantial degree in local communities. It is likely that local community expectations regarding longer term economic benefits of the project need to be managed carefully.

- Net gain in employment due to the project

The project is expected to create a limited number of job opportunities and there a will be an expected 80 annual job opportunities created due to the project for a duration of up to 15 years. The expected employment during operations is detailed below:

Measure	**Operations Phase**
Duration (years)	15
Direct Employment Opportunities (annual ave.)	80
Likely Employment by Skill Level	
Skilled/Highly Skilled	50%
Semi-skilled	15%
Unskilled	15%
Employment by Geographic Origin	
South African Workers	50%
Regional Workers (Northern Cape Province)	50%
Total Employment Opportunities	**280**

An input-output model, adjusted for employment figures, was used to model the employment implications of the project. Considering the likely industries in which the direct employment

opportunities will be created (electricity generation) a total of 280 employment opportunities will be created across all industries in South Africa when the indirect and induced multiplier effects are taken into account. It is likely that 50% of these workers can be sourced within the province for employment at all levels, but particularly at the semiskilled and unskilled levels.

It must be noted that direct employment opportunities as well as the skills and location percentages were broadly estimated by the project proponent, and where no information was supplied, by the consultant. These numbers must be refined and confirmed when the feasibility study information is finalised.

- Enabling economic growth through the removal of electricity supply constraints

One of the economic implications of the project is to assist in ensuring electricity security for the country as a whole. As was demonstrated at the beginning of 2008 electricity is a strategic economic issue, and the project will contribute to a more stable energy supply situation. There are several aspects to this:

Lack of electricity supply is an inhibitor that hampers economic growth;

- A surplus of electricity capacity presents an opportunity for revenue in the short term and further economic growth in the future; and
- Fully utilised electricity capacity represents a dependency, meaning that its removal will create a reduction in the economic activity for which is an enabler.

This impact is difficult to rate using the standardised rating scale due to its nationwide implications and the fact that it does not represent a manageable or impact or one that can be enhanced.

- Increase in local disposable income and business revenues

An increase in revenues to local businesses and disposable income for individuals due to procurement of products and services is expected, and local businesses will still benefit from the new facility. This increase will be moderate during the operations phase as a large portion of goods and services are likely to be sourced from outside the area. It is expected that general goods and services such as cleaning and catering can be sourced locally. This is likely to increase during the lifetime of the project as local industries adapt to supply the needs of the project.

- Increased revenue for national and local authorities

The project will require access to utilities from local authorities resulting in revenue for local government. Also, if land is rezoned for the development increased property taxes will apply. Furthermore, if revenues are generated tax payments will be made to national government adding to its revenue streams. In all three cases the impact on local and national government finances will be small, as the project does not have major resource needs and does not require extensive supporting infrastructure.

- Institutional and Legal Changes

The most significant change processes during the operation and maintenance phase relate to an increase in housing needs/demands and the Corporate Social Investment (CSI) that the project proponent would bring to the area.

- Increase in housing need/demand

The most important change process is that an additional 80 people would require housing in an area that already has a housing backlog (cf. IDP, 2010). A rural town like De Aar would have a limited property market and therefore finding suitable accommodation for 80 families might prove difficult. However, as per the figure above, the municipality has set aside a significant number of portions for future residential development, including dense housing developments (townhouses). Depending on the timing of the project and how it coincides with the housing developments in De Aar, this impact may be entirely negated. However, as the timing of the housing developments is not known, the potential increase in housing needs/demands has been assessed based on a worst case scenario where the current situation prevails in terms of the housing backlog in De Aar.

- Corporate Social Investment

The goal of any CSI programme is for the project proponent to recognise their responsibilities in terms of their actions by bringing about positive change through its activities in the environment and on consumers, employees, communities, stakeholders and all other members of the public sphere. A company that implements a CSI programme aims to proactively promote the public interest by encouraging and supporting growth and development in their area of operation, and by eliminating practices that harm the public sphere, regardless of such actions' legality. In this regard, Mainstream have identified a Youth Skills Development Programme as part of its CSI. At the time of the study, the programme was not finalised but served as an indication of what Mainstream aims to plough back into the affected community. The youth skills development initiative would mostly entail training in the following fields:

Table 36: Youth Skills Development Initiative

TOTAL TRAINEES	**14**
Electrical artisans	4
Boilermakers	4
Welders	2
Electrical Technicians	2
Recruitment priorities	1
Placement priorities	1

In addition to the Youth Skills Development Initiative, Mainstream also indicated that their aim is to benefit and enhance job creation for the local community as a priority. In this regard they will set specific targets on how much labour will be utilised based on the needs for the project, the existing skills in the community, and the degree to which people are willing to undergo training. Where possible, opportunities for training unskilled and semi-skilled workers from the local community will be maximised. Mainstream also intends to make use of local sub-contractors where possible and in the event that contractors from outside the area is appointed, they will be required to make use of local labour as far as possible (bearing in mind the skills levels required).

Mainstream aims to enhance local community benefits with a focus on Broad-based Black Economic Empowerment through mechanisms such as community beneficiation and a Trust. In line with the Department of Trade and Industry's guidelines, up to 4% of after tax profit will be ploughed back into the local community for use on socio-economic and enterprise development initiatives.

At the time of study, Mainstream indicated that they would only be able to draft proposals regarding targets for jobs and training once they had a better idea of who the contractor(s) will be and what their capacities are. These proposals might include targets such as (1) the percentage of the total construction value that has to go into local contractors, and (2) the percentage of total labour requirements that should be afforded to local labour. However, it is important to note that, due to the skills levels required, material and other sub-contractors will have to come from outside the area with a high portion of international imports (specifically materials).

Mainstream (SA) is also in the process of establishing a Trust whereby the community owns 6%of the project. They will vendor fund this equity, whereas the community will be beneficiaries. The trust will provide revenue for the next 20 years or more. The dividend from the Trust will be spent on energy, agriculture and enterprise development, with the aim to advance local development needs. The Trust will be in addition to the 4% after tax profit, but the Trust may be used as a delivery mechanism for this revenue stream. Possible projects will be identified in collaboration with the Trustees, the Emthanjeni Municipality and appropriate community representatives to ensure that projects are aligned with the key needs identified in the IDP.

In terms of employment and procurement:

i. Mainstream will establish a recruitment and procurement policy that will set out reasonable targets for the employment of South African and/or local residents/suppliers and that will promote the employment of women as a means of reducing gender inequality. Criteria will also be set for prioritising, where possible, local residents/suppliers over regional, provincial or national people/suppliers. All contractors will be required to recruit and procure people and services in terms of Mainstream's recruitment and procurement policy.
ii. Mainstream undertakes to work closely with the relevant authorities, community representatives and organisations to ensure that the use of local labour and procurement is maximised.
iii. Mainstream will work closely with suppliers to provide the requisite training to workers, with a special focus on the development of local skills.

iv. Mainstream will ensure that the appointed contractors and suppliers have access to health, safety, environmental and quality training as required by the project. It is believed that this will help to ensure that contractors and suppliers have future opportunities to provide goods and services to the sector.
v. Mainstream, together with its appointed contractors, will develop an induction programme that will include a Code of Conduct for all workers directly related to the project. A copy of the Code of Conduct will be presented to all workers and signed by each person.
vi. Mainstream will implement a grievance procedure that is easily accessible to local communities where they can lodge complaints related to the contractor or employee behaviour.
vii. Mainstream and its contractors will develop and implement a HIV/AIDS policy and information document for all workers directly related to the project.

- Socio-Cultural Changes

The most important socio-cultural change during the operation and maintenance phase relates to a change in sense of place.

- Sense of Place

Much of what is valuable in a culture is embedded in place, which cannot be measured in monetary terms. It is because of a sense of place and belonging that some people loath to be moved from their dwelling place, despite the fact that they will be compensated for the inconvenience and impact on their lives. Throughout De Aar small sections of vacant land has been identified that will be used for the integration and development of the town, although the presence of the railway line prohibits the town to integrate completely.

Research on the psychological experience of sense of place suggests that people rapidly discount a landscape as soon as the first scar occurs, rather like a stain ruining a favourite garment. Thereafter, any additional impacts on the landscape have a correspondingly smaller effect. Hence, the aesthetic impact of placing the CSP and PV Plants in a landscape that already bears the marks of development would be less than that of placing it in a relatively unspoilt environment. As reflected above, the SDF of the Emthanjeni Municipality indicated that a large section of the southern part of the site would be utilised for industrial development in future. The placement of the proposed CSP and PV plants within this area is therefore in line with the municipality's intention for this area, even though the area is currently largely a greenfields area.

The potential impact on socio-cultural behaviour and the related perception of environmental changes can have either a positive or a negative impact on sense of place (e.g. peace of mind vs. frustration/anger). The introduction of a new project to the area can be viewed as a positive impact if people perceive the project as infrastructural and/or economic development that is not intrusive on their lives and do not cause them immediate danger. Potential negative impacts include the visual impact and the resultant intrusion on sense of place.

8.8 Geology

The geotechnical assessment is included in Appendix 6H. The geotechnical assessment has illustrated that no major blasting activities will be required and that generic bulk earthworks will be sufficient for the proposed development. Foundations will be shallow and hence the impact on geology has not been rated.

Site gradients are generally less than 2 degrees. Gradients are steeper along local ridges notably at the south of the site. If necessary the level of these ridges can be reduced using large excavators (>25t) with rock breaker attachments. Investigations on the site revealed that the ridge comprises boulder size sandstone bedrock that can be partly reduced by excavation. The use of blasting is unlikely to be necessary.

Based on the trialpit results bedrock is encountered at a shallow depth across the site. The bedrock is loose at the near surface, increasing in competence with depth. It can reasonably be assumed that the safe bearing capacity at a depth of generally less than 0.5m below ground level is in excess of 500kN/m2 and shallow spread foundations can be safely used at all potential power block positions. Depending on the relative elevations across the Power Block, some rock breaking is expected to be required.

At some locations where bedrock is near the surface (notably on a ridge at the south of the site) breaking of bedrock using a rock breaker attached to an excavator should be possible (blasting unlikely to be necessary).

The ground conditions present are suitable for a number of PV foundation types. There are no permanently soft ground conditions present. Bedrock suited to anchoring is present at relatively shallow depth.

8.9 Stormwater

The full stormwater management plan is included as Appendix 6I.

Stormwater management has been identified as a mitigation and has thus not been rated in the impact assessment section below. The report will be included in the EMPr. This report is included in Appendix 8.

The farm area is divided into three drainage areas by way of minor ridge lines. The ridge lines originate in the south east corner of the site and run in two directions. The first ridge line, runs towards

the north western boundary and the other towards the western boundary, the resultant being three separate drainage areas;

The northern drainage area will drain towards the north west, whilst the central drainage zone will drain in a westerly direction and the southern drainage area will drain towards the west. It is the intention to develop the site as proposed and therefore all three drainage areas will need to be assessed.

8.9.1 Plant Drainage

The planned development will house both a CSP Plant and a PV Plant. The Technical Description[7] indicates that each plant has different requirements in terms of natural vegetation and therefore different stormwater management requirements will be adopted.

The PV plant includes inter alia that the natural vegetation of the site is to remain and that only the large trees/shrubs should be removed. Furthermore, that the PV panels will be mounted on a central pivot structure, above the natural vegetation. The pivot structures will be supported on shallow spread foundations and therefore no bulk earthworks is required.
However, the CSP Plant includes inter alia that the area be graded free of the natural vegetation with the possibility of a stepped terrace, dependant on the slope of the land.

The PV Plant will not require any bulk earthworks; therefore we believe that minimal stormwater measures will be required. Furthermore, it should be noted that the Mean Annual Precipitation (MAP) for the De Aar area is ±303mm/year8 which further substantiates the minimal need for stormwater management with natural vegetation intact.

The CSP Plant however, requires that the area be graded which will involves bulk earthworks in order to construct terraces. Additional stormwater management will include stormwater channels and chutes so as to minimize erosion.

The proposed stormwater measures for both the PV Plant and the CSP Plant will include the draining of each drainage area by means of suitably sized grass lined earth channels positioned within the proposed road reserves, gravitating towards the identified detention areas, where accidental oil spills and/or stormwater will be attenuated in order to deposit any transported sediments and reduce the flow velocities. Furthermore, for the areas where terraces are required, such as the CSP Plant, additional earth channels above each terrace is proposed to avoid stormwater running down slopes causing possible erosion. These channels will incrementally discharge into the channels located within the road reserve.

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[7] SiVEST EIA – Technical Description

[8] Design Rainfall and Flood Estimation in South Africa by JC Smithers & RE Schulze

8.9.2 Road Drainage

The description of the required roads as indicated in the Technical Description are gravel roads, both for the main access road to the plant and for the internal road network between the PV panels / troughs. It is our recommendations that both the access road and the internal roads be graded and shaped with a crossfall towards the high side of the road reserve, allowing stormwater to flow into graded channels adjacent and parallel to each road, and gravitate towards the natural drainage lines i.e. rivers & streams.

Where these road networks cross defined drainage lines, we suggest the installation of a suitably sized culvert to accommodate the major storms. The discharging of stormwater through culverts must include energy dissipaters at the exits to reduce any possible chances of erosion.

Stormwater channels that channel stormwater incrementally from the troughs will occasionally cross internal access roads. Concrete lined, Low level causeways should be constructed to reduce any erosion to the roads in these areas.

8.10 Water Use License

In terms of the National Water Act, 1998 (Act No. 36 of 1998) the proponent will require a Water Use License (WUL) for the following activities:

Form number	Application form	Description
DW758	Registration	Registration of Water Use
DW760	Section 21a	Taking water from a water resource
DW762	Section 21b	Storing water - Dam Registration

Consultation has been undertaken with the Department of Water Affairs (DWA) and they accompanied the team on the site visit on the 15th of February 2011. Once the Environmental Impact Assessment has been completed and should the proponent receive authorisation to proceed, an application for the WUL will be made to the DWA. A technical report will accompany this document. All registered Interested and Affected Parties will afforded an opportunity to review this document. The WUL has been included in adverts in the EIA process and was included in the EIA Newsletter.

9 ENVIRONMENTAL IMPACT ASSESSMENT

9.1 Methodology for Impact Assessment

The EIA Methodology assists in evaluating the overall effect of a proposed activity on the environment. The determination of the effect of an environmental impact on an environmental parameter is determined through a systematic analysis of the various components of the impact. This is undertaken using information that is available to the environmental practitioner through the process of the environmental impact assessment. The impact evaluation of predicted impacts was undertaken through an assessment of the significance of the impacts.

9.1.1 Determination of Significance of Impacts

Significance is determined through a synthesis of impact characteristics which include context and intensity of an impact. Context refers to the geographical scale i.e. site, local, national or global whereas Intensity is defined by the severity of the impact e.g. the magnitude of deviation from background conditions, the size of the area affected, the duration of the impact and the overall probability of occurrence. Significance is calculated as shown in Table 38.

Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The total number of points scored for each impact indicates the level of significance of the impact.

9.1.2 Impact Rating System

Impact assessment must take account of the nature, scale and duration of effects on the environment whether such effects are positive (beneficial) or negative (detrimental). Each issue / impact is also assessed according to the project stages:

- planning
- construction
- operation
- decommissioning

Where necessary, the proposal for mitigation or optimisation of an impact should be detailed. A brief discussion of the impact and the rationale behind the assessment of its significance has also been included.

- Rating System Used To Classify Impacts

The rating system is applied to the potential impact on the receiving environment and includes an objective evaluation of the mitigation of the impact. Impacts have been consolidated into one rating. In assessing the significance of each issue the following criteria (including an allocated point system) is used:

Table 37: Description of impact classification

NATURE		
Include a brief description of the impact of environmental parameter being assessed in the context of the project. This criterion includes a brief written statement of the environmental aspect being impacted upon by a particular action or activity.		
GEOGRAPHICAL EXTENT		
This is defined as the area over which the impact will be expressed. Typically, the severity and significance of an impact have different scales and as such bracketing ranges are often required. This is often useful during the detailed assessment of a project in terms of further defining the determined.		
1	Site	The impact will only affect the site
2	Local/district	Will affect the local area or district
3	Province/region	Will affect the entire province or region
4	International and National	Will affect the entire country
PROBABILITY		
This describes the chance of occurrence of an impact		
1	Unlikely	The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).
2	Possible	The impact may occur (Between a 25% to 50% chance of occurrence).
3	Probable	The impact will likely occur (Between a 50% to 75% chance of occurrence).
4	Definite	Impact will certainly occur (Greater than a 75% chance of occurrence).
REVERSIBILITY		
This describes the degree to which an impact on an environmental parameter can be successfully reversed upon completion of the proposed activity.		
1	Completely reversible	The impact is reversible with implementation of minor mitigation measures
2	Partly reversible	The impact is partly reversible but more intense mitigation measures are required.
3	Barely reversible	The impact is unlikely to be reversed even with intense mitigation measures.
4	Irreversible	The impact is irreversible and no mitigation measures exist.

IRREPLACEABLE LOSS OF RESOURCES		
This describes the degree to which resources will be irreplaceably lost as a result of a proposed activity.		
1	No loss of resource.	The impact will not result in the loss of any resources.
2	Marginal loss of resource	The impact will result in marginal loss of resources.
3	Significant loss of resources	The impact will result in significant loss of resources.
4	Complete loss of resources	The impact is result in a complete loss of all resources.
DURATION		
This describes the duration of the impacts on the environmental parameter. Duration indicates the lifetime of the impact as a result of the proposed activity		
1	Short term	The impact and its effects will either disappear with mitigation or will be mitigated through natural process in a span shorter than the construction phase (0 – 1 years), or the impact and its effects will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).
2	Medium term	The impact and its effects will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).
3	Long term	The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 50 years).
4	Permanent	The only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered transient (Indefinite).
CUMULATIVE EFFECT		
This describes the cumulative effect of the impacts on the environmental parameter. A cumulative effect/impact is an effect which in itself may not be significant but may become significant if added to other existing or potential impacts emanating from other similar or diverse activities as a result of the project activity in question.		
1	Negligible Cumulative Impact	The impact would result in negligible to no

		cumulative effects
2	Low Cumulative Impact	The impact would result in insignificant cumulative effects
3	Medium Cumulative impact	The impact would result in minor cumulative effects
4	High Cumulative Impact	The impact would result in significant cumulative effects

INTENSITY/ MAGNITUDE		
Describes the severity of an impact		
1	Low	Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.
2	Medium	Impact alters the quality, use and integrity of the system/component but system/ component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).
3	High	Impact affects the continued viability of the system/ component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.
4	Very high	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component permanently ceases and is irreversibly impaired (system collapse). Rehabilitation and remediation often impossible. If possible rehabilitation and remediation often unfeasible due to extremely high costs of rehabilitation and remediation.

SIGNIFICANCE

Significance is determined through a synthesis of impact characteristics. Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. This describes the significance of the impact on the environmental parameter. The calculation of the significance of an impact uses the following formula:

(Extent + probability + reversibility + irreplaceability + duration + cumulative effect) x magnitude/intensity.

The summation of the different criteria will produce a non weighted value. By multiplying this

value with the magnitude/intensity, the resultant value acquires a weighted characteristic which can be measured and assigned a significance rating.		
Points	Impact Significance Rating	Description
6 to 28	Negative Low impact	The anticipated impact will have negligible negative effects and will require little to no mitigation.
6 to 28	Positive Low impact	The anticipated impact will have minor positive effects.
29 to 50	Negative Medium impact	The anticipated impact will have moderate negative effects and will require moderate mitigation measures.
29 to 50	Positive Medium impact	The anticipated impact will have moderate positive effects.
51 to 73	Negative High impact	The anticipated impact will have significant effects and will require significant mitigation measures to achieve an acceptable level of impact.
51 to 73	Positive High impact	The anticipated impact will have significant positive effects.
74 to 96	Negative Very high impact	The anticipated impact will have highly significant effects and are unlikely to be able to be mitigated adequately. These impacts could be considered "fatal flaws".
74 to 96	Positive Very high impact	The anticipated impact will have highly significant positive effects.

Table 38: Rating of impacts

IMPACT TABLE FORMAT	
Environmental Parameter	A brief description of the environmental aspect likely to be affected by the proposed activity e.g. Surface water
Issue/Impact/Environmental Effect/Nature	A brief description of the nature of the impact that is likely to affect the environmental aspect as a result of the proposed activity e.g. alteration of aquatic biota The environmental impact that is likely to positively or negatively affect the environment as a result of the proposed activity e.g. oil spill in surface water
Extent	A brief description indicating the chances of the impact occurring
Probability	A brief description of the ability of the environmental components recovery after a disturbance as a result of the proposed activity
Reversibility	A brief description of the environmental aspect likely to be affected by the proposed activity e.g. Surface water

IMPACT TABLE FORMAT		
Irreplaceable loss of resources	A brief description of the degree in which irreplaceable resources are likely to be lost	
Duration	A brief description of the amount of time the proposed activity is likely to take to its completion	
Cumulative effect	A brief description of whether the impact will be exacerbated as a result of the proposed activity	
Intensity/magnitude	A brief description of whether the impact has the ability to alter the functionality or quality of a system permanently or temporarily	
Significance Rating	A brief description of the importance of an impact which in turn dictates the level of mitigation required	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	4	1
Probability	4	1
Reversibility	4	1
Irreplaceable loss	4	1
Duration	4	1
Cumulative effect	4	1
Intensity/magnitude	4	1
Significance rating	-96 (high negative)	-6 (low negative)
Mitigation measures	Outline/explain the mitigation measures to be undertaken to ameliorate the impacts that are likely to arise from the proposed activity. Describe how the mitigation measures have reduced/enhanced the impact with relevance to the impact criteria used in analyzing the significance. These measures will be detailed in the EMPR.	

9.2 Environmental Issues and Potential Impacts

9.2.1 Construction Phase Impacts

These impacts are likely to be observed during the construction phase of the proposed project. Although the duration of these impacts is temporary, their effects are long lasting after the construction is over.

Typical activities which are likely to be observed during the proposed CSP plant construction phase include ground clearing (removal of vegetative cover), grading, excavation, blasting, drilling, vehicular and pedestrian traffic, and construction and installation of facilities. Activities conducted in locations other than the facility site include excavation/blasting for construction materials (sands, gravels) and access road construction.

Since the duration of the construction phase is temporary and the impacts readily predicted and easily mitigated, more attention will be given to the operational phase impacts. It should be noted that a comprehensive construction phase Environmental Management Programme (EMPr) would be developed and implemented to regulate and minimise the impacts during the construction phase.

9.2.2 Construction - Biodiversity

Table 39: Rating of impacts related to loss of habitat for red data / general species

IMPACT TABLE FORMAT	
Environmental Parameter	Biodiversity
Issue/Impact/Environmental Effect/Nature	Loss of habitat for red data / general species
Extent	The impact is only expected to affect the site.
Probability	The impact may occur (Between a 25% to 50% chance of occurrence).
Reversibility	The impact is partly reversible but more intense mitigation measures are required.
Irreplaceable loss of resources	The impact will result in marginal loss of resources
Duration	The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 50 years)
Cumulative effect	The impact would result in minor cumulative effects
Intensity/magnitude	Impact alters the quality, use and integrity of the system/component but system/ component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).
Significance Rating	**Prior to mitigation measures:** There will be a negative Low impact i.e. the anticipated impact

IMPACT TABLE FORMAT		
	will have negligible negative effects however mitigation measures must be implemented. **After mitigation measures:** After mitigation measures, the negative low impact persists.	
	Pre-mitigation impact rating	**Post mitigation impact rating**
Extent	1	1
Probability	2	1
Reversibility	2	1
Irreplaceable loss	2	1
Duration	3	1
Cumulative effect	3	1
Intensity/magnitude	2	1
Significance rating	-26 (low negative)	-6(low negative)
Mitigation measures	▪ Maintain footprint strictly during construction ▪ Appoint Environmental Control Officer (ECO) for the duration of construction. ▪ Conduct construction walk down prior to construction to conduct a search and rescue exercise. ▪ Existing indigenous vegetation must be retained where possible. ▪ Remove and relocate any plants of botanical or ecological significance (these must be indicated by the ECO) ▪ Vegetation to be removed as it becomes necessary ▪ No vegetation to be used for firewood. ▪ Demarcation of sensitive areas prior to construction activities starting. ▪ Phased drying up of waste water area to allow species (if present) to move away. ▪ Search and rescue exercise prior to construction to relocated any species that may be inhabiting the site.	

Table 40: Rating of impacts related to edge effect

IMPACT TABLE FORMAT	
Environmental Parameter	Biodiversity
Issue/Impact/Environmental Effect/Nature	Edge effect
Extent	The impact is only expected to affect the site.

IMPACT TABLE FORMAT	
Probability	Impact will certainly occur (Greater than a 75% chance of occurrence).
Reversibility	The impact is partly reversible but more intense mitigation measures are required.
Irreplaceable loss of resources	The impact will result in marginal loss of resources
Duration	The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 50 years)
Cumulative effect	The impact would result in minor cumulative effects
Intensity/magnitude	Impact alters the quality, use and integrity of the system/component but system/ component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).
Significance Rating	**Prior to mitigation measures:** There will be a negative medium impact i.e. the anticipated impact will have moderate negative effects and will require moderate mitigation measures **After mitigation measures:** After mitigation measures, a negative low impact will be achieved.

	Pre-mitigation impact rating	**Post mitigation impact rating**
Extent	1	1
Probability	4	2
Reversibility	2	1
Irreplaceable loss	2	1
Duration	3	1
Cumulative effect	3	1
Intensity/magnitude	2	1
Significance rating	-30 (medium negative)	-7(low negative)

IMPACT TABLE FORMAT	
Mitigation measures	▪ The contractor should be responsible for implementing a programme of weed control (particularly in areas where soil has been disturbed); and grassing of any remaining stockpiles to prevent weed invasion. ▪ The spread of exotic species occurring throughout the site should be controlled. ▪ All exotic vegetation must be removed from the site (if present).

Table 41: Rating of impacts related to bird collisions

IMPACT TABLE FORMAT	
Environmental Parameter	Biodiversity
Issue/Impact/Environmental Effect/Nature	Bird Collisions
Extent	The impact is only expected to affect the site.
Probability	Impact will certainly occur (Greater than a 75% chance of occurrence).
Reversibility	The impact is reversible
Irreplaceable loss of resources	The impact will result in marginal loss of resources
Duration	The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 50 years)
Cumulative effect	The impact could result in minor cumulative effects
Intensity/magnitude	Impact alters the quality, use and integrity of the system/component but system/ component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).
Significance Rating	**Prior to mitigation measures:** There will be a negative medium impact i.e. the anticipated impact will have moderate negative effects and will require intense mitigation measures **After mitigation measures:** After mitigation measures, a negative low impact will be

IMPACT TABLE FORMAT		
	achieved.	
	Pre-mitigation impact rating	**Post mitigation impact rating**
Extent	1	1
Probability	4	2
Reversibility	1	1
Irreplaceable loss	2	1
Duration	3	1
Cumulative effect	3	1
Intensity/magnitude	2	1
Significance rating	-28 (medium negative)	-7(low negative)
Mitigation measures	▪ Bird flappers must be placed on the new power lines. ▪ Bird guards or similar must be placed on the new towers.	

Table 42: Rating of impacts related to bird electrocutions

IMPACT TABLE FORMAT	
Environmental Parameter	Biodiversity
Issue/Impact/Environmental Effect/Nature	Bird Electrocutions
Extent	The impact is only expected to affect the site.
Probability	Impact will certainly occur (Greater than a 75% chance of occurrence).
Reversibility	The impact is reversible
Irreplaceable loss of resources	The impact will result in marginal loss of resources
Duration	The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 50 years)
Cumulative effect	The impact could result in minor cumulative effects
Intensity/magnitude	Impact alters the quality, use and integrity of the system/component but system/ component still continues to function in a moderately modified way and maintains general

IMPACT TABLE FORMAT		
	integrity (some impact on integrity).	
Significance Rating	**Prior to mitigation measures:** There will be a negative medium impact i.e. the anticipated impact will have moderate negative effects and will require intense mitigation measures **After mitigation measures:** After mitigation measures, a negative low impact will be achieved.	
	Pre-mitigation impact rating	**Post mitigation impact rating**
Extent	1	1
Probability	4	2
Reversibility	1	1
Irreplaceable loss	2	1
Duration	3	1
Cumulative effect	3	1
Intensity/magnitude	2	1
Significance rating	-28 (medium negative)	-7(low negative)
Mitigation measures	▪ Bird flappers must be placed on the new power lines. ▪ Bird guards or similar must be placed on the new towers.	

9.2.3 Construction - Surface Water

Table 43. Impact rating for impacts associated with inappropriate construction activities on rivers.

IMPACT TABLE	
Environmental Parameter	*Rivers (Construction Phase)*
Issue/Impact/Environmental Effect/Nature	Impact of general inappropriate construction activities on rivers
Extent	*Local/district*
Probability	*Possible*
Reversibility	*Completely reversible*
Irreplaceable loss of resources	*No loss of resource*

Duration	*Short term*	
Cumulative effect	*Medium cumulative Impact*	
Intensity/magnitude	*Medium*	
Significance Rating	*Pre-mitigation significance rating is negative but low. With appropriate mitigation measures, the impact will be negligible.*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	1
Probability	2	1
Reversibility	1	1
Irreplaceable loss	1	1
Duration	1	1
Cumulative effect	3	1
Intensity/magnitude	2	1
Significance rating	**-20 (low negative)**	**-6 (low negative)**
Mitigation measures	*To prevent any of the above mentioned impacts associated with inappropriate construction activities, it is imperative that both the river and stream systems as well as their associated buffer areas be fenced off preferably with palisade fencing. This erection of the fencing should take place prior to any construction activities taking place on site. Where it is required, a gate should also be constructed to allow resident cattle and sheep to access rivers for water supply.*	

Table 44. Impact rating for impacts associated with construction pollution risks to rivers.

IMPACT TABLE	
Environmental Parameter	*Wetland (Construction Phase)*
Issue/Impact/Environmental Effect/Nature	Impacts associated with construction pollution risks to rivers
Extent	*Local/district*
Probability	*Possible*
Reversibility	*Completely reversible*
Irreplaceable loss of resources	*No loss of resource*

Duration	*Short term*	
Cumulative effect	*Medium cumulative Impact*	
Intensity/magnitude	*Medium*	
Significance Rating	*Pre-mitigation significance rating is negative but low. With appropriate mitigation measures, the impact will be negligible.*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	2	1
Reversibility	1	1
Irreplaceable loss	1	1
Duration	1	1
Cumulative effect	3	1
Intensity/magnitude	2	1
Significance rating	**-20 (low negative)**	**-6 (low negative)**
Mitigation measures	*Site specific mitigation measures will be needed to prevent the spillage and/or leakage of oils, fuels and other toxic substances entering the wetlands. Firstly, all vehicles will need to be checked for leakage before and after entering the construction area. Secondly, areas where fuels are either kept or transferred will need to be bunded so as to contain spillage. Cement mixing sites will also need to be strategically designated and at least 100metres away from the wetland areas. Ablution facilities must be provided to prevent workers urinating near or in the wetlands.*	

Table 45: Impact rating for impacts associated with clearing extensive areas of vegetation resulting in erosion (wind and water) impacts to rivers.

IMPACT TABLE	
Environmental Parameter	*Wetland (Construction Phase)*
Issue/Impact/Environmental Effect/Nature	Impacts associated with clearing extensive areas of vegetation resulting in erosion (wind and water) impacts to rivers
Extent	*Local/district*
Probability	*Definite*

Reversibility	*Barely reversible*	
Irreplaceable loss of resources	*Significant loss of resource*	
Duration	*Permanent term*	
Cumulative effect	*High cumulative Impact*	
Intensity/magnitude	*Medium*	
Significance Rating	*Pre-mitigation significance rating is negative and high. The impact is an inevitable loss of resources to be sacrificed for the proposed development. Mitigation measures are restricted to ameliorating other associated cumulative impacts such as run-off and erosion that may potentially occur to cleared areas of land.*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	1
Probability	4	4
Reversibility	3	3
Irreplaceable loss	3	3
Duration	4	4
Cumulative effect	4	1
Intensity/magnitude	3	2
Significance rating	**-60 (high negative)**	**-32 (medium negative)**
Mitigation measures	*The loss of vegetation is inevitable and necessary for the proposed development to take place. Hence, the impact of vegetation clearance will be definite. Mitigation measures primarily will relate to the cumulative impacts associated with exposed open stretches of land. Run-off is to be mitigated by the use of structures that will reduce the rate and volume of run-off so as to prevent erosion and siltation impacts affecting nearby wetlands. Structures can include silt nets, grass blocks and any other related structure that can prevent silt build-up and erosion. In terms of potential impacts associated with wind erosion, regular but light watering must take place whilst surfaces are left exposed.*	

Table 46. Impact rating for impacts associated with effluent release into nearby hydrological systems.

IMPACT TABLE		
Environmental Parameter	*Wetland (Construction Phase)*	
Issue/Impact/Environmental Effect/Nature	Impacts associated with effluent release into nearby hydrological systems	
Extent	*Local/district*	
Probability	*Definite*	
Reversibility	*Partly reversible*	
Irreplaceable loss of resources	*Significant loss of resource*	
Duration	*Medium term*	
Cumulative effect	*High cumulative Impact*	
Intensity/magnitude	*Medium*	
Significance Rating	*Pre-mitigation significance rating is negative and high. The impact currently affecting the health of the Brak River system which has previously been classified as largely natural (Class B). Well designed mitigation measures in the form of rehabilitation plans will be required. Where rehabilitation and mitigation measures are implemented, the impact will be positive for the local area.*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	4	2
Reversibility	2	1
Irreplaceable loss	3	4
Duration	2	1
Cumulative effect	4	1
Intensity/magnitude	3	1
Significance rating	**-51 (high negative)**	**-11 (low positive)**
Mitigation measures	*During the construction phase it is important for point sources of the effluent release are removed and treatment of the effluent remains within the sewage treatment works plant. It is likely that an upgrade will be required for this to take place. Once the point source pollution has been ceased,*	

	specialist studies will need to be conducted in terms of soil and vegetation rehabilitation. Site specific rehabilitation plans will therefore be required and need to be implemented in order for the impact to be ameliorated.

9.2.4 Construction - Groundwater

Table 47: Rating Matrix for impacts in the **Construction** phases

IMPACT TABLE FORMAT	
Environmental Parameter	**Groundwater**
Issue/Impact/Environmental Effect/Nature	Deterioration in the groundwater quality in the vicinity of the site.
Extent	Changes to groundwater quality during construction and decommissiong are likely to affect the local area of the siteonly.
Probability	It is considered possible that the impact may occur (between a 25% and 50% chance of occurrence)
Reversibility	Groundwater pollution / deterioration in groundwater quality is partly reversible. Measures to "clean up" groundwater pollution can be expensive and time-consuming
Irreplaceable loss of resources	If groundwater pollution with a persistent contaminant occurs, and this pollution affects groundwater used for public supply (e.g. to De Aar), then a significant loss of resource may occur.
Duration	Potentially long-term. Impacts such as polluted groundwater may persist long after (many years) the plants have been decommissioned.
Cumulative effect	Medium Cumulative Impact. Minor cumulative effects may occur if groundwater impacts combine – specifically if increased groundwater recharge combines with groundwater pollution, leading to more rapid migration of contaminants away from the site.
Intensity/magnitude	Serious groundwater pollution at De Aar has the potential to permanently alter the functionality of the local groundwater system.
Significance Rating	Negative medium impact - The anticipated impact if it occurs will have moderate negative effects and will require moderate mitigation measures

IMPACT TABLE FORMAT		
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	2	1
Reversibility	3	2
Irreplaceable loss	2	1
Duration	3	2
Cumulative effect	3	2
Intensity/magnitude	3	1
Significance rating	**-42 (negative medium)**	**-9 (low negative)**
Mitigation measures	The following mitigation measures are recommended for the construction and decommissioning phases: • An inventory should be made of substances which will be used on site (both temporarily during construction and decommissiong, and during operation) that are potentially harmful to groundwater. • All areas for the storage and handling of potentially hazardous (to groundwater) materials such as hydrocarbon fluids, therminol, salts, herbicides, solvents, etc are securely bunded. This should include workshop areas. Any spillages should be removed as soon as possible. This should apply to all contractors on the site, who may only be on site for a relatively short time during construction or decommissioning. • Monitoring of groundwater quality and levels should be carried out at boreholes at the site (at least two boreholes per site, at least one of which is situated downgradient of the site.) The monitoring boreholes should be constructed with the advice of a qualified hydrogeologist, and securely capped. At De Aar, results from the monitoring network should be combined with data from boreholes supplying De Aar. Any discrepancies must be immediately investigated. Monitoring networks provide an "early warning" system and can potentially save considerable costs if properly used.	

9.2.5 Construction - Noise

Table 48: Noise impacts during construction

IMPACT TABLE		
Environmental Parameter	**Noise**	
Issue/Impact/Environmental Effect/Nature	Deterioration in the noise environment of the study area	
Extent	The plant will have an impact over distances of about 2200m. At this distance (and closer to the plant), and at a residual[9] noise level of 31dB, the plant impact is calculated to begin to be noticeable.	
Probability	It is considered possible that the impact may occur (between a 25% and 50% chance of occurrence)	
Reversibility	The impact is completely reversible.	
Irreplaceable loss of resources	The impact will not result in the loss of any resources.	
Duration	Short term	
Cumulative effect	The impact would result in negligible to no cumulative effects	
Intensity/magnitude	A low impact is predicted in the De Aar industrial area.	
Significance Rating	Negative low impact - The anticipated impact if it occurs will have moderate negative effects and will require moderate mitigation measures	
	Pre-mitigation impact rating	**Post mitigation impact rating**
Extent	1	1
Probability	1	1
Reversibility	1	1
Irreplaceable loss	1	1
Duration	1	1
Cumulative effect	1	1
Intensity/magnitude	1	1
Significance rating	**-6 (low negative)**	**-6 (low negative)**

[9] Residual noise is the totally encompassing sound in a given situation at a given time, and usually composed of sound from many sources, both near and far, excluding the noise under investigation.

IMPACT TABLE	
Mitigation measures	The following mitigation measures are recommended for the construction and decommissioning phases: • During construction care should be taken to ensure that noise from construction vehicles and plant equipment does not intrude on the Juvenile Secure Care Facility. Plant equipment such as generators, compressors, concrete mixers as well as vehicles should be kept in good operating order and where appropriate have effective exhaust mufflers. • Gravel roads used during construction and during the operational life of the plant should be kept in good order. Corrugations and drainage ruts should not be allowed to develop as these can contribute to mechanical rattling and banging noise on vehicles traversing these roads. • The final CSP plant location must be positioned as far away as practically possible from the nearest human habitation, i.e. preferably not closer than 2000 m. Given the size and shape of the land on which the proposed plant will be constructed, and the positions of noise receptors, this should be feasible if the plant is positioned to the north of the property. • If a cooling tower is to be utilised then fans should be fitted with sound attenuators; • It is recommended that none of the inverter hardware or tracker units (with motors and associated electrical equipment) be positioned adjacent to the Juvenile Secure Care Centre. The design of the PV plant should take into account the noise emissions of these units such that these units be positioned where their noise levels will not be a disturbance.

9.2.6 Construction - Visual

Table 49: Rating of day-time visual impacts during construction

IMPACT TABLE FORMAT	
Environmental Parameter	**Visual environment:** The aesthetic or scenic nature of the environment within a defined time and space, which covers the broad range of visual, cultural and spiritual aspects of the landscape.
Issue/Impact/Environmental Effect/Nature	Day-time visual impact resulting from the erection of a solar energy facility in the area. Large construction vehicles and equipment during the construction phase will alter the natural character of the study area and expose sensitive receptors to visual impacts associated with the construction phase.
Extent	**Local/district:** Will affect the local area or district.
Probability	**Likely:** The impact will likely occur (Between a 50% to 75% chance of occurrence).
Reversibility	**Completely reversible:** The impact is reversible as it will only last the duration of the construction period.
Irreplaceable loss of resources	**No loss:** The impact will not result in the loss of any resources as it is temporary.
Duration	**Short term:** The impact and its effects will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).
Cumulative effect	**Negligible:** The impact would result in negligible to no cumulative effects.
Intensity/magnitude	**Medium:** Impact alters the visual quality of the landscape but the system/ component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).
Significance Rating	**Prior to mitigation measures:** There will be a negative low impact i.e. the anticipated impact will have negligible negative effects and will require little to no mitigation. **After mitigation measures:** The negative low impact will persist after mitigation.

	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	3	3
Reversibility	1	1
Irreplaceable loss	1	1
Duration	1	1
Cumulative effect	1	1
Intensity/magnitude	2	1

IMPACT TABLE FORMAT		
Significance rating	-18 (negative low)	-9 (negative low)
Mitigation measures	▪ Carefully plan to reduce the construction period. ▪ Locate laydown and storage areas in zones of low visibility i.e. behind tall trees or in lower lying areas. ▪ Minimise vegetation clearing and rehabilitate cleared areas as soon as possible. ▪ Maintain a neat construction site by removing rubble and waste materials regularly. ▪ Make use of existing gravel access roads where possible.	

Table 50: Rating of night-time visual impacts during construction

IMPACT TABLE FORMAT	
Environmental Parameter	**Visual environment:** The aesthetic or scenic nature of the environment within a defined time and space, which covers the broad range of visual, cultural and spiritual aspects of the landscape.
Issue/Impact/Environmental Effect/Nature	Potential visual impact of construction lighting on the nightscape. Other than the rural settlement in De Aar located to the south of the proposed site, there is limited human settlement in the area, and thus few existing light sources. Most construction activities are likely to take place during normal business hours and therefore the construction phase of the development is unlikely to have a significant impact on the visual quality of the area at night.
Extent	**Local/district:** Will affect the local area or district.
Probability	**Unlikely:** The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).
Reversibility	**Completely reversible:** The impact is reversible as it will not last longer than the duration of the construction period.
Irreplaceable loss of resources	**No loss:** The impact will not result in the loss of any resource as it is temporary.
Duration	**Short term:** The impact and its effects will either disappear with mitigation or will be mitigated through natural process in a span shorter than the construction phase (0 – 1 years), or the impact and its effects will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).
Cumulative effect	**Negligible:** The impact would result in negligible to no cumulative effects.
Intensity/magnitude	**Low:** Impact alters the visual quality and integrity of the nightscape in a way that is barely perceptible.

IMPACT TABLE FORMAT		
Significance Rating	**Prior to mitigation measures:** There will be a negative low impact i.e. the anticipated impact will have negligible negative effects and will require little to no mitigation. **After mitigation measures:** The negative low impact will persist after mitigation.	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	1
Probability	1	1
Reversibility	1	1
Irreplaceable loss	1	1
Duration	1	1
Cumulative effect	1	1
Intensity/magnitude	1	1
Significance rating	-7 (negative low)	-6 (negative low)
Mitigation measures	▪ Limit construction activities to day-time hours in order to minimise night lighting during construction.	

9.2.7 Construction - Heritage

Table 51: Rating Matrix for impacts in the Construction phase

- Chance finds

IMPACT TABLE FORMAT	
Environmental Parameter	*Discovery of previously unidentified heritage sites (archaeological, palaeontological, historical or grave sites)*
Issue/Impact/Environmental Effect/Nature	*During construction activity and earthmoving archaeological material could be unearthed that was previously unidentified due to its position.*
Extent	*In most cases confined to small areas on the site*
Probability	*Due to the close proximity to water course, localised archaeological finds may possibly occur*
Reversibility	*In most cases where such finds are made damaged is irreversible*
Irreplaceable loss of resources	*Significant loss but in most cases the scientific data recovered will mitigate such losses*

IMPACT TABLE FORMAT		
Duration	*Permanent*	
Cumulative effect	*Low cumulative impact*	
Intensity/magnitude	*Medium*	
Significance Rating	*The impact is anticipated as being low and localised but will vary due to type of heritage find that could be made*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	2	1
Reversibility	4	2
Irreplaceable loss	4	3
Duration	4	4
Cumulative effect	2	1
Intensity/magnitude	2	1
Significance rating	-24(Low negative)	-11 (low negative)
Mitigation measures	*A heritage monitoring program that will identify finds during construction will be able to mitigate the impact on the finds through scientific documentation of finds and provide valuable data on any finds made.*	

- Known Archaeological Sites

IMPACT TABLE FORMAT	
Environmental Parameter	*Identified archaeological sites and areas*
Issue/Impact/Environmental Effect/Nature	*Due to the nature of the development it is possible that some sites will be impacted and impossible to avoid in the layout plan of the project*
Extent	*In most cases confined to small areas on the site*
Probability	*Possible impact in large scale sites like Site 1 that is extended over a wide area in one of the CSP Alternative areas*
Reversibility	*In most cases where a site cannot be excluded and needs to be destructed the impact is irreversable*
Irreplaceable loss of resources	*Significant loss but in most cases the scientific data recovered will mitigate such losses*
Duration	*Permanent*
Cumulative effect	*Low cumulative impact*

IMPACT TABLE FORMAT		
Intensity/magnitude	*Medium*	
Significance Rating	*The impact is anticipated as being low and localised but will vary due to type of heritage find that could be made*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	2	1
Reversibility	4	2
Irreplaceable loss	4	3
Duration	4	4
Cumulative effect	3	2
Intensity/magnitude	2	1
Significance rating	-32 (Medium negative)	-13 (low negative)
Mitigation measures	*Mitigation measures as recommended with each identified site and,* *A heritage monitoring program that will identify finds during construction will be able to mitigate the impact on the finds through scientific documentation of finds and provide valuable data on any finds made.*	

9.2.8 Construction - Socio-economic

Table 52: Rating of socio economic impacts relative to influx of people

INFLUX OF PEOPLE	
Environmental Parameter	*Change in the demographic profile of the area.*
Issue/Impact/Environmental Effect/Nature	*A rapid increase in the population size of the area will lead to various other changes of which the most pressing issues are an increase in housing needs, additional demand on municipal services, and conflict with locals over limited resources. There is an existing backlog of 1,793 houses in De Aar, but this backlog can mostly relate to the conversion of informal houses to RDP houses.*
Extent	*Will affect the local area or district.*
Probability	*It is possible that the impact will occur (between a 25% and 50% chance of occurring).*
Reversibility	*The impact is reversible with the implementation of minor mitigation measures.*

INFLUX OF PEOPLE		
Irreplaceable loss of resources	*The impact will result in marginal loss of resources.*	
Duration	*The impact and its effects will last for the duration of the construction period after which it will be entirely negated over a period of 2 years.*	
Cumulative effect	*The impact could result in minor cumulative effects, depending on the number of unemployed job seekers that also enter the area.*	
Intensity/magnitude	*The impact can alter the quality, use and integrity of the system, but the system would still be able to function in a moderately modified way.*	
Significance Rating	*The change in the demographic profile of the area is regarded as moderately significant as it will mostly impact on other areas of functionality.*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	2	1
Reversibility	2	1
Irreplaceable loss	2	1
Duration	1	1
Cumulative effect	3	2
Intensity/magnitude	2	1
Significance rating	**-24 (Low Negative)**	**-8 (Low Negative)**
Mitigation measures	*Inform local businesses that construction workers will move into the area to enable local businesses to plan for the extra demand.* *Ensure that employment procedures/polices are communicated to local stakeholders, especially community representative organisations and ward councillors.* *Have clear rules and regulations for access to the construction site to control loitering. Consult with the local SAPS to establish standard operating procedures for the control and/or removal of loiterers at the construction site.*	

Table 53: Rating of socio economic impacts relative to change to municipal infrastructure

CHANGE TO MUNICIPAL INFRASTRUCTURE	
Environmental Parameter	*The Emthanjeni Municipality's capability to continue to deliver municipal services without increasing existing backlogs.*

CHANGE TO MUNICIPAL INFRASTRUCTURE		
Issue/Impact/Environmental Effect/Nature	*The influx of people to the area rapidly increases the population size by an estimated 3.0% (worst case scenario) in addition to the normal population growth rate of 1.3% per annum. All these people require functioning municipal services and with the influx of people, the municipality's ability to continue to provide these services might be affected. This in turn can impact on current residents' quality of life and their access to services.*	
Extent	*Where the impact occurs it will affect mostly the local area, specifically De Aar as the closest urban settlement.*	
Probability	*The impact may occur and largely depends on the municipality's ability to provide the necessary services in addition to maintaining the current level of services.*	
Reversibility	*If the impact does occur it would be reversible with the implementation of minor mitigation measures.*	
Irreplaceable loss of resources	*Where the impact does occur it can lead to a marginal loss of resources. The area will gain resources in the form of revenue.*	
Duration	*The impact and its affects can continue for some time after the construction phase but can be mitigated by direct human action thereafter.*	
Cumulative effect	*The impact could result in minor cumulative impacts if services become unstable or unavailable, which in turn could impact on segments of the local community.*	
Intensity/magnitude	*If managed properly, the impact would affect the quality, use and integrity of the system in a way that is barely perceptible. However, if the change to municipal infrastructure is not managed properly, it could result in impacts that affect the continued viability of the system so that it becomes severely impaired.*	
Significance Rating	*If the system becomes severely impaired, the anticipated impact will have significant effects that would require significant mitigation measures to reverse the impact.*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	2	1
Reversibility	1	1
Irreplaceable loss	2	1
Duration	2	1
Cumulative effect	3	2
Intensity/magnitude	2	1

CHANGE TO MUNICIPAL INFRASTRUCTURE		
Significance rating	**-24 (Negative Low)**	**-8 (Negative Low)**
Mitigation measures	*Where possible, construction workers should be housed within the local community to reduce the possible additional strain on local resources.* *Contractors to supply and install infrastructure needed to access municipal services, e.g. water and sewerage pipelines. On site, sufficient portable services must be available (e.g. portable toilet facilities) and serviced regularly to prevent contamination.* *The use of local labour during construction will negate the need for additional housing; therefore contractors are again urged to make use of as much local labour as possible.* *Contractors must comply with the mitigation and/or enhancement measures stipulated in the EMP. Corrective measures must be implemented where the EMP has not been adhered to.*	

Table 54: Rating of socio economic impacts relative to integration with local communities

INTEGRATION WITH LOCAL COMMUNITIES	
Environmental Parameter	*The ease with which the construction team integrates with the existing local community's social practices and cultural background.*
Issue/Impact/Environmental Effect/Nature	*The construction team can consist of a sizeable amount of people, up to 840 (worst case scenario, no local employment) that enters the area where there are established cultural and social norms. Where integration is hindered for whatever reason, this can lead to conflict situations that can delay the project and prolong the duration of impacts, which in turn would affect local residents' quality of life and result in economic impacts for Mainstream. Apart from situations where social integration is hindered, the presence of the construction team can have certain health and safety impacts on the local area.*
Extent	*Where the impact occurs it will affect mostly the local area, specifically De Aar as the closest urban settlement.*
Probability	*For both conflict, and health and safety, the impact may occur. Conflict situations can theoretically be avoided, whereas health and safety impacts are largely dependent on the construction worker's personal conduct.*
Reversibility	*Conflict situations are completely reversible, whereas HIV post-facto infection is deemed irreversible. Other health impacts are partly reversible with intense mitigation*

INTEGRATION WITH LOCAL COMMUNITIES		
	measures.	
Irreplaceable loss of resources	*Conflict situations that turn violent can result in marginal loss of resources, whereas health and safety impacts can result in more significant loss of resources.*	
Duration	*Conflict situations are expected to last for a very short duration, whereas health and safety impacts can have permanent effects on affected individuals.*	
Cumulative effect	*HIV infection adds to the current HIV infection rate in the province and the country, thereby taxing health resources further in combating the disease.*	
Intensity/magnitude	*Depending on the intensity of a conflict situation, most of the conflicts that occur will affect the whole system in a way that is barely perceptible. However, health and safety impacts on the other hand, especially in the case of HIV infection, can affect the continued viability of the system with little to no remediation.*	
Significance Rating	*In the case of health and safety, the anticipated impacts will have significant effects and will require significant mitigation measures to achieve an acceptable level of impact. Conflict situations on the other hand, will have negligible effects on the community as a whole (might be more intense at the point of conflict).*	
** Only health and safety impacts (specifically HIV infections) were assessed in this table, as conflict situations are expected to be minimal and where it does occur, the effect is expected to be negligible.*		
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	3	2
Probability	2	1
Reversibility	3	2
Irreplaceable loss	3	2
Duration	3	1
Cumulative effect	4	2
Intensity/magnitude	3	1
Significance rating	**-54 (Negative High)**	**-10 (Negative Low)**
Mitigation measures	*An aggressive STI and HIV/AIDS awareness campaign should be launched, which is not only directed at construction workers but also at the community as a whole. To accomplish this, the Health & Safety Plan should be implemented, which should include a detailed HIV prevention plan.* *Local women should be empowered. This could be achieved by employing them to work on the project, which in turn*	

INTEGRATION WITH LOCAL COMMUNITIES	
	would decrease their (financial) vulnerability.

Table 55: Rating of socio economic impacts relative to revenue opportunities

NET INCREASE IN LOCAL BUSINESS REVENUE OPPORTUNITIES		
Environmental Parameter	*Change in the economic profile of the area*	
Issue/Impact/Environmental Effect/Nature	*A net increase in revenues of local businesses, considering the benefits of the project and any potential losses or forfeit of opportunities that may occur.*	
Extent	*Local area or district.*	
Probability	*It is likely that the impact will occur.*	
Reversibility	*The impact is reversible with the implementation of specific mitigation measures.*	
Irreplaceable loss of resources	*Not applicable.*	
Duration	*The impact and its effects will last for the duration of the construction period after which it will be entirely negated over a period of 2 years.*	
Cumulative effect	*The impact could result in minor cumulative effects, depending on the extent to which local economic stimulation results in additional benefits locally.*	
Intensity/magnitude	*The impact can alter the quality, use and integrity of the system, but the system would still be able to function in a moderately modified way.*	
Significance Rating	*The change is considered of low significance.*	
	Pre-enhancement impact rating	**Post enhancement impact rating**
Extent	2	3
Probability	4	4
Reversibility	3	3
Irreplaceable loss	3	3

NET INCREASE IN LOCAL BUSINESS REVENUE OPPORTUNITIES		
Duration	1	1
Cumulative effect	2	3
Intensity/magnitude	2	2
Significance rating	**+30 (Medium Positive)**	**+34 (Medium Positive)**
Mitigation measures	• *Survey local businesses together with a local business organisation or chamber and determine which business opportunities can be accessed during construction by local operations.* • *Compile a list of good and services which can be locally supplied, such as earthmoving, plumbing and electricity, security, cleaning and catering.* • *Commit to local procurement targets, or a process for maximising local procurement spend.* • *Set up a business support centre to educate potential suppliers*	

Table 56: Rating of socio economic impacts relative to employment opportunities

NET INCREASE IN LOCAL EMPLOYMENT OPPORTUNITIES	
Environmental Parameter	*Change in the economic profile of the area*
Issue/Impact/Environmental Effect/Nature	*A net increase in local employment opportunities, considering the benefits of the project and any potential losses or forfeit of opportunities that may occur.*
Extent	*Local area or district.*
Probability	*It is likely that the impact will occur.*
Reversibility	*The impact is reversible with the implementation of specific mitigation measures.*
Irreplaceable loss of resources	*Not applicable.*
Duration	*The impact and its effects will last for the duration of the construction period after which it will be entirely negated over a period of 2 years.*
Cumulative effect	*The impact could result in moderate cumulative effects, depending on the extent to which local employment results in additional benefits locally.*
Intensity/magnitude	*The impact can alter the quality, use and integrity of the system, but the system would still be able to function in a*

NET INCREASE IN LOCAL EMPLOYMENT OPPORTUNITIES		
	moderately modified way.	
Significance Rating	*The change is considered of medium significance.*	
	Pre-enhancement impact rating	**Post enhancement impact rating**
Extent	2	3
Probability	4	4
Reversibility	3	3
Irreplaceable loss	3	3
Duration	1	1
Cumulative effect	2	3
Intensity/magnitude	2	2
Significance rating	**+30 (Medium Positive)**	**+34 (Medium Positive)**
Mitigation measures	• *Consider a local skills registration period before the construction phase to determine which skills can be reliably sourced from inside the local community. This process must lead to a local recruitment process for both the project and its contractors.* • *Advertise positions locally whenever possible.*	

9.2.9 Operation - Biodiversity

Table 57: Rating of impacts related to loss of habitat for red data / general species

IMPACT TABLE FORMAT	
Environmental Parameter	Biodiversity
Issue/Impact/Environmental Effect/Nature	Loss of habitat for red data / general species
Extent	The impact is only expected to affect the site.
Probability	The impact may occur (Between a 25% to 50% chance of occurrence).

IMPACT TABLE FORMAT		
Reversibility	The impact is partly reversible but more intense mitigation measures are required.	
Irreplaceable loss of resources	The impact will result in marginal loss of resources	
Duration	The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 50 years)	
Cumulative effect	The impact would result in minor cumulative effects	
Intensity/magnitude	Impact alters the quality, use and integrity of the system/component but system/ component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).	
Significance Rating	**Prior to mitigation measures:** There will be a negative Low impact i.e. the anticipated impact will have negligible negative effects however mitigation measures must be implemented. **After mitigation measures:** After mitigation measures, the negative low impact persists.	
	Pre-mitigation impact rating	**Post mitigation impact rating**
Extent	1	1
Probability	2	1
Reversibility	2	1
Irreplaceable loss	2	1
Duration	3	1
Cumulative effect	1	1
Intensity/magnitude	1	1
Significance rating	-11 (low negative)	-6(low negative)
Mitigation measures	▪ Maintain footprint strictly during operation ▪ Constant removal of alien invasive species in and around plant. ▪ Control of erosion risks surrounding the plants.	

Table 58: Rating of impacts related to edge effect

IMPACT TABLE FORMAT	
Environmental Parameter	Biodiversity

IMPACT TABLE FORMAT		
Issue/Impact/Environmental Effect/Nature	Edge effect	
Extent	The impact is only expected to affect the site.	
Probability	The impact may occur (Between a 25% to 50% chance of occurrence).	
Reversibility	The impact is partly reversible but more intense mitigation measures are required.	
Irreplaceable loss of resources	The impact will result in marginal loss of resources	
Duration	The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 50 years)	
Cumulative effect	The impact would result in minor cumulative effects	
Intensity/magnitude	Impact alters the quality, use and integrity of the system/component but system/ component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).	
Significance Rating	**Prior to mitigation measures:** There will be a negative low impact i.e. the anticipated impact will have moderate negative effects and will require moderate mitigation measures **After mitigation measures:** After mitigation measures, a negative low impact will be achieved.	
	Pre-mitigation impact rating	**Post mitigation impact rating**
Extent	1	1
Probability	2	2
Reversibility	2	1
Irreplaceable loss	2	1
Duration	3	1
Cumulative effect	3	1
Intensity/magnitude	2	1
Significance rating	-26 (low negative)	-7(low negative)

IMPACT TABLE FORMAT	
Mitigation measures	▪ The client should be responsible for implementing a programme of weed control ▪ The spread of exotic species occurring throughout the site should be controlled. ▪ All exotic vegetation must be removed from the site (if present).

Table 59: Rating of impacts related to bird collisions

IMPACT TABLE FORMAT	
Environmental Parameter	Biodiversity
Issue/Impact/Environmental Effect/Nature	Bird Collisions
Extent	The impact is only expected to affect the site.
Probability	Impact will certainly occur (Greater than a 75% chance of occurrence).
Reversibility	The impact is reversible
Irreplaceable loss of resources	The impact will result in marginal loss of resources
Duration	The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 50 years)
Cumulative effect	The impact could result in minor cumulative effects
Intensity/magnitude	Impact alters the quality, use and integrity of the system/component but system/ component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).
Significance Rating	**Prior to mitigation measures:** There will be a negative medium impact i.e. the anticipated impact will have moderate negative effects and will require intense mitigation measures **After mitigation measures:** After mitigation measures, a negative low impact will be achieved.

IMPACT TABLE FORMAT		
	Pre-mitigation impact rating	**Post mitigation impact rating**
Extent	1	1
Probability	4	2
Reversibility	1	1
Irreplaceable loss	2	1
Duration	3	1
Cumulative effect	3	1
Intensity/magnitude	2	1
Significance rating	-28 (medium negative)	-7(low negative)
Mitigation measures	▪ Bird flappers must be maintained on the power lines. ▪ Bird guards or similar must be maintained. ▪ Placement of netting covering over evaporation ponds to discourage gathering of birds.	

Table 60: Rating of impacts related to bird electrocutions

IMPACT TABLE FORMAT	
Environmental Parameter	Biodiversity
Issue/Impact/Environmental Effect/Nature	Bird Electrocutions
Extent	The impact is only expected to affect the site.
Probability	Impact will certainly occur (Greater than a 75% chance of occurrence).
Reversibility	The impact is reversible
Irreplaceable loss of resources	The impact will result in marginal loss of resources
Duration	The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 50 years)
Cumulative effect	The impact could result in minor cumulative effects
Intensity/magnitude	Impact alters the quality, use and integrity of the system/component but system/ component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).

IMPACT TABLE FORMAT		
Significance Rating	**Prior to mitigation measures:** There will be a negative medium impact i.e. the anticipated impact will have moderate negative effects and will require intense mitigation measures **After mitigation measures:** After mitigation measures, a negative low impact will be achieved.	
	Pre-mitigation impact rating	**Post mitigation impact rating**
Extent	1	1
Probability	4	2
Reversibility	1	1
Irreplaceable loss	2	1
Duration	3	1
Cumulative effect	3	1
Intensity/magnitude	2	1
Significance rating	-28 (medium negative)	-7(low negative)
Mitigation measures	▪ Bird flappers must be maintained on the power lines. ▪ Bird guards or similar must be maintained.	

9.2.10 Operation - Surface Water

Table 61. Impact rating for impacts associated with excessive stormwater run-off impacting on rivers.

IMPACT TABLE	
Environmental Parameter	*Wetland (Operational Phase)*
Issue/Impact/Environmental Effect/Nature	Impacts associated with stormwater run-off impacting on nearby river systems
Extent	*Local/district*
Probability	*Possible*
Reversibility	*Completely reversible*
Irreplaceable loss of resources	*Marginal loss of resource*
Duration	*Long term*
Cumulative effect	*Medium cumulative Impact*
Intensity/magnitude	*Medium*

Significance Rating	*Pre-mitigation significance rating is negative but low. With appropriate mitigation measures, the impact can be ameliorated.*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	1
Probability	2	2
Reversibility	2	1
Irreplaceable loss	1	1
Duration	3	3
Cumulative effect	3	1
Intensity/magnitude	2	1
Significance rating	**-26 (low negative)**	**-9 (low negative)**
Mitigation measures	*The mitigation measures required simply relates to the development and implementation of an adequate storm water management plan to be designed by an appropriate engineer. Attenuation dams and evaporation ponds are examples that can contain storm water run-off. Other structures that may be considered are semi-permeable surfaces that can absorb run-off somewhat, in addition to energy dissipation structures. Such structures can reduce the amount and rate of run-off generated by the proposed development entering hydrological systems and thereby prevent the onset of erosion.*	

Table 62. Impact rating for impacts associated with oil pollution risks impacting on rivers.

IMPACT TABLE	
Environmental Parameter	*Wetland (Operational Phase)*
Issue/Impact/Environmental Effect/Nature	Impacts associated with oil pollution risks to rivers
Extent	*Local/district*
Probability	*Possible*
Reversibility	*Partly reversible*
Irreplaceable loss of resources	*Significant loss of resources*
Duration	*Medium term*
Cumulative effect	*Medium cumulative Impact*

Intensity/magnitude	*Medium*	
Significance Rating	*Pre-mitigation significance rating is negative and medium. With appropriate mitigation measures, the impact can be averted.*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	2	1
Reversibility	2	1
Irreplaceable loss	3	1
Duration	2	3
Cumulative effect	4	1
Intensity/magnitude	3	1
Significance rating	**-42 (medium negative)**	**-8 (low negative)**
Mitigation measures	*Transducer oils mitigation measures - Standard measures are typically accommodated in the design of the substation to ensure that should an accident occur which may cause spillage of this oil, that it would not pollute the surrounding soils or any runoff from the substation. The transformers are typically housed within a concrete bund that would be linked to an oil holding dam within the footprint of the substation and plants. Should contaminated water enter the oil holding dam, this would typically be removed from the site, and would be recycled off-site as part of the remediation process. It is important that such design-related mitigation measures be incorporated into the substation design to minimise the risk of any oil spillage being transported off the site.* *Synthetic oils mitigation measures – Due to the probable construction of flat and hard surfaces, oil leakage through the foundations of the proposed development is unlikely. However, the highest risk posed by the leakage of synthetic oils is via uncontrolled stormwater run-off into adjacent rivers. It is critical that the storm water management plan and structural design\layout integrates additional measures that will prevent any stormwater run-off around the piping to be circulated to an attenuation dam and not into the adjacent environment in*	

	general (including adjacent wetlands).Hence, this stormwater must be contained on the proposed development site in order for impacts to be minimized.

Table 63. Impact rating for impacts associated with wastewater pollution risks impacting on wetlands.

IMPACT TABLE		
Environmental Parameter	*Wetland (Operational Phase)*	
Issue/Impact/Environmental Effect/Nature	Impacts associated with wastewater pollution risks impacting on wetlands	
Extent	*Site*	
Probability	*Unlikely*	
Reversibility	*Completely reversible*	
Irreplaceable loss of resources	*Significant loss of resource*	
Duration	*Long term*	
Cumulative effect	*Significant cumulative impact*	
Intensity/magnitude	*Medium*	
Significance Rating	*Pre-mitigation significance rating is negative but low. With appropriate mitigation measures, the impact can be ameliorated.*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	1	1
Reversibility	1	1
Irreplaceable loss	3	1
Duration	3	3
Cumulative effect	3	1
Intensity/magnitude	3	1
Significance rating	**-36 (medium negative)**	**-8 (low negative)**
Mitigation measures	*It is vital that the evaporation ponds containing the wastewater of the proposed development is adequately maintained and regularly monitored for possible leaks or damage to the structure of the ponds. Additionally, measures accommodating overspill by the evaporation ponds must be incorporated into the design of the evaporation ponds.*	

9.2.11 Operation - Groundwater

Table 64: Rating Matrix for impacts in the **Operation** phase

IMPACT TABLE FORMAT		
Environmental Parameter	**Groundwater**	
Issue/Impact/Environmental Effect/Nature	Deterioration in the groundwater quality in the vicinity of the site.	
Extent	Changes to groundwater quality are likely to affect the local area of the site initially, but if pollution continues in sufficient quantities during the operational phase a wider area (e.g. several kilometres from the site) may be ultimately affected.	
Probability	It is considered possible that the impact may occur (between a 25% and 50% chance of occurrence).	
Reversibility	Groundwater pollution / deterioration in groundwater quality is partly reversible. Measures to "clean up" groundwater pollution can be expensive and time-consuming.	
Irreplaceable loss of resources	If groundwater pollution with a persistent contaminant occurs, and this pollution affects groundwater used for public supply (e.g. to De Aar), then a significant loss of resource may occur.	
Duration	Potentially long-term. Impacts such as polluted groundwater may persist long after (many years) the plants have been decommissioned.	
Cumulative effect	Medium Cumulative Impact. Minor cumulative effects may occur if groundwater impacts combine – specifically if increased groundwater recharge combines with groundwater pollution, leading to more rapid migration of contaminants away from the site.	
Intensity/magnitude	Serious groundwater pollution at De Aar has the potential to permanently alter the functionality of the local groundwater system.	
Significance Rating	Negative medium impact - The anticipated impact if it occurs will have moderate negative effects and will require moderate mitigation measures	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	1
Probability	2	1
Reversibility	3	2
Irreplaceable loss	2	1

IMPACT TABLE FORMAT		
Duration	3	2
Cumulative effect	3	2
Intensity/magnitude	3	1
Significance rating	**-45 (negative medium)**	**-9 (low negative)**
Mitigation measures	The following mitigation measures are recommended: • An inventory should be kept of substances which will be used on site during the operational phase that are potentially harmful to groundwater. Each substance should be assessed in terms of the risk of release to the groundwater environment. • All areas for the storage and handling of potentially hazardous (to groundwater) materials such as hydrocarbon fluids, therminol, salts, herbicides, solvents, etc are securely bunded. This should include workshop areas. Any spillages should be removed as soon as possible. Underground storage of hydrocarbons (e.g. diesel) is not recommended – such facilities are highly prone to leakage. If molten salt is stored underground, the facility should be constructed in such a way that no leakage to groundwater can occur.	

9.2.12 Operation - Noise

Table 65: Noise impacts during construction

IMPACT TABLE FORMAT	
Environmental Parameter	**Noise**
Issue/Impact/Environmental Effect/Nature	Deterioration in the noise environment of the study area
Extent	The plant will have an impact over distances of about 2200m. At this distance (and closer to the plant), and at a residual[10] noise level of 31dB, the plant impact is calculated to begin to be noticeable.
Probability	It is considered possible that the impact may occur (between a 25% and 50% chance of occurrence)

[10] Residual noise is the totally encompassing sound in a given situation at a given time, and usually composed of sound from many sources, both near and far, excluding the noise under investigation.

IMPACT TABLE FORMAT		
Reversibility	The impact is completely reversible.	
Irreplaceable loss of resources	The impact will not result in the loss of any resources.	
Duration	Long term	
Cumulative effect	The impact would result in negligible to no cumulative effects	
Intensity/magnitude	A low impact is predicted in the De Aar industrial area.	
Significance Rating	Negative low impact - The anticipated impact if it occurs will have moderate negative effects and will require moderate mitigation measures	
	Pre-mitigation impact rating	**Post mitigation impact rating**
Extent	1	1
Probability	1	1
Reversibility	1	1
Irreplaceable loss	1	1
Duration	3	3
Cumulative effect	1	1
Intensity/magnitude	1	1
Significance rating	**-6 (low negative)**	**-6 (low negative)**
Mitigation measures	The following mitigation measures are recommended for the construction and decommissioning phases: • During construction care should be taken to ensure that noise from construction vehicles and plant equipment does not intrude on the Juvenile Secure Care Facility. Plant equipment such as generators, compressors, concrete mixers as well as vehicles should be kept in good operating order and where appropriate have effective exhaust mufflers. • Gravel roads used during construction and during the operational life of the plant should be kept in good order. Corrugations and drainage ruts should not be allowed to develop as these can contribute to mechanical rattling and banging noise on vehicles traversing these roads.	

IMPACT TABLE FORMAT	
	• The final CSP plant location must be positioned as far away as practically possible from the nearest human habitation, i.e. preferably not closer than 2000 m. Given the size and shape of the land on which the proposed plant will be constructed, and the positions of noise receptors, this should be feasible if the plant is positioned to the north of the property. • If a cooling tower is to be utilised then fans should be fitted with sound attenuators; • It is recommended that none of the inverter hardware or tracker units (with motors and associated electrical equipment) be positioned adjacent to the Juvenile Secure Care Centre. The design of the PV plant should take into account the noise emissions of these units such that these units be positioned where their noise levels will not be a disturbance.

9.2.13 Operation - Visual

Table 66: Rating of day-time visual impacts during operation

IMPACT TABLE FORMAT	
Environmental Parameter	**Visual environment:** The aesthetic or scenic nature of the environment within a defined time and space, which covers the broad range of visual, cultural and spiritual aspects of the landscape.
Issue/Impact/Environmental Effect/Nature	Day-time visual impact resulting from a solar energy facility. The solar field and associated infrastructure will alter the natural character of the study area and expose sensitive receptor locations to visual impacts associated with the proposed solar power plant during operation.
Extent	**Local/district:** Will affect the local area or district due to the extensive size of the proposed project.
Probability	**Definite:** Impact will certainly occur (Greater than a 75% chance of occurrence).
Reversibility	**Irreversible:** The impact is irreversible and no mitigation measures exist.
Irreplaceable loss of resources	**Marginal loss:** Scenic / natural views are valuable visual resources that are almost impossible to replace. The impact will

IMPACT TABLE FORMAT		
	result in marginal loss of this resource as most views from visually sensitive receptor locations have already been somewhat degraded by existing electrical infrastructure.	
Duration	**Long term:** The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 50 years).	
Cumulative effect	**Negligible:** The impact would result in negligible to no cumulative effects.	
Intensity/magnitude	**Medium:** Impact alters the visual quality and integrity of the landscape but it still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).	
Significance Rating	**Prior to mitigation measures:** There will be a negative medium impact i.e. the anticipated impact will have moderate negative effects and will require moderate mitigation measures. **After mitigation measures:** No mitigation measures, therefore the negative medium impact will persist.	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	4	4
Reversibility	4	4
Irreplaceable loss	2	2
Duration	3	3
Cumulative effect	1	1
Intensity/magnitude	2	2
Significance rating	-32 (negative medium impact)	-32 (negative medium impact)
Mitigation measures	No mitigation measures.	

Table 67: Rating of night-time visual impacts during operation

IMPACT TABLE FORMAT	
Environmental Parameter	**Visual environment:** The aesthetic or scenic nature of the environment within a defined time and space, which covers the broad range of visual, cultural and spiritual aspects of the landscape.

IMPACT TABLE FORMAT		
Issue/Impact/Environmental Effect/Nature	Potential visual impact of security and operational lighting from the facility on the nightscape. Other than the rural settlement in De Aar located to the south of the proposed site, there is limited human settlement in the area, and thus few existing light sources. The proposed development will therefore alter the visual quality of the area at night.	
Extent	**Local/district:** Will affect the local area or district as it will stand out in the existing dark night scene.	
Probability	**Definite:** Impact will certainly occur (Greater than a 75% chance of occurrence).	
Reversibility	**Partly reversible:** The impact is partly reversible with the implementation of mitigation measures.	
Irreplaceable loss of resources	**No loss:** The impact will not result in the loss of any resources.	
Duration	**Long term:** The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 50 years).	
Cumulative effect	**Medium:** The impact would result in minor cumulative effects by increasing the extent of the light pollution in the area at night.	
Intensity/magnitude	**Medium:** Impact alters the visual quality and integrity of the nightscape but it still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).	
Significance Rating	**Prior to mitigation measures:** There will be a negative medium impact i.e. the anticipated impact will have moderate negative effects and will require moderate mitigation measures. **After mitigation measures:** There will be a negative low impact as the mitigation measures are likely to reduce the magnitude of the impact.	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	4	3
Reversibility	2	2
Irreplaceable loss	1	1
Duration	3	3
Cumulative effect	3	2
Intensity/magnitude	2	2
Significance rating	-30 (negative medium)	-26 (negative low)

IMPACT TABLE FORMAT	
Mitigation measures	▪ Make use of fittings that focus the light and prevent light spill. ▪ Direct perimeter lighting in a downward direction toward the site. ▪ Limit the use of flood lighting where possible.

9.2.14 Operation - Heritage

Table 68: Rating Matrix for impacts in the Construction phase

- Chance finds

IMPACT TABLE FORMAT		
Environmental Parameter	*Discovery of previously unidentified heritage sites (archaeological, palaeontological, historical or grave sites)*	
Issue/Impact/Environmental Effect/Nature	*During construction activity and earthmoving archaeological material could be unearthed that was previously unidentified due to its position.*	
Extent	*In most cases confined to small areas on the site*	
Probability	*Due to the close proximity to water course, localised archaeological finds may possibly occur*	
Reversibility	*In most cases where such finds are made damaged is irreversible*	
Irreplaceable loss of resources	*Significant loss but in most cases the scientific data recovered will mitigate such losses*	
Duration	*Permanent*	
Cumulative effect	*Low cumulative impact*	
Intensity/magnitude	*Medium*	
Significance Rating	*The impact is anticipated as being low and localised but will vary due to type of heritage find that could be made*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	2	1
Reversibility	4	2
Irreplaceable loss	4	3
Duration	4	4

IMPACT TABLE FORMAT		
Cumulative effect	2	1
Intensity/magnitude	2	1
Significance rating	-24(Low negative)	-11 (low negative)
Mitigation measures	*A heritage monitoring program that will identify finds during construction will be able to mitigate the impact on the finds through scientific documentation of finds and provide valuable data on any finds made.*	

- Known Archaeological Sites

IMPACT TABLE FORMAT		
Environmental Parameter	*Identified archaeological sites and areas*	
Issue/Impact/Environmental Effect/Nature	*Due to the nature of the development it is possible that some sites will be impacted and impossible to avoid in the layout plan of the project*	
Extent	*In most cases confined to small areas on the site*	
Probability	*Possible impact in large scale sites like Site 1 that is extended over a wide area in one of the CSP Alternative areas*	
Reversibility	*In most cases where a site cannot be excluded and needs to be destructed the impact is irreversable*	
Irreplaceable loss of resources	*Significant loss but in most cases the scientific data recovered will mitigate such losses*	
Duration	*Permanent*	
Cumulative effect	*Low cumulative impact*	
Intensity/magnitude	*Medium*	
Significance Rating	*The impact is anticipated as being low and localised but will vary due to type of heritage find that could be made*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	2	1
Reversibility	4	2
Irreplaceable loss	4	3
Duration	4	4
Cumulative effect	3	2
Intensity/magnitude	2	1
Significance rating	-32 (Medium negative)	-13 (low negative)

IMPACT TABLE FORMAT	
Mitigation measures	*Mitigation measures as recommended with each identified site and,* *A heritage monitoring program that will identify finds during construction will be able to mitigate the impact on the finds through scientific documentation of finds and provide valuable data on any finds made.*

9.2.15 Operation - Socio-economic

Table 69: Rating of socio economic impacts relative to increase in housing needs/demands

INCREASE IN HOUSING NEEDS/DEMANDS	
Environmental Parameter	*An increase in housing needs/demands would place additional strain on the local municipality.*
Issue/Impact/Environmental Effect/Nature	*De Aar has a limited property market and therefore finding suitable accommodation for up to 80 families (worst case scenario) might prove difficult.*
Extent	*Where the impact occurs it will affect mostly the local area, specifically De Aar as the closest urban settlement.*
Probability	*Unless the current housing backlog has been adequately addressed by the time the CSP and PV plants becomes operational, the impact will probably occur (between a 50% and 75% chance of occurrence).*
Reversibility	*The impact will be partly reversible, but only if significant mitigation measures are put in place, which in all probability would entail the construction of additional houses.*
Irreplaceable loss of resources	*If a severe strain is placed on the municipal services, the increase in housing would result in marginal loss of resources as systems start to fail due to the increased pressure placed on these systems, affecting segments of the town.*
Duration	*As a minimum, the impact and its effects would last over the medium term (2-10 years), depending on how the municipal services are able to keep up.*
Cumulative effect	*A breakdown in municipal services would affect segments of De Aar, which can result in minor cumulative impacts.*
Intensity/magnitude	*Where the municipal serves are unable to keep up with the demand, the impact could affect the continued viability of the system so that it becomes severely impaired and may temporarily cease in certain parts of town (not expected to affect De Aar as a whole).*

INCREASE IN HOUSING NEEDS/DEMANDS		
Significance Rating	*The anticipated impacts can alter the quality, use and integrity of the system, but the system will continue to function in a moderately modified way while it maintains general integrity.*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	3	2
Reversibility	2	1
Irreplaceable loss	2	1
Duration	2	1
Cumulative effect	3	2
Intensity/magnitude	2	1
Significance rating	**-28 (Negative Low)**	**-9 (Negative Low)**
Mitigation measures	Consult with Emthanjeni Local Municipality to establish housing need/demand with the municipality to ensure that land is released timeously to developers.	

Table 70: Rating of socio economic impacts relative to corporate social investment

CORPORATE SOCIAL INVESTMENT	
Environmental Parameter	*The upliftment of the affected community through proactive interventions.*
Issue/Impact/Environmental Effect/Nature	*The CSI programme is aimed at bringing about a positive change to the local affected community by proactive action in terms of community upliftment. Not only does the CSI focus on ways in which the community can be assisted, but also how Mainstream takes responsibility for their actions by means of proactive mitigation.*
Extent	*Where the impact occurs it will affect mostly the local area, specifically Loeriesfontein as the closest urban settlement.*
Probability	*Mainstream has clearly stated their intention to plough back into the community, and therefore the impacts are regarded as definite. However, to bring about sustainable change it is important to consult with the community on their needs. The establishment of a community trust will contribute to this.*
Reversibility	*Not required.*
Irreplaceable loss of resources	*None.*
Duration	*Depending on the type of intervention, the duration can be short term to long term.*

CORPORATE SOCIAL INVESTMENT		
Cumulative effect	*The community would be uplifted through certain interventions, which means that they are more able to find employment and gain skills, which in turn could impact positively on the individual and family concerned.*	
Intensity/magnitude	*The intensity of the impact would rely on the type of intervention and how it is received by the community.*	
Significance Rating	*The anticipated impacts could be significant in terms of positive change, but again it is dependent on the type of intervention and how it is received by the community.*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	2
Probability	2	3
Reversibility	2	3
Irreplaceable loss	1	3
Duration	1	3
Cumulative effect	1	4
Intensity/magnitude	1	3
Significance rating	**+8 (Low Positive)**	**+54 (High Positive)**
Mitigation measures	*Consult with the community to determine their needs. Following a top-down approach without community consultation can result in irrelevant interventions that are disregarded by the community.*	

Table 71: Rating of socio economic impacts relative to sense of place

SENSE OF PLACE	
Environmental Parameter	*Change in sense of place.*
Issue/Impact/Environmental Effect/Nature	*The presence of the CSP and PV plants could render the area 'spoilt' and as such can set a precedent for further land use change, which could further alter people's sense of place. However, the placement of these plants is in line with the Emthanjeni Municipality's intention for the area and therefore it is expected that the area will be transformed in any event. The proposed development could be used to improve tourism in the greater study area.*
Extent	*Where the impact occurs it will affect mostly the local area, specifically De Aar as the closest urban settlement.*
Probability	*Seeing as the area is currently 'unspoiled' with vast open spaces, the negative impact on sense of place is highly probable. Some residents might experience a positive impact*

SENSE OF PLACE		
	on sense of place that can rapidly decrease if they do not receive tangible benefits from the project. The construction of the project will remove the raw sewage from the current environment.	
Reversibility	*Once the CSP and PV plant is constructed, the impact would be irreversible as little can be done to shield the visual impact.*	
Irreplaceable loss of resources	*The impact can result in marginal loss of resources as the expectation is that the area will in any case be transformed given the Emthanjeni Municipality's SDF.*	
Duration	*The impact will continue for some time but will be mitigated by human action (further industrial development in De Aar) within 2-10 years.*	
Cumulative effect	*The presence of the CSP and PV plant can set an precedent for land use change, but this is in line with the SDF and therefore a certain level of cumulative impacts can be expected.*	
Intensity/magnitude	*The impact would alter the quality of the system, but the system can continue functioning albeit in a modified way.*	
Significance Rating	*The anticipated impact will have negligible negative effects that can be addressed with minor mitigation measures.*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	1
Probability	3	2
Reversibility	2	1
Irreplaceable loss	3	2
Duration	2	1
Cumulative effect	2	1
Intensity/magnitude	2	1
Significance rating	**-28 (Negative Low)**	**-8 (Negative Low)**
Mitigation measures	*Job opportunities should be afforded to local individuals as far as possible to enhance their sense of place.* *Mitigation measures identified by the visual impact assessment should be implemented and maintained.*	

Table 72: Rating of socio economic impacts relative business revenue opportunities

NET INCREASE IN LOCAL BUSINESS REVENUE OPPORTUNITIES	
Environmental Parameter	*Change in the economic profile of the area*

NET INCREASE IN LOCAL BUSINESS REVENUE OPPORTUNITIES		
Issue/Impact/Environmental Effect/Nature	*A net increase in revenues of local businesses, considering the benefits of the project and any potential losses or forfeit of opportunities that may occur.*	
Extent	*Local area or district.*	
Probability	*It is likely that the impact will occur.*	
Reversibility	*The impact is reversible with the implementation of specific mitigation measures.*	
Irreplaceable loss of resources	*Not applicable.*	
Duration	*The impact will continue indefinitely.*	
Cumulative effect	*The impact could result in minor cumulative effects, depending on the extent to which local economic stimulation results in additional benefits locally.*	
Intensity/magnitude	*The impact can alter the quality, use and integrity of the system, but the system would still be able to function in a moderately modified way.*	
Significance Rating	*The change is considered of low significance.*	
	Pre-enhancement impact rating	**Post enhancement impact rating**
Extent	3	3
Probability	3	4
Reversibility	3	3
Irreplaceable loss	3	3
Duration	1	1
Cumulative effect	2	3
Intensity/magnitude	2	2
Significance rating	**+30 (Medium Positive)**	**+34 (Medium Positive)**
Mitigation measures	• *Continue and develop relationships with local business organisations or chambers to improve business opportunities.* • *Compile a list of good and services which can be locally*	

NET INCREASE IN LOCAL BUSINESS REVENUE OPPORTUNITIES	
	supplied, such as security, cleaning and catering. • *Set achievable targets for local procurement and determine a local procurement growth path.*

Table 73: Rating of socio economic impacts relative business employment opportunities

NET INCREASE IN LOCAL EMPLOYMENT OPPORTUNITIES		
Environmental Parameter	*Change in the economic profile of the area*	
Issue/Impact/Environmental Effect/Nature	*A net increase in local employment opportunities, considering the benefits of the project and any potential losses or forfeit of opportunities that may occur.*	
Extent	*Local area or district.*	
Probability	*It is likely that the impact will occur.*	
Reversibility	*The impact is reversible with the implementation of specific mitigation measures.*	
Irreplaceable loss of resources	*Not applicable.*	
Duration	*The impact will continue indefinitely.*	
Cumulative effect	*The impact could result in moderate cumulative effects, depending on the extent to which local employment results in additional benefits locally.*	
Intensity/magnitude	*The impact can alter the quality, use and integrity of the system, but the system would still be able to function in a moderately modified way.*	
Significance Rating	*The change is considered of medium significance.*	
	Pre-enhancement impact rating	**Post enhancement impact rating**
Extent	3	4
Probability	4	4
Reversibility	3	3
Irreplaceable loss	3	3
Duration	1	1

NET INCREASE IN LOCAL EMPLOYMENT OPPORTUNITIES		
Cumulative effect	2	3
Intensity/magnitude	1	1
Significance rating	**+16 (Medium Positive)**	**+18 (Medium Positive)**
Mitigation measures	• *Consider the creation of local skills development initiatives that allow residents of Loeriesfontein to gain access to opportunities.* • *Source labour locally whenever possible for both temporary and permanent positions, especially for semiskilled and unskilled work.* • *Effectively manage local expectations of available opportunities and provide details on recruitment processes to secure local supply when necessary.*	

9.2.16 Decommissioning – Biodiversity

Table 74: Rating of impacts related to loss of habitat for red data / general species

IMPACT TABLE FORMAT	
Environmental Parameter	Biodiversity
Issue/Impact/Environmental Effect/Nature	Loss of habitat for red data / general species
Extent	The impact is only expected to affect the site.
Probability	The impact may occur (Between a 25% to 50% chance of occurrence).
Reversibility	The impact is partly reversible but more intense mitigation measures are required.
Irreplaceable loss of resources	The impact will result in marginal loss of resources
Duration	The impact and its effects will either disappear with mitigation or will be mitigated through natural process in a span shorter than the decommissioning phase (0 – 1 years), or the impact and its effects will last for the period of a relatively short decommissioning phase and a limited recovery time after decommissioning, thereafter it will be entirely negated (0 – 2 years).
Cumulative effect	The impact would result in negligible to no cumulative effects

IMPACT TABLE FORMAT		
Intensity/magnitude	Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.	
Significance Rating	**Prior to mitigation measures:** There will be a negative Low impact i.e. the anticipated impact will have negligible negative effects however mitigation measures must be implemented. **After mitigation measures:** After mitigation measures, the negative low impact persists.	
	Pre-mitigation impact rating	**Post mitigation impact rating**
Extent	1	1
Probability	2	1
Reversibility	2	1
Irreplaceable loss	2	1
Duration	1	1
Cumulative effect	1	1
Intensity/magnitude	1	1
Significance rating	+8 (low negative)	+6(low negative)
Mitigation measures	▪ Maintain footprint strictly during decommissioning ▪ Existing access roads must be used. ▪ All infrastructure must be removed from the site. ▪ A rehabilitation plan must be compiled by a qualified ecologist. ▪ Re-vegetation of affected areas must be made a priority to avoid erosion. ▪ Suitable stormwater / wind controls must be put in place until rehabilitation is complete ▪ Constant removal of alien invasive species in and around plant.	

Table 75: Rating of impacts related to edge effect

IMPACT TABLE FORMAT	
Environmental Parameter	Biodiversity
Issue/Impact/Environmental Effect/Nature	Edge effect
Extent	The impact is only expected to affect the site.
Probability	The impact may occur (Between a 25% to 50% chance of

IMPACT TABLE FORMAT		
	occurrence).	
Reversibility	The impact is reversible with implementation of minor mitigation measures.	
Irreplaceable loss of resources	The impact will result in marginal loss of resources.	
Duration	The impact and its effects will either disappear with mitigation or will be mitigated through natural process in a span shorter than the decommissioning phase (0 – 1 years), or the impact and its effects will last for the period of a relatively short decommissioning phase and a limited recovery time after decommissioning, thereafter it will be entirely negated (0 – 2 years).	
Cumulative effect	The impact would result in minor cumulative effects	
Intensity/magnitude	Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.	
Significance Rating	**Prior to mitigation measures:** There will be a negative low impact i.e. the anticipated impact will have low negative effects and will require minimal mitigation measures. **After mitigation measures:** After mitigation measures, a negative low impact will persist.	
	Pre-mitigation impact rating	**Post mitigation impact rating**
Extent	1	1
Probability	2	2
Reversibility	1	1
Irreplaceable loss	2	1
Duration	1	1
Cumulative effect	3	1
Intensity/magnitude	1	1
Significance rating	-10 (low negative)	-7(low negative)
Mitigation measures	▪ The contractor should be responsible for implementing a programme of weed control ▪ The spread of exotic species occurring throughout the site should be controlled. ▪ All exotic vegetation must be removed from the site (if present).	

9.2.17 Decommissioning - Surface Water

Surface water impacts during the decommissioning phase are the same as those during the construction phase.

9.2.18 Decommissioning - Groundwater

- Impact Matrix

The impacts for the site are presented in the following impact matrices:

Table 76: Rating Matrix for impacts in the **Decommissioning** phases

IMPACT TABLE FORMAT	
Environmental Parameter	**Groundwater**
Issue/Impact/Environmental Effect/Nature	Deterioration in the groundwater quality in the vicinity of the site.
Extent	Changes to groundwater quality during construction and decommissioning are likely to affect the local area of the site only.
Probability	It is considered possible that the impact may occur (between a 25% and 50% chance of occurrence)
Reversibility	Groundwater pollution / deterioration in groundwater quality is partly reversible. Measures to "clean up" groundwater pollution can be expensive and time-consuming
Irreplaceable loss of resources	If groundwater pollution with a persistent contaminant occurs, and this pollution affects groundwater used for public supply (e.g. to De Aar), then a significant loss of resource may occur.
Duration	Potentially long-term. Impacts such as polluted groundwater may persist long after (many years) the plants have been decommissioned.
Cumulative effect	Medium Cumulative Impact. Minor cumulative effects may occur if groundwater impacts combine – specifically if increased groundwater recharge combines with groundwater pollution, leading to more rapid migration of contaminants away from the site.
Intensity/magnitude	Serious groundwater pollution at De Aar has the potential to permanently alter the functionality of the local groundwater system.
Significance Rating	Negative medium impact - The anticipated impact if it occurs will have moderate negative effects and will

IMPACT TABLE FORMAT		
	require moderate mitigation measures	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	2	1
Reversibility	3	2
Irreplaceable loss	2	1
Duration	3	2
Cumulative effect	3	2
Intensity/magnitude	3	1
Significance rating	**-42 (negative medium)**	**-9 (low negative)**
Mitigation measures	The following mitigation measures are recommended for the construction and decommissioning phases: • An inventory should be made of substances which will be used on site (both temporarily during construction and decommissiong, and during operation) that are potentially harmful to groundwater. • All areas for the storage and handling of potentially hazardous (to groundwater) materials such as hydrocarbon fluids, therminol, salts, herbicides, solvents, etc are securely bunded. This should include workshop areas. Any spillages should be removed as soon as possible. This should apply to all contractors on the site, who may only be on site for a relatively short time during construction or decommissioning. • Monitoring of groundwater quality and levels should be carried out at boreholes at the site (at least two boreholes per site, at least one of which is situated downgradient of the site.) The monitoring boreholes should be constructed with the advice of a qualified hydrogeologist, and securely capped. At De Aar, results from the monitoring network should be combined with data from boreholes supplying De Aar. Any discrepancies must be immediately investigated. Monitoring networks provide an "early warning" system and can potentially save considerable costs if properly used.	

IMPACT TABLE FORMAT	

9.2.19 Decommissioning - Noise

Noise impacts during the decommissioning phase are the same as those during the construction phase.

9.2.20 Decommissioning - Visual

Visual impacts during the decommissioning phase are the same as those during the construction phase.

9.2.21 Decommissioning - Heritage

Table 77: Rating Matrix for impacts on decommissioning phase

IMPACT TABLE FORMAT	
Environmental Parameter	*Discovery of previously unidentified heritage sites (archaeological, palaeontological, historical or grave sites)*
Issue/Impact/Environmental Effect/Nature	*During decommissioning activity and earthmoving archaeological material could be unearthed that was previously unidentified due to its position.*
Extent	*In most cases confined to small areas on the site*
Probability	*Due to the close proximity to water course, localised archaeological finds may possibly occur*
Reversibility	*In most cases where such finds are made damaged is irreversible*
Irreplaceable loss of resources	*Significant loss but in most cases the scientific data recovered will mitigate such losses*
Duration	*Permanent*
Cumulative effect	*Low cumulative impact*
Intensity/magnitude	*Magnitude dependent on type of finds made – however in most cases Medium*

IMPACT TABLE FORMAT		
Significance Rating	*The impact is anticipated as being low and localised but will vary due to type of heritage find that could be made*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	2	1
Reversibility	4	2
Irreplaceable loss	4	3
Duration	4	4
Cumulative effect	2	1
Intensity/magnitude	2	1
Significance rating	-24 (Low negative)	-11 (low negative)
Mitigation measures	*A heritage monitoring program that will identify finds during decommissioning will be able to mitigate the impact on the finds through scientific documentation of finds and provide valuable data on any finds made.*	

9.2.22 Decommissioning - Socio-economic

Socio-economic impacts during the decommissioning phase are the same as those during the construction phase.

10 CUMULATIVE IMPACTS AND MITIGATION MEASURES

10.1 Cumulative Impacts

Table 78: Cumulative impacts and proposed mitigation measures

Environmental Component	Cumulative Impact
Biodiversity Impact Assessment	▪ Construction Due to the negligible amount of infrastructure present within the study area, cumulative impacts are anticipated to be low during construction. ▪ Operation Cumulative impacts during the operation phase relate mainly to avifauna. Existing power line infrastructure in the study area and the addition of more will increase the risk of collisions and electrocutions. However suitable mitigation measures recommended in this report can reduce these impacts. In addition, the additional infrastructure to be added is very small in comparison to that already present. It is recommended that the client enter into discussions with Eskom to investigate the possibility of adding bird flappers to the existing power line infrastructure in order to reduce the current impact present. ▪ Decommissioning Decommissioning of the plant will result in the elimination of the cumulative impacts mentioned above.
Surface Water Impact Assessment	Water pollution as a result of the life cycle is being supplied into the hydrological system in the local area and therefore, is impacting all areas surrounding the site. Run-off is to be mitigated by the use of structures that will reduce the rate and volume of run-off so as to prevent erosion

	and siltation impacts affecting nearby wetlands. Structures can include silt nets, grass blocks and any other related structure that can prevent silt build-up and erosion. In terms of potential impacts associated with wind erosion, regular but light watering must take place whilst surfaces are left exposed.
Groundwater Impact Assessment	▪ Construction Phase Cumulative impacts are considered unlikely for the construction phase, since the timescales are relatively short. ▪ Operation Phase Cumulative impacts for the operation phase have been classifed as "Medium", since minor cumulative effects may occur if groundwater impacts combine – specifically if increased groundwater recharge combines with groundwater pollution, leading to more rapid migration of contaminants away from the site. ▪ Reversibility of Impacts Groundwater pollution / deterioration in groundwater quality is only partly reversible, since the fate of groundwater contaminants in the sub-surface can be very complex. This depends to some extent on the type of contaminant. Measures to "clean up" groundwater pollution can be expensive and time-consuming.
Noise Impact Assessment	None foreseen
Visual Impact Assessment	The majority of impacts will be negligible however the project would result in minor cumulative effects by increasing the extent of the light pollution in the area at night.
Heritage Impact Assessment	None foreseen

Socio-economic Impact Assessment	▪ Construction Phase The influx of people could result in minor cumulative effects, depending on the number of unemployed job seekers that also enter the area in addition to the construction team of 840. An additional demand on municipal services could result in significant cumulative impacts if services become unstable or unavailable, which in turn would impact on permanent residents. HIV infection adds to the current HIV infection rate in the province and the country, thereby taxing health resources further in combating the disease. ▪ Operation Phase A breakdown in municipal services would affect segments of De Aar, which in turn can affect the quality of life of current and new residents. The community would be uplifted through certain interventions, which means that they are more able to find employment and gain skills, which in turn could impact positively on the individual and family concerned. The presence of the CSP and PV plants can set an unintended precedent for land use change, which in future can lead to cumulative impacts. ▪ Reversibility of Impacts Most impacts are deemed partly to completely reversible. However, the reversibility of impacts is largely dependent on the successful implementation of mitigation measures. Where mitigation measures fail, impacts become less reversible.

10.2 Mitigation Measures

10.2.1 Biodiversity

The following mitigation measures are recommended for the study area during construction:

- Demarcation of sensitive areas prior to construction activities starting
- Use of appropriate construction methods in the sensitive area.
- Intensive environmental audits (frequently in sensitive areas) by an independent party during this construction period.
- A copy of the Environmental Impact Report and associated Environmental Management Programme as well as the specialist study must be present at the construction site for easy reference to specialist recommendations in sensitive areas.
- It is recommended that the construction crew be educated about the sensitivities involved in these areas as well as the potential species they could encounter.
- Rehabilitation to be undertaken as soon as possible after construction.
- Only vegetation within the study area must be removed.
- Vegetation removal must be phased in order to reduce impact of construction.
- Construction site office and laydown areas must be clearly demarcated and no encroachment must occur beyond demarcated areas.
- All natural areas impacted during construction must be rehabilitated with locally indigenous plant species.
- Construction areas must be well demarcated and these areas strictly adhered to.
- The use of pesticides and herbicides in the study area must be discouraged as these impacts on important pollinator species of indigenous vegetation.
- Soils must be kept free of petrochemical solutions that may be kept on site during construction. Spillage can result in a loss of soil functionality thus limiting the re-establishment of flora.

The following mitigation measures are recommended for the study area during operation

- Six monthly checks of the area should take place for the emergence of invader species.
- Mitigation measures mentioned for the construction phase above must be implemented for any maintenance of the development that may be undertaken during the operation phase.
- Correct rehabilitation with locally indigenous species.
- Monitoring programme to ensure that rehabilitation efforts are successful to ensure that risks such as erosion and the edge effect are avoided.
- Constant maintenance of the area to ensure re-colonisation of floral species.
- Regular removal of alien species which may jeopardise the proliferation of indigenous species.
- Regular maintenance of bird flappers and guards must be undertaken.

- Regular maintenance of protection of evaporation ponds to ensure birds do not gather in this area.
- A monitoring programme in conjunction with a national authority on birds such as Birdlife or the Endangered Wildlife Trust must be initiated at the site to quantify the long term effects of such plants in South Africa.

All mitigation measures applied during construction will apply to the decommissioning phase of the project.

10.2.2 Surface Water

- Construction site specific mitigation measures

i. All vehicles in and out of the site will be required to be checked for leakages before and after entering the construction area.
ii. Areas where fuels are either kept or transferred will need to be bunded so as to contain spillage. Cement mixing sites will also need to be strategically designated and at least 100metres away from the wetland areas.
iii. Ablution facilities must be provided to prevent workers urinating near or in the wetlands.
iv. The river and stream systems as well as their associated buffer areas should be fenced off preferably with palisade fencing. This fencing should take place prior to any construction activities taking place on site. Where it is required, a gate should also be constructed to allow resident cattle and sheep to access rivers for water supply.
v. Removal of allpoint sources of the effluent released during construction and treatment of the effluent remains within the sewage treatment works plant.

- Operation site specific mitigation measures

i. Development and implementation of an adequate storm water management plan designed by an appropriate engineer.
ii. Construction of structures such as attenuation dams and evaporation ponds that can contain storm water run-off.
iii. Other structures that may be considered are semi-permeable surfaces that can absorb run-off somewhat, in addition to energy dissipation structures. Such structures can reduce the amount and rate of run-off generated by the proposed development entering hydrological systems and thereby prevent the onset of erosion.
iv. Housing of the transformers within a concrete bund that would be linked to an oil holding dam within the footprint of the substation and plants.
v. Removal and recycling of all contaminated water from the site to be recycled off-site as part of the remediation process.
vi. It is critical that the storm water management plan and structural design\layout integrates additional measures that will prevent any stormwater run-off around the piping to be circulated into an attenuation dam.

vii. Regular maintenance and monitoring of the evaporation ponds containing the wastewater of the proposed development for possible leaks or damage to the structure of the ponds. Additionally, measures accommodating overspill by the evaporation ponds must be incorporated into the design of the evaporation ponds.

10.2.3 Groundwater

- Construction, Operation and Decommissioning

The mitigation measures should be easy to achieve and should not be expensive. Pollution of groundwater is likely to cost far more in the long run than basic measures to prevent this.

The following mitigation measures are recommended for the study area:

i. Inventories should be made of all substances that are potentially hazardous to groundwater, which will be stored, used or transported over the sites. The risk of each substance to the groundwater should be considered.
ii. All areas in which substances potentially hazardous to groundwater are stored, loaded, worked with or disposed of should be securely bunded (impermeable floor and sides) to prevent accidental discharge to groundwater.

10.2.4 Noise

i. During construction, care should be taken to ensure that noise from construction vehicles and plant equipment does not intrude on the Juvenile Secure Care Facility. Plant equipment such as generators, compressors, concrete mixers as well as vehicles should be kept in good operating order and where appropriate have effective exhaust mufflers.
ii. Gravel roads used during construction and during the operational life of the plant should be kept in good order. Corrugations and drainage ruts should not be allowed to develop as these can contribute to mechanical rattling and banging noise on vehicles traversing these roads.
iii. The final CSP plant location must be positioned as far away as practically possible from the nearest human habitation, i.e. preferably not closer than 2000 m. Given the size and shape of the land on which the proposed plant will be constructed, and the positions of noise receptors, this should be feasible if the plant is positioned to the north of the property.
iv. If a cooling tower is to be utilised, then fans should be fitted with sound attenuators;
v. It is recommended that none of the inverter hardware or tracker units (with motors and associated electrical equipment) be positioned adjacent to the Juvenile Secure Care Centre. The design of the PV plant should take into account the noise emissions of these units such that these units be positioned where their noise levels will not be a disturbance.

10.2.5 Visual

Mitigation measure during construction:

- Carefully plan to reduce the construction period.
- Locate laydown and storage areas in zones of low visibility i.e. behind tall trees or in lower lying areas.
- Minimise vegetation clearing and rehabilitate cleared areas as soon as possible.
- Maintain a neat construction site by removing rubble and waste materials regularly.
- Make use of existing gravel access roads where possible.

Mitigation measures during operation:

- Make use of fittings that focus the light and prevent light spill.
- Direct perimeter lighting in a downward direction toward the site.
- Limit the use of flood lighting where possible.

10.2.6 Heritage

- Archaeology

  - Site 1

    i. Surface sampling

It is suggested that the sampling takes the following form: An archaeologist should be contracted to obtain the necessary permits from SAHRA for the documentation of material. The material within two strips 50x5m must be recorded through in-situ analysis and photography of the artefacts. Further analysis and collection must also be conducted where further earthmoving within the dam areas will take place. Material with $5m^2$ blocks within each strip could be collected in one spot for convenient analysis and photography and then re-scattered within the same block. Each 50 m strip would contain 10 blocks. The sampling strips should not be close or adjacent to each other but some distance apart.

ii. Monitoring during construction

  - Site 2

iii. Preservation of the site in situ and fencing of the site during construction, if this is not possible;

iv. Documentation of the site layout and test excavations to determine the cultural context before an application for a destruction permit can be lodged with SAHRA.

v. Monitoring during construction

  - Site 3

vi. No mitigation measures required

- Site 4

vii. It is recommended that site monitoring be done if any construction takes place in the vicinity of this site.

- Site 5 and 6

viii. Preservation of the site in situ and fencing of the site during construction, if this is not possible;
ix. Documentation of the site layout and test excavations to determine the cultural context before an application for a destruction permit can be lodged with SAHRA.
x. Monitoring during construction

- Site 7 and 8

xi. Preservation of the site in situ and fencing of the site during construction, if this is not possible;
xii. Further research into the structure will be required through, documentation of the site layout and test excavations to determine the cultural context before an application for a destruction permit can be lodged with SAHRA.
xiii. Monitoring during construction.

- Palaeontology

The following general mitigation measures are recommended:

i. A monitoring plan must be agreed upon by all the stakeholders for the different phases of the project focussing on the areas where earthmoving will occur.
ii. If during construction any possible finds are made, the operations must be stopped and the qualified archaeologist be contacted for an assessment of the find.
iii. Should substantial fossil remains (e.g. well-preserved fossil fish, reptiles or petrified wood) be exposed during construction, however, the ECO should carefully safeguard these, preferably in situ, and alert SAHRA as soon as possible so that appropriate action (e.g. recording, sampling or collection) can be taken by a professional palaeontologist.
iv. A management plan must be developed for managing the heritage resources in the surface area impacted by operations during construction and operation of the development. This includes basic training for construction staff on possible finds, action steps for mitigation measures, surface collections, excavations, and communication routes to follow in the case of a discovery.

10.2.7 Socio-economic

Most mitigation measures suggested in this report is relatively achievable as it either makes use of existing structures or processes without enormous cost to the project proponent. Mitigation measures identified by the visual impact assessment should be implemented and maintained.

- Construction

Construction activities have the potential to largely impact on the social environment. Thus social mitigation measures ensure that construction activities are managed in such a manner that the positive impacts may be enhanced and the negative impacts are minimised as far as possible.

- Influx of People

i. Inform local businesses that construction workers will move into the area to enable local businesses to plan for the extra demand.
ii. Ensure that employment procedures/polices are communicated to local stakeholders, especially community representative organisations and ward councillors.
iii. Have clear rules and regulations for access to the construction site to control loitering. Consult with the local SAPS to establish standard operating procedures for the control and/or removal of loiterers at the construction site.

- Change to Municipal Infrastructure

i. Where possible, construction workers should be housed within the local community to reduce the possible additional strain on local resources.
ii. Contractors to supply and install, at their own cost, infrastructure needed to access municipal services, e.g. water and sewerage pipelines. On site, sufficient portable services must be available (e.g. portable toilet facilities) and serviced regularly to prevent contamination.
iii. The use of local labour during construction will negate the need for additional housing; therefore contractors are again urged to make use of as much local labour as possible.
iv. Contractors must comply with the mitigation and/or enhancement measures stipulated in the EMP. Corrective measures must be implemented where the EMP has not been adhered to.

- Integration with Local Communities

i. An aggressive STI and HIV/AIDS awareness campaign should be launched, which is not only directed at construction workers but also at the community as a whole. To accomplish this, a Health & Safety Plan should be developed and implemented, which should include a detailed HIV prevention plan.
ii. Local women should be empowered. This could be achieved by employing them to work on the project, which in turn would decrease their (financial) vulnerability.

- Operation

Impacts that occur during the Operation and Maintenance phase have the potential to occur over a prolonged period and therefore particular attention should be paid to the mitigation of such impacts to either reduce the severity of the impacts or the duration of the impact.

- Increase in Housing Needs/Demands

  i. Consult with Emthanjeni Local Municipality to establish housing need/demand with the municipality to ensure that land is released timeously to developers.

- Corporate Social Investment

  ii. Consult with the community to determine their needs. Following a top-down approach without community consultation can result in irrelevant interventions that are disregarded by the community.

- Sense of Place

  iii. Job opportunities should be afforded to local individuals as far as possible to enhance their sense of place.

11 DESCRIPTION AND COMPARATIVE ASSESSMENT OF ALL ALTERNATIVES IDENTIFIED

The following technological alternatives were investigated and eliminated at Scoping level:

11.1.1 Technology Alternatives assessed

The table below introduces the dominant CSP technologies; parabolic troughs, solar towers, dish - Stirling systems and linear Fresnel reflectors. Parabolic trough systems have been operational since the late 1980s and are the most mature and commercially feasible CSP technology, the first commercial solar tower became operational in mid 2007 while no commercial dish-Stirling or linear Fresnel systems are in commercial operation.

Table 79: CSP Technologies

Technology	Description
Parabolic Trough 	▪ Sunlight concentrated on a central receiver ▪ Oil in receiver collects heat ▪ Heat used to generate steam ▪ Steam generates electricity in conventional power block ▪ Steam may be used to heat thermal storage medium ▪ Currently 800MW + of operational trough plants – by far the most mature CSP technology ▪ Currently the cheapest CSP technology
Solar Tower 	▪ Hundreds of flat mirrors (heliostats) track the sun and concentrate the light on a single point receiver on the tower ▪ Air / Graphite / Water in the tower collects heat ▪ Heat used to generate steam ▪ Steam generates electricity in conventional power block ▪ Steam may be used to heat thermal storage medium ▪ Higher temperatures therefore potential for higher efficiency ▪ Currently 31MW of operational commercial trough plants – less mature than trough technology.

Dish – Stirling Engine 	▪ Sunlight concentrated on a central receiver ▪ Stirling engine at focal point converts heat directly into electricity ▪ Unlike trough and tower no water is required ▪ Thermal storage is less practically feasible than trough and tower technologies ▪ No commercial plants in operation, currently not a mature CSP technology
Linear Fresnel Reflector 	▪ Similar to trough system except trough replaced by linear flat mirrors ▪ Sunlight concentrated on a central receiver ▪ Oil / Water in receiver collects heat ▪ Heat used to generate steam ▪ Steam generates electricity in conventional power block ▪ Steam may be used to heat thermal storage medium ▪ No commercial plants in operation: Lower CAPEX as cheap flat mirrors used. ▪ Higher MW/km^2 than any other CSP technology

The solar tower, Stirling engine and Linear Fresnel technology have not been used extensively globally and thus they do not have the proven usage as that of trough technology. In addition the avifaunal impacts of the power tower system are considered to be higher due to the beams that are created. The financial costs involved for these technologies is also substantially more than trough technology, making trough technology the most bankable in the industry at this stage. For South Africa, the technology with the proven track record has thus been selected i.e. **trough technology**.

In terms of PV technology, two different types of technology are available to Mainstream. These are:

PV – The panel is a packaged interconnected assembly of solar cells, also known as photovoltaic cells.

CPV - Sunlight is concentrated through a lens onto high performance solar cells, thus increasing the electricity generated

A decision on which PV technology to use for the project in question has not been decided and this will be explored in detail in the EIA phase.

As mentioned above in this report, additional farms were intended for inclusion in the EIA for assessment. These farms were however secured for other purposes and thus the proponent was forced to make use of the farm in question. Hence the development has serious space constraints. The property under investigation was chosen due to the access to the waste water for the CSP operation hence the selection of this farm. Thus the selection of on site layout alternatives is limited due to the size constraints.

The property in question was also selected as the lease agreement will benefit local government hence providing an additional revenue stream.

The client has however generate some alternative layouts which are discussed below with the most favourable selected.

Table 80 below highlights the issues associated with each alternative thereby identifying the preferred alternative.

Table 80: Alternatives Assessment

	Biodiversity	**Surface Water**	**Heritage**	**Socio-economic**	**Groundwater**	**Fatal Flaws**
CSP / PV Solar Field Alternative 1	Area highly contaminated with waste water and infested with alien species. Removal of waste water will reduce bird abundance and hence impacts on this faunal grouping.	Waste water settlement due to sewage treatment works. Brak River on northern boundary.	Some heritage features present which would require documentation prior to construction.	No social concerns.	Groundwater is likely to have been compromised by the waste water and upfront testing will be required.	No fatal flaws however waste water will have to be removed if construction is to take place.
CSP Solar Field Alternative 2	Area is transformed in part due to anthropogenic activities and grazing has affected species diversity.	No surface water concerns.	Some heritage features present which would require documentation prior to construction.	No social concerns.	No groundwater concerns.	No fatal flaws present.

	Biodiversity	Surface Water	Heritage	Socio-economic	Groundwater	Fatal Flaws
PV Solar Field	Area is affected by grazing. No major concerns as area will not be cleared.	Drainage line in the northern part of the property which must be avoided.	No heritage concerns.	No social concerns.	No groundwater concerns.	No fatal flaws present.
Laydown area CSP site 1	No biodiversity concerns	Close to the Brak River.	Potential heritage features which will require documentation prior to establishment.	No social concerns	No groundwater concerns.	No fatal flaws.
Laydown area CSP site 2	Area transformed by activities associated with sewage treatment works.	No surface water concerns	No heritage concerns	No social concerns	No groundwater concerns.	No fatal flaws.
Laydown area 3 CPV/PV Site	Area transformed by road and quarrying activities.	No surface water concerns.	No heritage concerns	No social concerns	No groundwater concerns	No fatal flaws.
No Go Alternative	No vegetation clearance and habitat loss would occur however the waste water accumulation and alien infestation would remain.	Waste water accumulation on the site would continue.	Heritage sites would remain undisturbed and undocumented.	The community would not benefit from the financial spin offs associated with the proposed development. In addition the landowner would not benefit from the lease agreement and the community will not benefit from the spin off job creation. The improvement in waste water treatment would not occur.	Waste water accumulation on the site would continue and risk contaminating the groundwater.	

	Biodiversity	Surface Water	Heritage	Socio-economic	Groundwater	Fatal Flaws
Preferred Alternatives	No preference with regards to biodiversity. PV Solar Field Alternative 1 CSP Solar Field Alternative 2 PV Solar Field Laydown area CSP site 2 Laydown area 3 CPV/PV Site	Preference to remove waste water and risks associated with the Brak River. PV Solar Field Alternative 1 CSP Solar Field Alternative 2 PV Solar Field Laydown area CSP site 2 Laydown area 3 CPV/PV Site	No particular preference however documentation of identified heritage features must take place. PV Solar Field Alternative 1 CSP Solar Field Alternative 2 PV Solar Field Laydown area CSP site 2 Laydown area 3 CPV/PV Site	No preference with regards to social. PV Solar Field Alternative 1 CSP Solar Field Alternative 2 PV Solar Field Laydown area CSP site 2 Laydown area 3 CPV/PV Site	Preference to remove waste water and risks associated with the groundwater contamination. PV Solar Field Alternative 1 CSP Solar Field Alternative 2 PV Solar Field Laydown area CSP site 2 Laydown area 3 CPV/PV Site	

Key

	ELIMINATED
	PREFERRED

CSP / PV Solar Field Alternative 1 is not suitable for CSP as the removal of waste water will not be able to be conducted prior to construction. It is thus not favourable. CSP / PV Solar Field Alternative 2 is however technically suitable. The construction on this area would allow the proponent to feed the treated waste water into the new plant whilst drying out the current waste water accumulation in the northern portion of the site. As mentioned in the technical description, the proponent will be upgrading the current treatment process at the waste water treatment plant in order to provide suitable industrial grade waste water to the CSP plant. This will allow for an improvement of the current situation. This will be done in conjunction with the Local Municipality.

The dried up area, once rehabilitated, will be suitable for the establishment of a section of the PV or CSP plant depending on the license that is granted to Mainstream. This will take place after the establishment of the CSP Plant.

The existing access roads present on the site will be utilised for the main access roads onto the site. Internal access roads within the footprint will be created based on the final layouts.

11.2 No Go Alternative

The No-Go Alternative is the option of not establishing the CSP and CPV/PV Plants in De Aar. The No-Go option would therefore result in contributing to the demand for electricity and more specifically renewable energy targets in South Africa not being met. This would also hinder the economic injection that the project promises to provide for the town of De Aar in the form of short term employment and long term job creation and financial injection.

The No-Go alternative has thus been eliminated due to the fact that the identified environmental impacts can be suitably mitigated and that by not building the project, the socio-economic benefits would be lost.

12 ENVIRONMENTAL MONITORING AND AUDITING

The Environmental Management Programme (EMPR) becomes a tool by which compliance on the proposed site can be measured against. In order to utilise this tool, environmental monitoring needs to take place with regular audits against the EMPR to ensure that all aspects are attended to.

Environmental monitoring establishes benchmarks to judge the natural and magnitude of potential environmental and social impacts.

Some of the key parameters for monitoring and auditing of the proposed project include the following inter alia:

- Soil erosion and siltation.
- Oil spillages
- Dust and gaseous emissions.
- Water quality
- Noise and vibration
- Change in biodiversity
- Socio-economic change
- Land use changes.

The overall objective of environmental and social monitoring is to ensure that mitigation measures are implemented and that they are effective. Environmental and social monitoring will also enable responses to new and developing issues of concern. The activities and indicators that have been recommended for monitoring are presented in the EMPr.

Environmental monitoring will be carried out to ensure that all construction activities comply and adhere to environmental provisions and standard specifications, so that all mitigation measures are implemented. The contractor shall employ an officer responsible for implementation of social/ environmental requirements. This person will maintain regular contact with the local District Environmental Officers. The contractor and proponent will have a responsibility to ensure that the proposed mitigation measures are properly implemented during the construction phase.

The environmental monitoring program will operate through the preconstruction, construction, and operation phases. It will consist of a number of activities, each with a specific purpose with key indicators and criteria for significance assessment. The following aspects will be subject to monitoring:

- Encroachment into sensitive areas
- Maintenance of project footprint
- Vegetation maintenance around project work sites, workshops and camps
- Health & Safety

Monitoring should be undertaken at a number of levels. Firstly, it should be undertaken by the Contractor at work sites during construction, under the direction and guidance of the Supervision Consultant who is responsible for reporting the monitoring to the implementing agencies. It is not the Contractor's responsibility to monitor land acquisition and compensation issues. It is recommended that the Contractor employ local full time qualified environmental inspectors for the duration of the Contract. The Supervision Consultant should include the services of an international environmental and monitoring specialist on a part time basis as part of their team.

Environmental monitoring is also an essential component of project implementation. It facilitates and ensures the follow-up of the implementation of the proposed mitigation measure, as they are required. It helps to anticipate possible environmental hazards and/or detect unpredicted impacts over time.

Periodic ongoing monitoring will be required during the life of the Project and the level can be determined once the Project is operational.

13 COMPLIANCE WITH WORLD BANK STANDARDS AND EQUATOR PRINCIPLES

This report has been prepared to comply with various environmental legislation as well as World Bank Standards (IFC Guidelines) and the Equator Principles. Thus in order to ensure compliance with these, a checklist has been compiled to ensure that all aspects of these guidelines have been taken into account when compiling this document. Table 81 below indicates that all applicable performance standards have been complied with.

The performance standards which have not been addressed at this stage as indicated in Table 81 below will be addressed at a later stage when the proponent has reached financial closure. Therefore the compliance level is partially compliant at this stage. It is important to note that the project proponent is committed to achieving compliance with the EPs.

The coding key is as follows:

Compliance level			
Clear			
Not assessed/determined	Not compliant	Partially compliant	Compliant

Table 81: Compliance with Equator Principles

PRINCIPLES	**COMPLIANCE LEVEL**	**REFERENCE**
General, Performance Standard 1 Environmental & Social Reporting		
1. Baseline Information		Refer to Chapter 6
2. Impacts and Risks		Refer to Chapter 9
3. Global impacts		N/A
4. Transboundary		N/A
5. Disadvantaged / vulnerable groups		Refer to Appendix 9
6. Third party		Refer to Chapter 8.7
7. Mitigation measures		Refer to Chapter 10 (EIR) and EMP
8. Documentation Assessment process		Refer to Chapter 9
9. Action Plans		No major Action Plans required as mostly generic mitigation measures have been required. Suitable mitigation plans are included in

		the EMPr.
10 Organizational capacity		Refer to Appendix 9
11. Training		Refer to Appendix 9
12. Grievance mechanism	The proponent commit to full compliance with this standard when financial closure has been reached. The proponent is fully aware of the implications of this standard and this information will be made available in due course as part of the development planning for the project.	Refer to Appendix 9
Performance Standard 2, Labour & Working Conditions		
1. Human Resource Policy	The proponent commit to full compliance with this standard when financial closure has been reached. The proponent is fully aware of the implications of this standard and this information will be made available in due course as part of the development planning for the project.	Refer to Appendix 9
2. Working relationship		Refer to Appendix 9
3. Working conditions with and terms of employment		Refer to Appendix 9
4. Workers organization		Refer to Appendix 9
5. Non discrimination and equal opportunities		Refer to Appendix 9
7. Occupational Health and Safety		Refer to Appendix 9
8. Non-employee workers		Refer to Appendix 9
9. Supply Chain		Refer to Appendix 9
10. Labor Assessment Component of a Social and Environmental Assessment		Refer to Appendix 9
Performance Standard 3, Pollution		
1. Pollution Prevention, Resource Conservation & Energy Efficiency		Refer the EMPr

2. Wastes		Refer the Appendix 6
3. Hazardous material		Refer the Appendix 6
4. Emergency preparedness & response	The proponent commit to full compliance with this standard when financial closure has been reached. The proponent is fully aware of the implications of this standard and this information will be made available in due course as part of the development planning for the project.	Refer to Appendix 9
5. Technical guidance – ambient considerations		Refer to Appendix 9
6. Greenhouse gas emissions		No greenhouse gas emissions will result from the proposed development
Performance Standard 4, Health & Safety		
1. Hazardous materials safety		Refer the Appendix 6
2.Environmental and natural resource issues		Refer to chapters 6 and 8
Performance Standard 5, Land Acquisition		**Refer to chapter 5**
Performance Standard 6, Biodiversity		**Refer to Chapter 6.4 and 8.1**
Performance Standard 7, Indigenous People		**Refer to Chapter 8.8**
Performance Standard 8, Cultural Hertiage		**Refer to Chapter 8.6**

14 EVALUATION AND RECOMMENDATIONS

Table 82 indicates the major findings of the EIA and states the major recommendations that have been made by the specialists.

14.1 Summary of Findings

Table 82: Summary and Recommendations

Environmental Parameter	Summary of major findings	Recommendations
Biodiversity Impact Assessment	The site has been determined to be fairly transformed by anthropogenic activities. The property is also earmarked for future industrial development by the SDF. Birds are the faunal grouping which could be affected the worst by the proposed development. The clearing of the waste water has been identified as a positive impact on both the soils and the bird species present.	The development will not result in a detrimental effect on the environment. Recommended mitigation measures must be put in place to reduce the identified impacts.
Surface Water Impact Assessment	Two surface water features are present on the property, these are however not to be directly affected by the proposed development. The removal of the waste water has been identified as a positive impact.	In consideration of the potential impacts that may affect the functional aspects of the surface water resources, a buffer zone of 32 metres has been applied to the water courses. The mitigation measures stipulated in terms of the above-mentioned impacts have been elaborated on. It is critical that these are followed in order to minimize impacts on the surface water resources found on the proposed study area.
Groundwater Impact Assessment	The proposed development has not been identified as a major risk to groundwater however minor risks associated with hydrocarbons are present which require management.	Stringent implementation of mitigation measures.

Noise Impact Assessment	The proposed development is not likely to affect the current noise environment.	Infrastructure should be placed away from the secure care centre.
Visual Impact Assessment	It was ascertained that the proposed development will not have a high visual impact on any visually sensitive receptors, most of which are located to the north of De Aar and include existing and future dwellings and motorists travelling along sections of the R48. The study revealed that the proposed solar energy facility will have a negative low visual impact during construction and a negative medium visual impact during operation, with very few mitigation measures available.	Mitigation measures suggested in the visual study must be implemented to reduce potential visual impacts.
Heritage Impact Assessment	Several heritage features have been identified on the site. Those that fall within the footprint will require documentation and removal by a qualified heritage specialist prior to construction. No palaeontological concerns were identified.	Strict implementation of mitigation and management measures. Consultation with SAHRA through a heritage specialist for the duration of construction.
Socio-economic Impact Assessment	Negative social impacts have been identified however these are able to be mitigated. Several positive impacts associated with the proposed development have also been identified such as a corporate social investment plan to address the high levels of poverty and unemployment in the local community. The proposed development is in line with the SDF and provides an opportunity for reviving the tourism environment of De Aar.	▪ Social issues identified during the EIA phase are addressed during construction. This could be done by engaging social specialists where necessary or by ensuring that ECOs used during construction have the necessary knowledge and skills to identify social problems and address these when necessary. Guidelines on managing possible social changes and

		impacts could be developed for this purpose. ▪ Neighbouring landowners are informed beforehand of any construction activity that is going to take place in close proximity to their property. Prepare them on the number of people that will be on site and on the activities they will engage in. ▪ Employees are aware of their responsibility in terms of Mainstream's relationship with landowners and communities surrounding the site. Implement an awareness drive to relevant parts of the construction team to focus on respect, adequate communication and the 'good neighbour principle.' ▪ All mitigation measures in the SIA that are relevant to the construction phase are incorporated in the EMP to ensure that Mainstream and the contractor adhered to these

14.2 Preferred Alternative Selection

Based on the findings of the specialists and taking into account the uniformity of the site, the selection of a preferred alternative has been determined based on existing infrastructure. The map below indicates the preferred layout highlight the location of:

- Substations
- Laydown areas
- Access Roads
- Office blocks

The layout also highlights the preferred CSP and CPV/PV area based on the access and location of infrastructure and the distance from surface water features. Please refer to Appendix 7for the A3 maps.

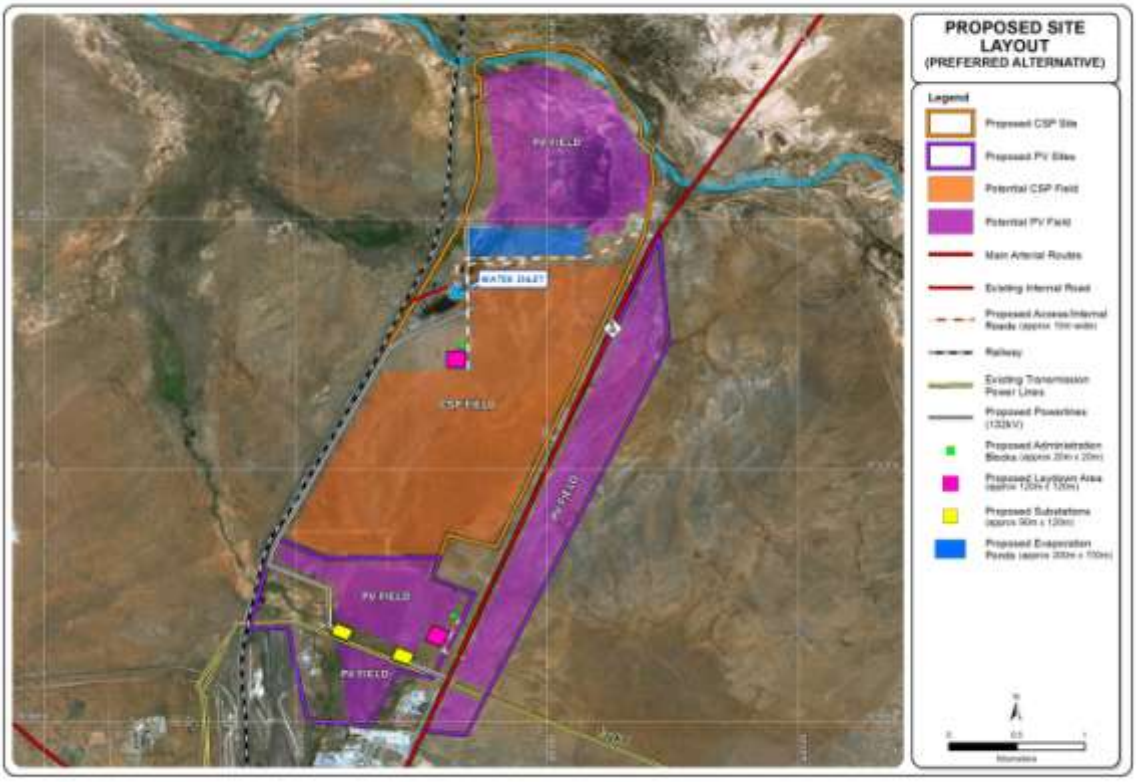

Figure 76: Preferred Site Layout

14.3 Conclusion

The findings of the specialist studies undertaken within this EIA provide an assessment of both the benefits and potential negative impacts anticipated as a result of the proposed CSP and CPV/PV project. The findings conclude that there are no environmental fatal flaws that should prevent the proposed project from proceeding. Areas of special concern have however been identified which will require site specific mitigation measures. These are included within the EMPr to ensure that these areas receive special attention.

The proposed solar plant is located on a site that has been partially transformed and is earmarked for future industrial development. In addition the current waste water system is potentially affecting soils, faunal species as well as the Brak River. The improvement of the oxidation pond system will improve this situation. The bird population on the site will return to normal and thus the impacts on birds are expected to the low. The proposed development is likely to improve socio-economic conditions in the long term whilst negative social impacts are anticipated for the construction phase. Suitable mitigation measures can however reduce these impacts. The following recommendations are made with regards to the proposed development:

- Bird mortality monitoring for the duration of the operation of the plant
- Heritage walk down and documentation of heritage features
- Implementation of stormwater management
- Strict implementation of the EMPr

It was determined during the EIA that the proposed plant will result in potential negative impacts. A preferred site layout has been identified which is less environmentally sensitive and will result in the least environmental impact.

Further to the above, it was demonstrated in the EIR that a detailed public participation process was followed during the EIA process which conforms to the public consultation requirements as stipulated in the EIA Regulations. In addition, all issues raised by I&APs were captured in the EIR and where possible, mitigation measures provided in the EMPr to address these concerns.

As sustainable development requires all relevant factors to be considered, including the principles contained in section 2 of NEMA, the EIR has strived to demonstrate that where impacts were identified, these have been considered in the determination of the preferred site layout.

We are therefore of the view that:

- A preferred site layout has been identified which is less environmentally sensitive compared to the other considered layouts.
- Through the implementation of mitigation measures, together with adequate compliance monitoring, auditing and enforcement thereof by the appointed ECO as well as competent authority, the potential detrimental impacts associated with the CSP and CPV/PV Plants can be mitigated to acceptable levels

It is trusted that the EIR provides the reviewing authority with adequate information to make an informed decision regarding the proposed project.

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