MAINSTREAM RENEWABLE POWER

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

Draft Environmental Impact Report

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For:	SiVEST Environmental Division

KEY PROJECT INFORMATION

FARM DESCRIPTION	21 DIGIT SURVEYOR GENERAL CODE
Portion 5 of the Farm De Hoop No 65	C03700000000006500005
Portion 10 of the Farm De Hoop No 65	C03700000000006500010
Portion 11 of the Farm De Hoop No 65	C03700000000006500011
Remainder of Farm 193	C03700000000019300000
Remainder of the Farm Droogfontein No 62	C03700000000006200000
Portion 1 of the Farm Droogfontein No 62	C03700000000006200001
Remainder of Farm 196	C03700000000019600000

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
Dronfield self drive routes	Recreational activity	Partially toward proposed site	Moderate distance
N12 highway	National route	Partially toward proposed site	Short distance
Riverton road	Secondary road	Partially toward proposed site	Short distance

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

STRUCTURE HEIGHT: 8-10m

SURFACE AREA TO BE COVERED: 8km^2.

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

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

GENERATION CAPACITY: 50MW (CPV) and 150MW (CSP)

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Executive Summary

Mainstream Renewable power intends to construct one Concentrated Solar Power (CSP) and one Concentrated Photovoltaic/Photovoltaic Plant in the Kimberley 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 new Environmental Impact Assessment Regulations (2006) released on the 18th of June, 2010 and promulgated on the 2nd of August, 2010, and thus require an Environmental Impact Assessment to be undertaken. 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 150 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, however, should a license be granted both plants will be constructed simultaneously.

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 Homevale 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 of 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:

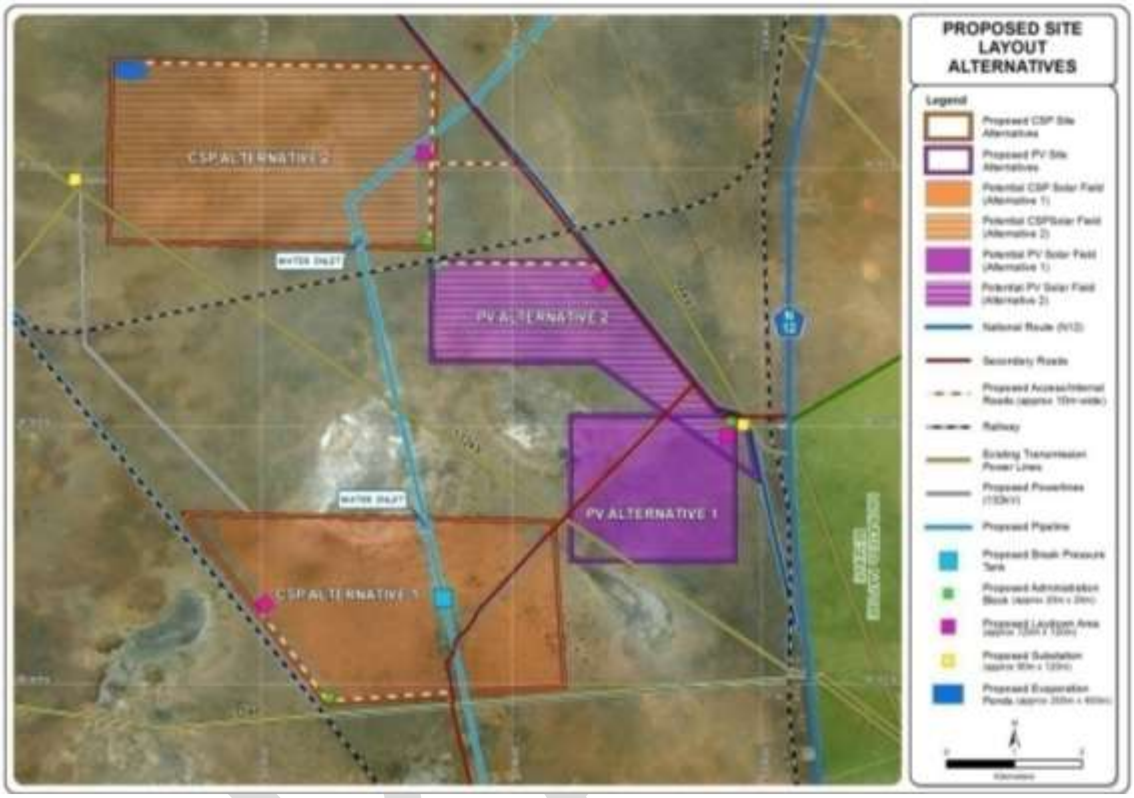

Figure i: Site layout alternatives

Kimberly falls within the bioregion described by Mucina *et al.*, 2006 as the Eastern Kalahari Bushveld Bioregion within the Savanna Biome.

Three vegetation types are present within the study area:

- Kimberley Thornveld
- Highveld Salt Pans
- Highveld Alluvial Vegetation

Several specialist studies were conducted for the EIR Phase as stipulated in the Plan of Study for the EIA, which was accepted by the DEA. These included:

- Biodiversity (including fauna, flora and avi-fauna) Assessment
- Surface Water Impact Assessment
- Groundwater Study
- Noise Impact Assessment
- Tourism Assessment

- Visual Impact Assessment
- Heritage Assessment
- Socio-economic Impact Assessment
- Waste Management Plan
- Compliance with Equator Principles

Table i: Summary of findings

Environmental Parameter	**Summary of major findings**	**Recommendations**
Biodiversity Impact Assessment	No fatal flaws are present on the site however some potentially sensitive areas are present namely the pans and thornveld areas. These areas exhibit sensitivities in terms of species present (Bullfrogs present, White backed vultures present) and ecological functionality. Actual footprint not an issue Birds are the faunal grouping which could be affected the worst by the proposed development.	Strict mitigation measures must be in place and must be implemented. Monitoring is required
Surface Water Impact Assessment	Pan is to be regarded as areas of ***high sensitivity*** and should be avoided.	In consideration of the potential impacts that may affect the functional aspects of the surface water resources, a buffer zone of 50 metres has been applied to the pan. 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	Stringent implementation of mitigation measures.

	however minor risks associated with hydrocarbons are present which require management.	
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 established that the proposed development will have a high visual impact on motorists travelling along the Riverton road and a medium visual impact on motorists travelling along the N12 highway and visitors using the self drive game routes within the Dronfield Nature Reserve. 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. Several Palaeontology features have been identified on the site	Strict implementation of mitigation and management measures. Consultation with SAHRA through a heritage specialist for the duration of construction.
Tourism Impact Assessment	Concentrated on sensitive tourism areas (N12/ the diamond route, Riverton road, and Dronfield Nature Reserve) close to the proposed site. CSP Alternative 2 exhibits no major visually sensitive tourist receptors and is distant from a	Mitigation measures suggested in the tourism study must be implemented to reduce potential impact on tourism.

	major tourist route (N12) and a major tourist destination (Dronfield Nature Reserve). It is anticipated that tourists travelling along N12 and those within the Nature Reserve will not view the proposed power plant in this area. Therefore the sensitivity of this alternative to the CSP plants is considered low and therefore preferred. PV Alternative 2 is slightly close to a major tourist route (N12) and a major tourist destination (Dronfield Nature Reserve). Although the site is slightly close to these tourist areas, tourists travelling along N12 and those within the Nature Reserve are not expected to view the proposed power plant in this area. The site is considered moderately sensitive to the CSP plants and hence preferred.	
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	▪ 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

	Kimberley.	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.

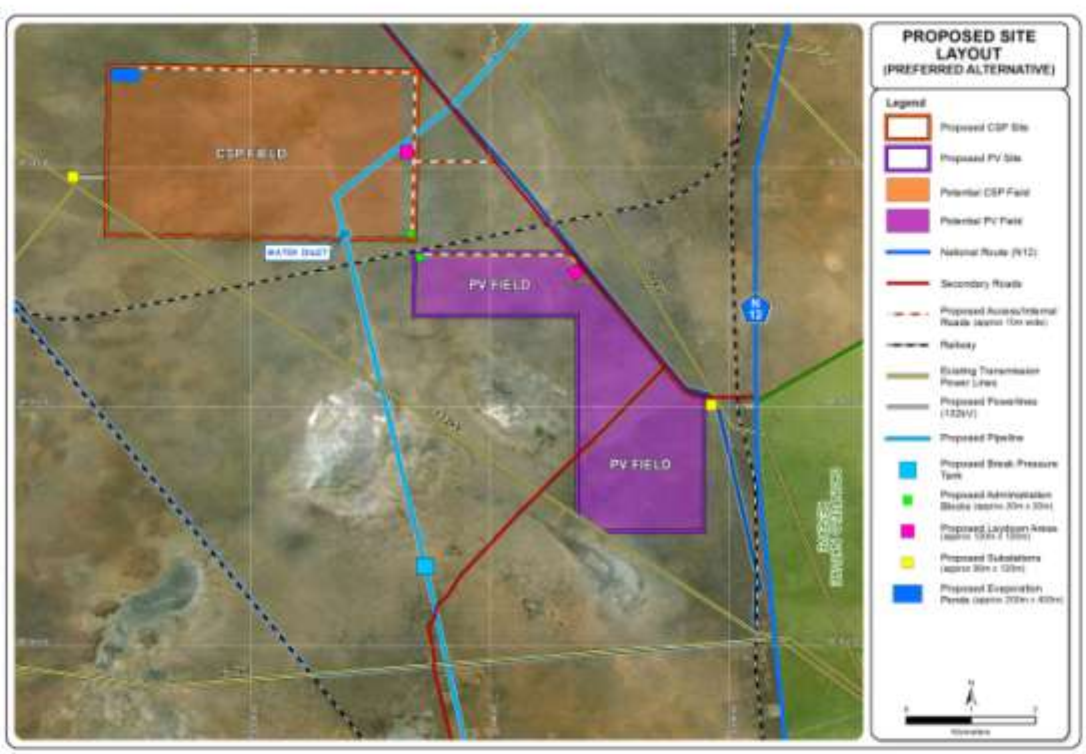

Figure ii: Preferred site layout alternatives

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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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 aluminum) 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

Table 1: 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 **SANDF**	- South African National Biodiversity Institute - South African National Defence Force
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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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) plant in Kimberley, Northern Cape Province, South Africa. The proposed project involves the construction of a 50 MW PV/CPV and 150 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 and 150MW 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). We are currently at the EIA phase.

This Report is compiled in accordance with World Bank standards and the Equator Principles. The Equator Principles ("EP") is a financial industry benchmark for determining, assessing and managing social & environmental risk in project financing (Equator Principles, 2006). EPs 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 2 below.

Table 2: Project Team

Name and Organisation	Role
Liesl Koch, SiVEST	Project Leader, Biodiversity (Flora, Fauna and Avi-fauna)
Paul da Cruz, Shaun Taylor, SiVEST	Visual impact, Surface water
Kurt Barichievy, SiVEST	Agricultural Potential
Faith Kalibbala, Lucy Chimoyi, SiVEST	Report writing and compilation
Paul Goldshagg, Wits University	Noise
Paul da Cruz, Faith Kalibbala, SiVEST	Tourism
Wouter Fourie - PGS	Heritage
John Almond – Natura Viva	Palaeontology
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 18^{th} of June, 2010 and promulgated on the 2^{nd} 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 project in question. The Listed Activities identified in terms of Sections 24(2) and 24D include;

Table 3: 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 8. 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 Eskom 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 to acquire funding. 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 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 considered 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 specific municipality. However, common concerns include municipal transformation and development, and service delivery and infrastructural development.

According to the Sol Plaatje Municipality Integrated Development Plan (IDP, 2007), the objectives of the municipality are to provide 1,700 households with basic electricity by 2011 and to reduce electricity losses to 10% by 2010/2011 (Sol Plaatje Municipality, Review 2008/2009; Planning 2009/2010 to 2011/2012).

Furthermore, an Action Programme is in place for the Sol Plaatje Municipality (Sol Plaatje Municipality, Review 2008/2009; Planning 2009/2010 to 2011/2012). This Action Programme aims to address the following:

- Connectivity
  - Increase capacity for prioritised new economic development.

- Existing Footprint (Energy efficiency) (Disaster Management)
  - Upgrade existing electricity network.
  - Roll out area lighting in line with desired footprint.
  - Expand CLFs programme.
  - Retrofit street lights/traffic lights.
  - Energy efficiency in municipal owned buildings.
  - Demand side management programme.
  - Develop alternative energy sources.

- CBD
  - Upgrade electricity network;
  - Area lighting; and
  - Energy saving strategy for CBD.

- Access to CBD and Neighbourhoods
  - Streetlights; and
  - Area lighting.

- Neighbourhood Centres for convenience
  - Area lighting.

- Prioritise disadvantaged areas and ensure benefits of Kimberley are more broadly available
  - Determine ward based electrification priorities and prepare five-year prioritised plan.

- Capacity and economic potential of River Valleys
  - Availability of electricity.

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

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

The Integrated Energy Plan, developed by the Department of Minerals and Energy (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 use 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 taking place within the country and within Eskom relating to Independent Power Producers (IPPs). It is important that certain enabling policies, rules and regulations are adhered to, 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); and
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 of REFIT targeting at least 1025MW as per the 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 was 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

According to 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 offer 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; 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 Independent System and Market Operator (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 precondition 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; and
- 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 which were required to be undertaken as part of the EIA-stage of the project. The Draft Scoping Report was made available for public review from the 2nd of November 2010 to the 2nd of December 2010. Additional information was added and the report was placed out for comment for a further 30 days from the 7th of December till 26th 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 Impact Assessment
- Tourism Impact Assessment
- 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 12/12/20/2024 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 1st of February 2011 and approved on the 17th of March 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 Environmental Affairs (DEA)
- Department of Water Affairs (DWA)
- Department of Land Affairs
- South African Heritage Resources Agency (SAHRA)
- Northern Cape Department of Environment and Nature Conservation
- Frances Baard District Municipality (FBDM)
- Sol Plaatje local Municipality
- Local Ward Councillors
- South African National Roads Agency Limited (SANRAL)
- Department of Agriculture
- Surrounding and affected land owners

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 representing Department of Environmental Affairs, Department of Water Affairs, SAHRA and Northern Cape Department of Environment and Nature Conservation. The 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 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 and South Africa and Mainstream Renewable Power Limited (hereafter referred to as 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 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.

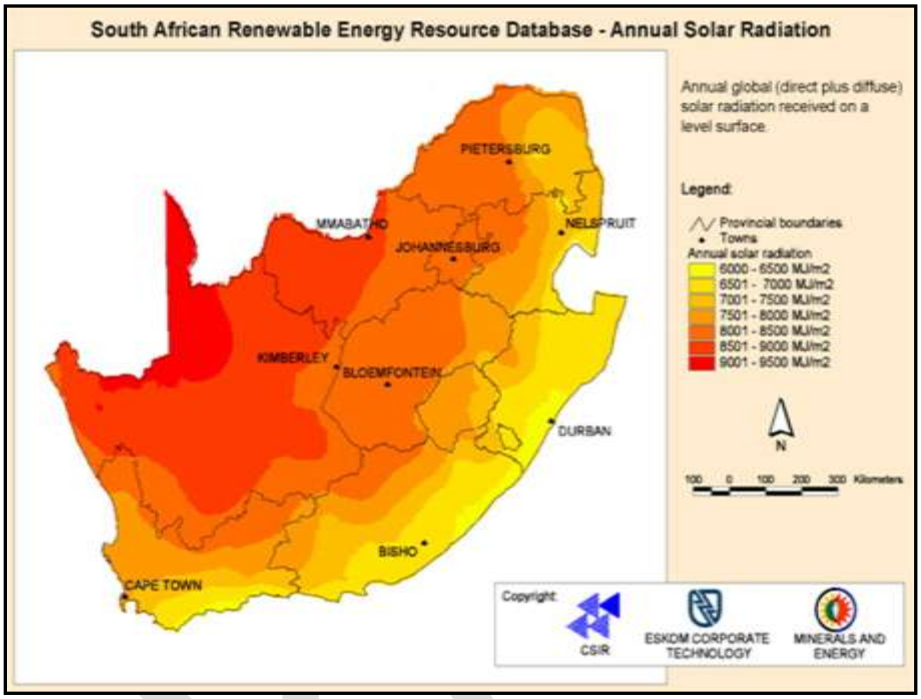

Figure 1: National Solar Resource Map (Source: Solar Vision, 2010)

In addition, CSP/ (CPV/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 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).

4.1.2 Local Employment

With regards to the Droogfontein site local and district level employment closely mirrors that of the province, with a high level of economic non-participation. This may be due to the major contribution of the area to provincial economic activity. In 2006, 25.9% of the people employed in the Northern Cape were employed inside the Sol Plaatje Local Municipality (MasterQ 2011).

4.1.3 Regional and Local Income Profile

Evidence of the employment patterns is apparent from the comparison of local, regional and provincial income figures. At the Droogfontein site access to income is disturbingly low but generally in line with provincial levels. There seems to be slightly more individuals locally in the R 3 201 - R 12 800 range, probably due to higher economic activity in the LM area. There seems to be a lack of opportunity for both the unemployed as well as the highly skilled

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 (MasterQ 2011).

5 TECHNICAL PROJECT DESCRIPTION

5.1 CSP Project Components

5.1.1 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

This infrastructure is 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 if required depending on the slope of the site.

Figure 2: Parabolic trough solar collector assembly

The parabolic trough plants will have solar collector assemblies (Figure 2) 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 foundations 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.

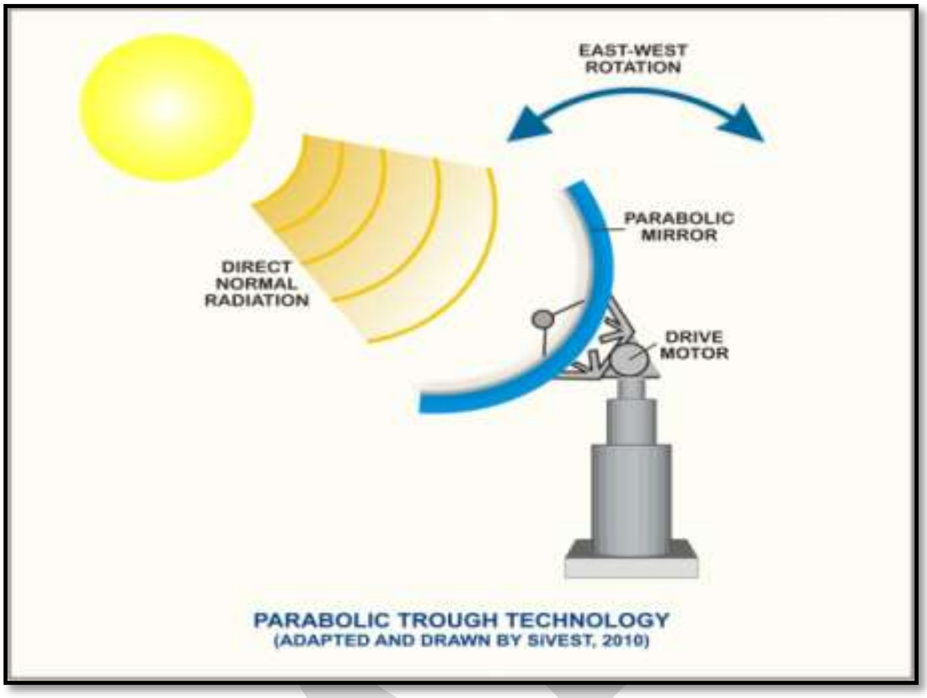

Figure 3: Functioning of the Parabolic Troughs

The rotation of the parabolic mirrors is typically operated using hydraulic arms (Figure 3). 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 4) 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).

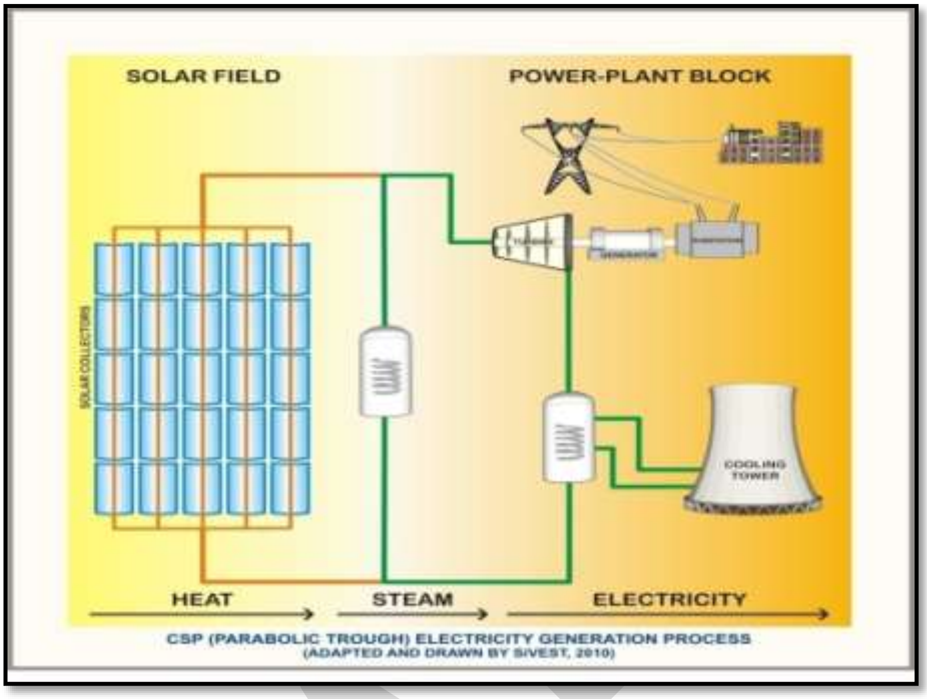

Figure 4: The CSP Process illustrated

- Water Pipeline

A water pipeline will be used to deliver cooling water to the cooling tower. It is envisaged that a 350mm diameter pipe will be sufficient to provide required flow. Water will be sourced from a pipeline that is currently being designed by the Sol Plaatjie Local Municipality. This pipeline will deliver waste water from the Homevale Waste Water Treatment Works to the pan on the property adjacent to Droogfontein (Piet Els is the landowner). A small offtake off this pipeline is planned in consultation with the municipality. The route of this pipeline is included in the layout maps.

- 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 5).

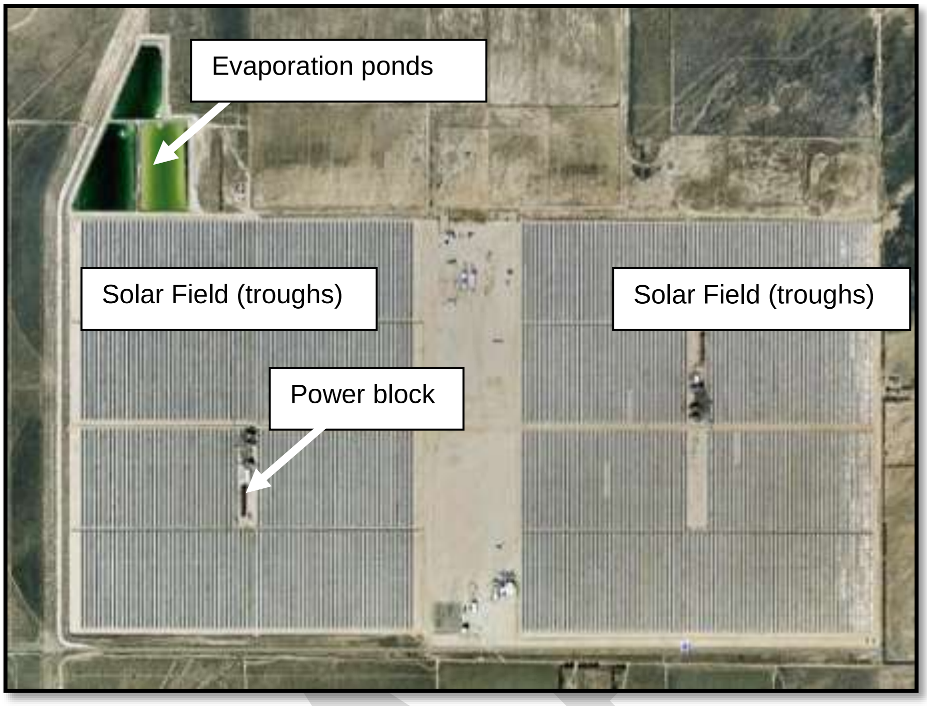

Figure 5: Google Earth Image© of the SEGS VIII and IX parabolic trough plants (Combined 160MW capacity) – Harper Lake, USA

- **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.

  - 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.

Approximately 2.7km south of the study area, is Kamfers Dam which measures 500ha in size. Kamfers Dam is thought to have previously been an ephemeral pan, only being inundated during high rainfall periods. It is now permanently inundated due to the constant inputs of effluent water from Kimberley in addition to the stormwater runoff from Kimberley through the Municipality's reticulation system. Mainstream will utilise water from Homevale Sewage Treatment Works, this will assist the Local municipality in dealing with this excess water and generate revenue.

- Electrical Connections

The project will provide electricity which will need to feed into the national grid. In order for this to occur, a new distribution substation needs to be constructed. The 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 attenuated and not released into the environment. The distribution substation will be fenced for security purposes.

If the substation is located beside the existing power line the connection to the line will be via drop-down conductors. If the line is remote from the substation the connection will be by overhead power line, using either pole or pylon construction depending on the voltage.

- Roads

Upgrading of certain existing public roads along the equipment transport route may need to take place. An access road with a gravel surface from an 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 and 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 measures 100m^2 and 5m in height has been installed on the 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. The land will be leased from the Local Government (generating revenue).

- 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.

5.2 CPV/PV Project Components

5.2.1 CPV/PV Project Description

The project will consist of two components:

- CPV/PV Power Plant
- Associated infrastructure

- **CPV/PV Solar Power Plant**

The CPV/ PV plant will consist of the following infrastructure

- Solar field
- Buildings

These are described in detail below:

- 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.

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 and contains a slightly different panel) or tilted at a fixed angle (PV) equivalent to the latitude at which the site is located in order to capture the most sun (Figure 6). Arrays usually reach up to between 5m and 10m above ground level. Either a CPV or PV plant will be installed.

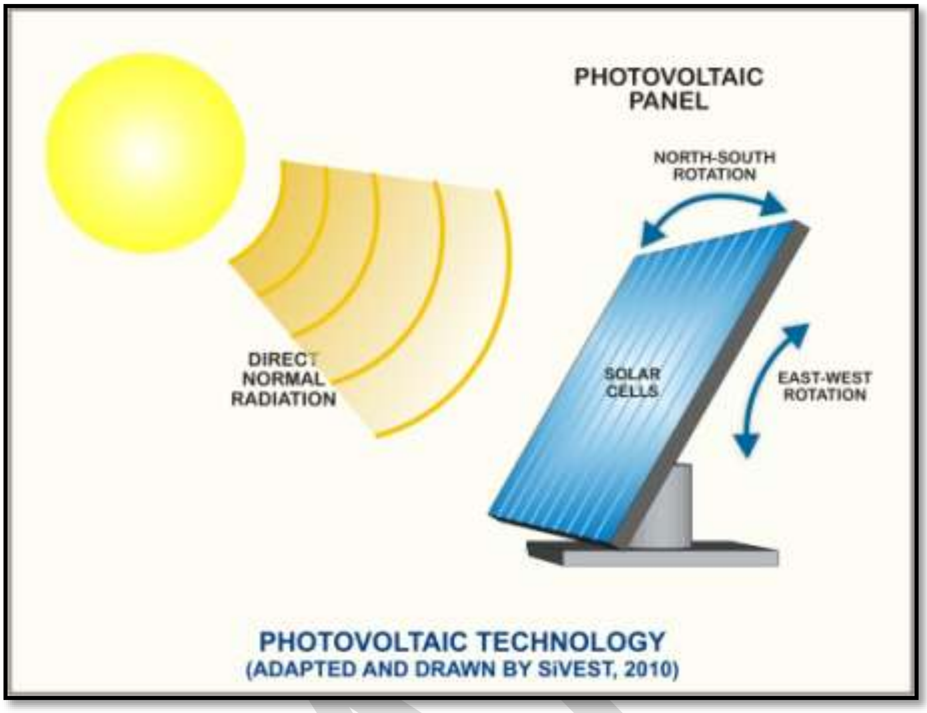

Figure 6: Illustration of how a CPV panel operates

- 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 telecommunications 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 7). 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 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.

If the substation is beside the existing power line the connection to the line will be via drop-down conductors. If the line is remote from the substation the connection will be by a newly constructed overhead power line, using either pole or pylon construction depending on the voltage.

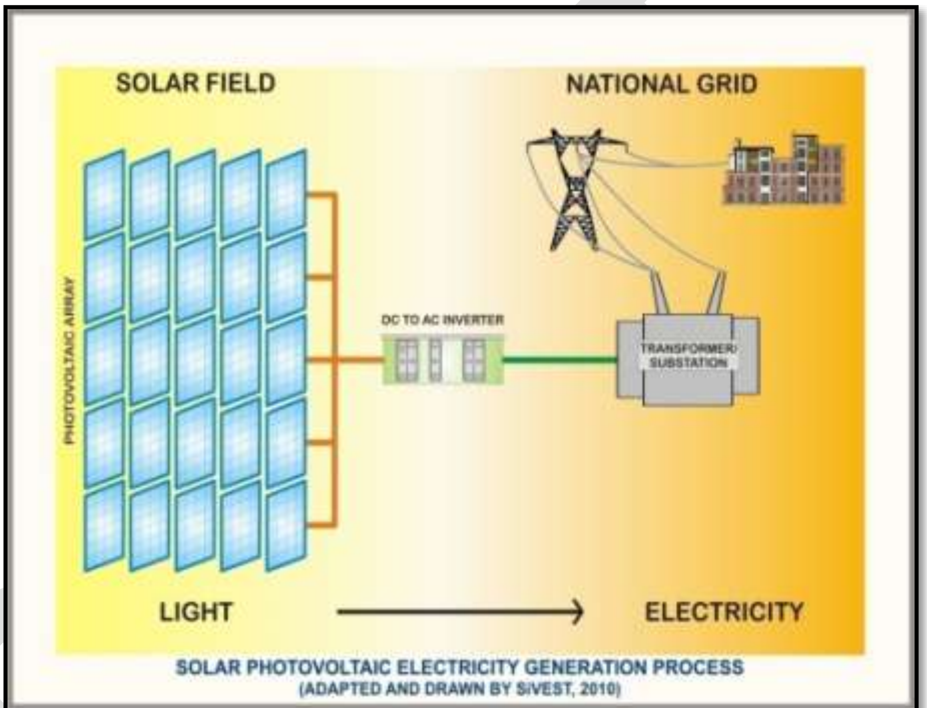

Figure 7: CPV/PV process

- Roads

Upgrading of certain existing public roads along the equipment transport route may take place. 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.

- 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 contractor site offices which will require a maximum of 5 000m^2.

- Panel maintenance

The panels will require cleaning as 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.

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

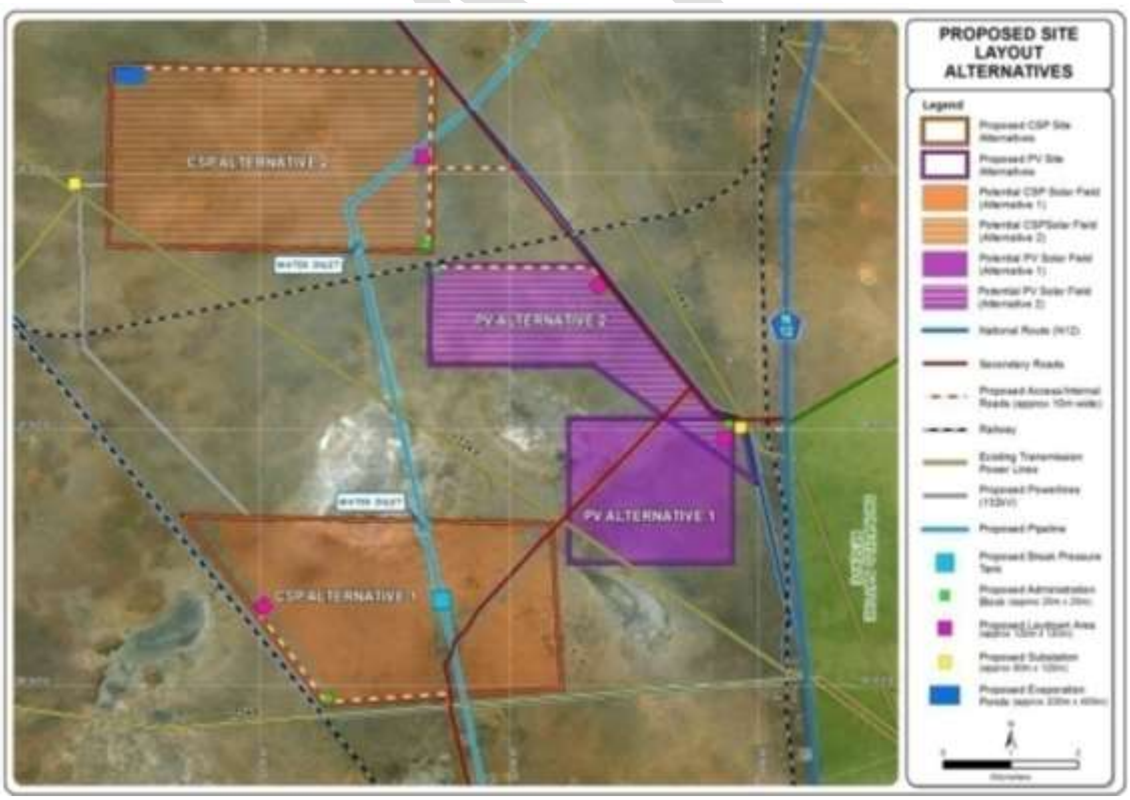

Figure 8: Site Layout Alternatives

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. Through the Environmental Scoping process, the Droogfontain site at Kimberley was selected as a preferred site as it meets all the criteria for the construction of the proposed Development. These include:

- Solar resource
- Grid access
- Flat land
- Wide horizon (so limited or low hills to avoid the blocking off of the sun as it rises and sets)
- Good infrastructure (roads and grid mainly)
- Suitable soils, not too much rock and not shallow
- Not using high value agriculture land
- Suitable on the grid network (where there is capacity for new power)
- Water availability (CSP)

In addition to the technological alternatives, further (more detailed) layout alternatives have been investigated for the proposed project and these are presented in (Figure 8). Layout alternatives relate mainly to the associated infrastructure required for the proposed development. The alternatives that were considered by all specialists in the EIA phase are illustrated in Figure 8 (above). All the alternatives are located to the West of the N12 National road.

The alternatives have been split into two sections:

- Two Alternatives for the CSP site; and
- Two Alternatives for the PV site.

The 2 Alternatives for the CSP site are described as follows:

- CSP Alternative 1 is located west of the N12, north of the existing 275kV line and south of the 132kV line. A secondary road traverses this CSP Alternative 1 site in a north easterly direction. Proposed Administration block, substation and laydown areas have been included in the location of this alternative.
- CSP Alternative 2 is located west of the N12 and north of the existing 132 kV line, in closer proximity to the Vaal River compared to the CSP Alternative 1. This alternative includes an evaporation pond in the North-West corner of the site alternative. Proposed Administration block, substation and laydown areas have been included in the location of this alternative.

The 2 Alternatives for the PV site are described as follows:

- PV Alternative 1 is located west of the N12 and South of PV Alternative 2. Proposed Administration block, substation and laydown areas have been included in the location of this alternative.

- PV Alternative 2 is located west of the N12 and incorporates parts of PV Alternative 1, so as to avoid the pan that part of PV Alternative 1 is situated on, Proposed Administration block, substation and laydown areas have been included in the location of this alternative.

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. Mainstream is proposing the establishment of a Concentrated Solar Power plant and a Concentrated Photovoltaic (CPV) / Photovoltaic (PV) plant in Kimberley, Northern Cape Province.

6.1 Locality

The study area is situated, approximately 15km north of Kimberley in Sol Plaatje Local Municipality, Northern Cape Province (Figure 9). The study area which is 116.44km^2 extends north near the Vaal River closer to Riverton. It is located on the following farms:

- Portion 5 of the Farm De Hoop No 65
- Portion 10 of the Farm De Hoop No 65
- Portion 11 of the Farm De Hoop No 65
- Remainder of Farm 193
- Remainder of the Farm Droogfontein
- Portion 1 of the Farm Droogfontein
- Remainder of Farm 196

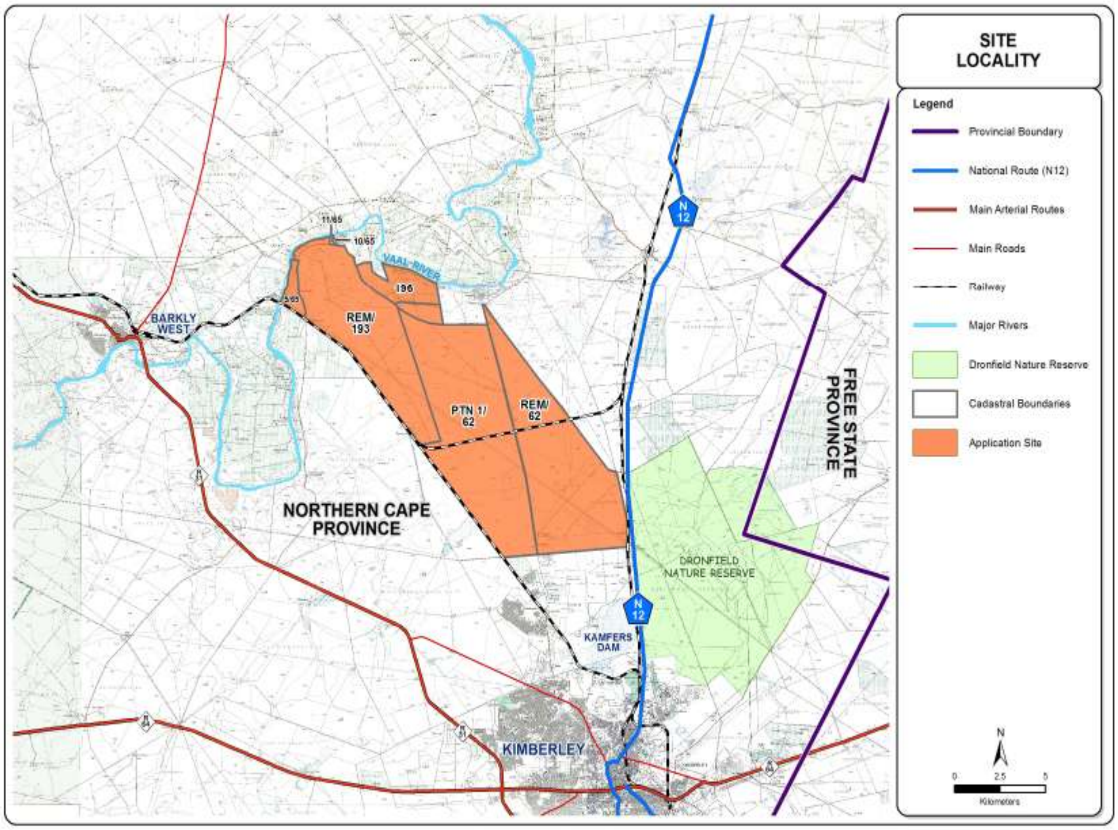

Figure 9: Regional locality map

6.2 Study Area Description

The study area is characterised by flat and gently sloping topography with an average gradient of less than 10%. The flat topography makes this area ideal for the proposed development. It should however be noted that the topography slopes down into the Vaal River valley to the north of the site (Figure 10). Meanwhile, south east of the study area, at the Dronfield Nature Reserve, the ground is slightly higher.

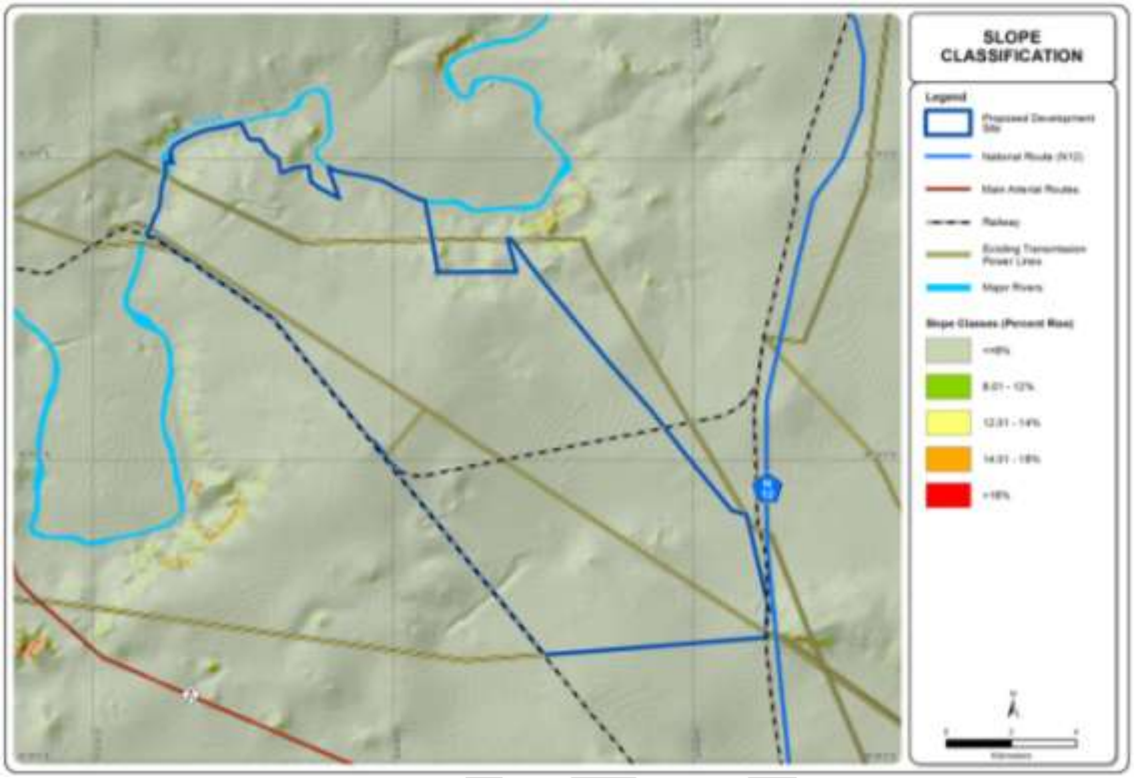

Figure 10: Slope of the study area

The site is approximately 12 000ha in size however only 8km^2 will be required of this area for the proposed project.

The study area is characterized by large areas of natural vegetation, covered by shrublands (Figure 11). The site is classified as “natural” having relatively little human infrastructure on it and is used as grazing land for cattle and sheep herds. Open grazing land is interspersed with two ephemeral pans in the south-eastern part of the study area. The pans are sensitive habitats for birds and may be prone to seasonal inundation.

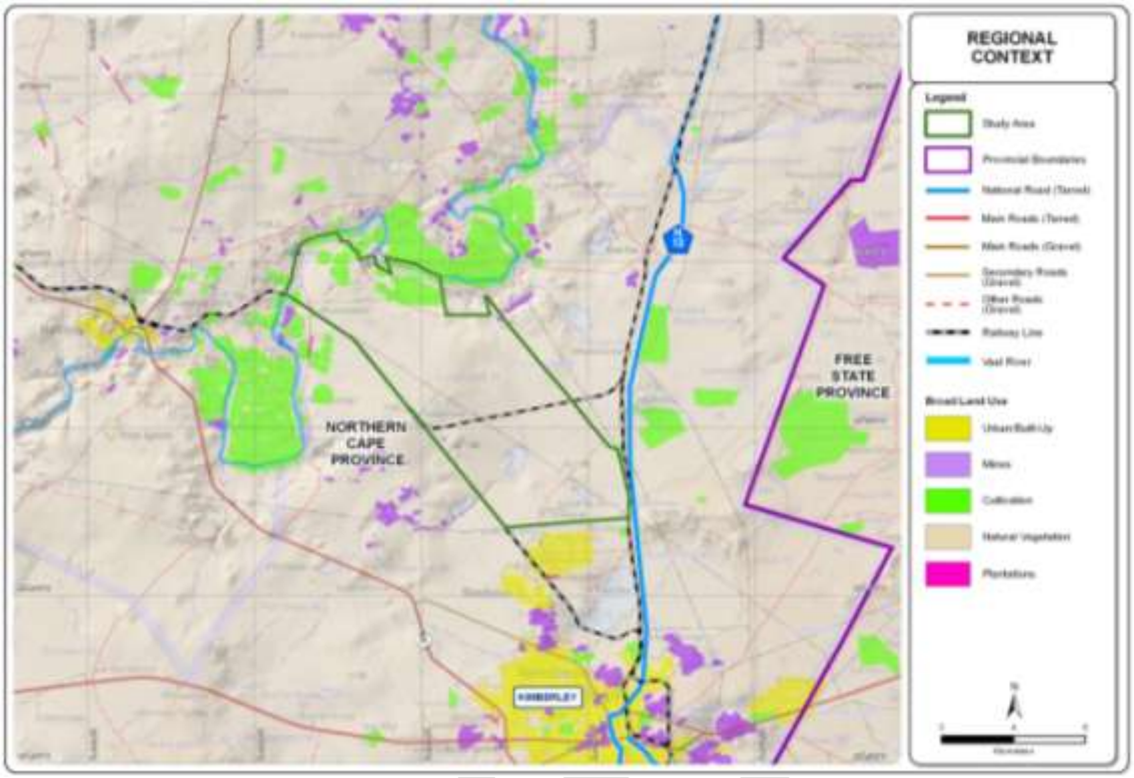

Figure 11: Regional Context of the project

There are existing transmission lines of 275kV, 132kV, 66kV and 11kV traversing diagonally across the site.

Residential, agriculture and some mining (diamond mines, nevertheless four De Beers Mines are closed) land uses surround the study area. According to the ENPAT data, sourced from DEAT (2001), the study area and immediate surrounding areas are characterised by natural vegetation (Figure 11).

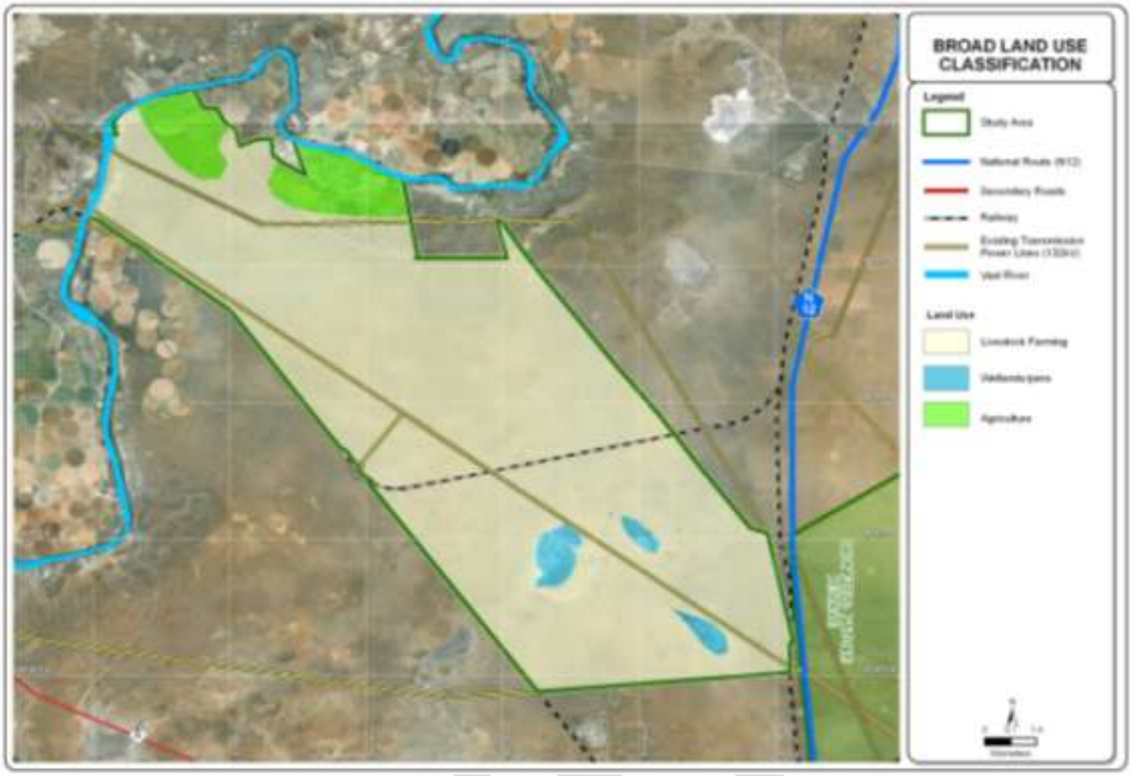

Figure 12: Land use Classification of the study area

The N12 (which is a portion of the diamond route) runs along the eastern side of the study area. To the south of the site is Kamfers Dam (400Ha in size) a permanent and large pan which is a sensitive habitat with high ecological importance and should be protected. This dam is the home to up to 50 000 Lesser Flamingoes (*Phoeniconaias minor*). According to Barnes (2000), the Lesser Flamingo which is listed as a Near Threatened species requires shallow eutrophic saline and alkaline wetlands such as saltpans and sheltered coastal lagoons (Brown *et al.,* 1982). The Vaal River forms the northern boundary of the study area. Centre pivot irrigation schemes are prominent to the north-west of the study area and along the banks of the Vaal River (Figure 12).

The Riverton Road and the railway line are located to the east of the study area. The Riverton Road located closer to the boundaries of the study area borders to the east.

The Dronfield Nature Reserve is located directly to the south-east of the study area.

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 392mm per year and without some form of supplementary irrigation natural rainfall is generally insufficient to produce sustainable harvests for cultivated crops. This is reflected in the limited dry land crop production within the study area. Precipitation usually takes the form of infrequent thundershowers. Average daily temperatures range from 25°C in summer to 10 °C in winter. Average night time temperatures drop to around 0.3 °C during winter (Table 4).

Table 4: Mean Monthly and Annual Precipitation and Temperature for Kimberley (SAWS (South African Weather Service), 2010)

	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Mean**
MAP (mm)	58	62.9	67.5	41.1	18	6.7	4.4	6	13.1	27.5	38.2	48.1	392
MAT (°C)	24.7	23.6	21.3	17.5	13.4	10.1	10.2	12.8	16.6	19.7	21.9	24	18

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

6.4.1 Flora in the study area

The prominent plant of concern within the study area is the Camel thorn (*Acacia erioloba*) which is common throughout the area. This is a protected tree species in terms of the National Forest Act, 1998 (Act No. 30 of 1998). Several of these trees are present on the site. Mitigation measures will thus need to be included within the EMPr and a permit applied for with the Department of Water Affairs.

- Kimberley Thornveld

This vegetation type is characterised by rolling topography but more often very flat. A well developed tree layer is present dominated by Camel thorn (*Acacia erioloba*), Umbrella thorn (*Acacia tortillis*) and Shepherds tree (*Boscia albitrunca*). Grass is present however a large amount of exposed soil is present.

Larger dominant species include *Acacia mellifera*, *Tarchonanthus camphoratus*, *Rhus lancea*, *Ehretia rigida* and *Diospyros pallens*. The herb layer is dominated by *Acacia hebeclada, Euclea crispa, Hermannia comosa, Melolobium microphyllum* and *Aloe hereroensis*.

Grass species occurring include *Eragrostis lehmanniana*, *Aristida congesta*, *Cymbopogon posposchilii, Digitaria eriantha, Enneapogon cenchroides, Themeda triandra* and *Eragrostis rigidior.*

The vegetation type is considered to be Least Threatened with 82.3% remaining however only 2% has been formally protected.

- Highveld Salt Pans

Highveld salt pans are characterised by being depressions in the landscape which contain temporary (some permanent) water. They are sparsely vegetated and are subject to heavy grazing pressure.

Low shrubs and herbs dominate the vegetation layers. Some of these species include *Atriplex vestita, Felicia filifolia, Felicia muricata, Pentzia globosa* and *Pentzia incana.* Succulent shrubs include *Salsola glabrescens, Lycium cinereum* and *Titanopsis hugoschlechteri*. Grass species include Chloris *virgata, Cynodon dactylon, Cyperus laevigatus, Cyperus marginatus, Eragrostis bicolour, Eragrostis chloromelas, Eragrostis plana, Hemarthria altissima, Juncus rigidus* and *Setaria incrassata*.

The vegetation type is considered to be Least Threatened with 96.5% remaining however only 0.2% is formally protected.

- Highveld Alluvial Vegetation

Located on the banks of the Vaal River this vegetation is characterised by riparian thickets.

Species present are dominated by *Acacia karroo, Salix mucronata, Ziziphus mucronata, Celtis Africana, Rhus lancea, Gymnosporia buxifolia, Rhus pyroides* and *Diospyros lycioides*.

The vegetation is considered to be Least Threatened with 75.7% remaining however only 9.2% is formally protected.

6.4.2 Fauna in the study area

Friedman & Daly, (2004) list several red data mammal species that could potentially occur in the study area e.g. the South African Hedgehog (*Atelerix frontalis*), Brown Hyaena (*Hyaena brunnea*) and the Honey Badger (*Mellivora capensis*) 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.

Two Important Bird Areas (IBAs) are in close proximity to the study area and bird life in the area is fairly diverse (SABAP 2). African White Backed Vultures (Gyps africanus) were noted to be breeding on the site.

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).

Invertebrate information for the study area is limited although several species are anticipated to be present.

6.5 Surface Water

6.5.1 Drainage Context

The study site is bordered by the Vaal River to the north. The Vaal River is the largest tributary of the Orange River in South Africa. The Vaal River is characterised by tributaries including the Vet and Vals amongst others. The general area falls within Quaternary Catchment C91E.

In a macro-geomorphological context, the Study Area is located in a transition area between two Geomorphic Provinces (Lower Vaal and Orange Geomorphic Province and Highveld Geomorphic Province). Geomorphic Provinces have been developed as a way to classify similar areas of surface water drainage and are defined as similar areas containing a limited range of recurring landforms that reflect comparable erosional, climatic and tectonic histories (Partridge *et al*. 2010).

The boundary of the two Geomorphic provinces traverses the study site diagonally. Therefore, while the north-western half of the study area falls under the Lower Vaal and Orange Geomorphic Province, the south-eastern half falls under the Highveld Geomorphic Province (Figure 13). The boundary in the geomorphic provinces reflects a distinction in hydrological characteristics that occurs across the study area that is explained in the sections below.

- Lower Vaal and Orange Geomorphic province

According to Partridge *et al.* (2010), this large province coincides with areas adjoining the Lower Vaal and Orange rivers that were incised in the Post-African I cycle and, below the Augrabies Falls, in the Post-African 2 cycle.

In the area above and below the Orange-Vaal confluence the present channels are strongly controlled by pre-Karoo valleys which are now being re-excavated.

Most drainage in the portion of the site that falls within this geomorphic province consists of drainage to the north into the Vaal River valley bottom. This drainage typically takes the form of dry, ephemeral, watercourses due to the arid climate of the area.

- Highveld Geomorphic Province

The Highveld Geomorphic Province makes up a large part of the interior plateau of southern Africa. Much of the Highveld Geomorphic province is gently undulating and is dominated by the late Cretaceous African erosion surface, which remains intact on many of the broad interfluves (Partridge *et al*. 2010). Dry valleys occupied by lines of pans tend to occur in the western parts of this geomorphic province. In this area they represent right-bank tributaries of the palaeo-Vaal River (Partridge *et al*. 2010). In some areas, there are so many pans that they have redirected the original drainage into contiguous, small endoreic basins. The western and southern parts of the Highveld are drained by two major river systems, the Orange (Gariep) and Vaal and their respective tributaries. The part of the site falling into this geomorphic province is relatively flat and very gently undulating. This flat nature of the topography is indicated by the presence of a number of pan / depression wetlands, which are the primary surface water features on this part of the site. These pans indicate endorheic (i.e. inwardly-aligned) drainage, and are not linked into the wider Vaal River catchment at a surface level. The largest pan in the area is located to the south of the site; the permanently-inundated Kamfers Dam which has been hydrologically slightly modified by water inputs.

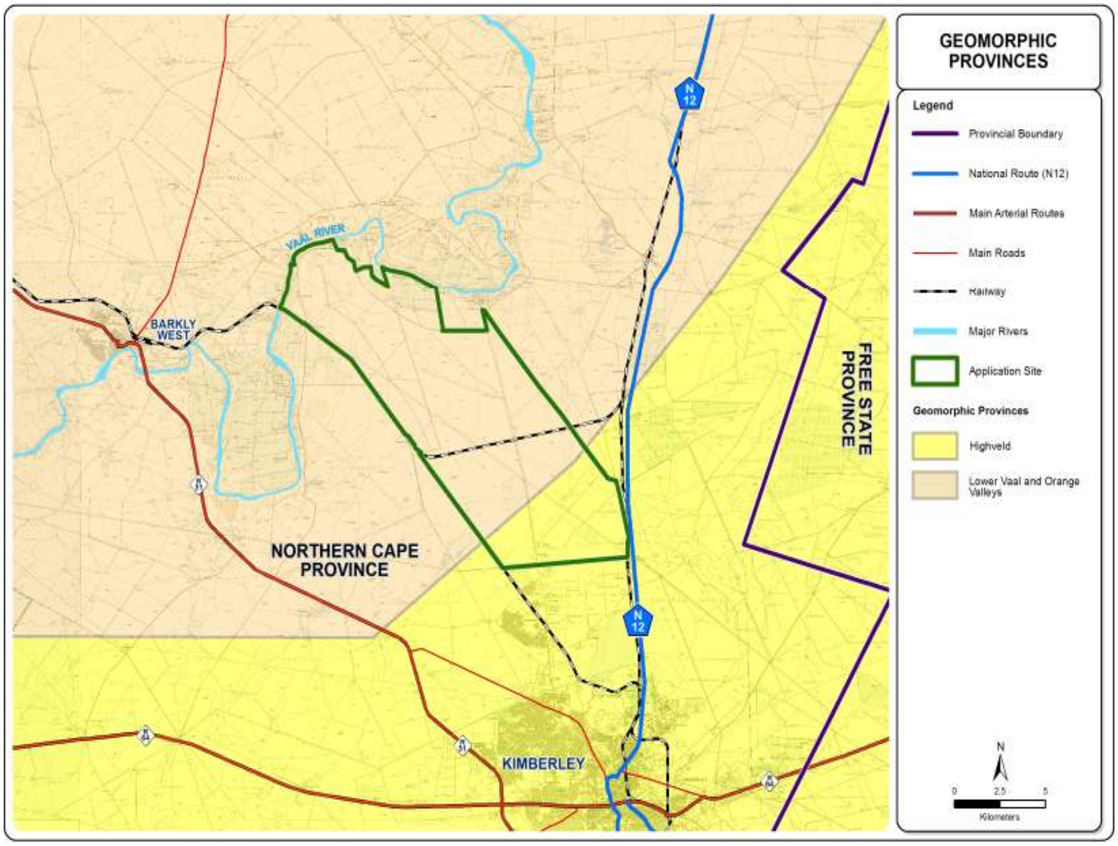

Figure 13: Spatial Distribution of Geomorphic Provinces across the Study Area

6.5.2 Surface Water Resource Occurrence in the Study Area

The study area is characterised by water resources such as the Vaal River, Kamfers dam (located outside the boundaries of the study site) as well as several non-perennial pans (within the boundaries of the study site). The very flat nature of the topography is a strong factor in influencing the nature of surface water occurrence in the study area as described above.

The Vaal River which forms the northern boundary of the Study Area has an overall catchment of 196 438 km^2 and has a runoff of 3 929 million m^3/year (DEAT, 1999). The River rises on the western slopes of the Drakensberg escarpment and flows approximately 900km west-south-west across the interior plateau and joins the Orange River near Douglas. The major tributaries of the Vaal drain the Drakensberg in the east, the Witwatersrand in the north and the Maluti Mountains in the south (Braune & Rogers, 1987). The river is controlled through the Vaal Dam, the Vaal Barrage and Bloemhof Dam. While it provides water through water transfer schemes to the Crocodile and Olifants Rivers, it receives water from the Assegaai, Buffalo, Tugela, Orange and Senqu Rivers (DEAT, 1999).

The most prominent surface water feature in the southern parts of the study area and further south outside the study area are the pan / depression wetlands. There are three larger and three smaller ephemeral pans distributed across the entire study area (five of these pans lie in the southern portion while one is located in the northeastern portion of the study area). It is anticipated that the pans are inundated seasonally for short periods and during high rainfall periods. The pans are considered sensitive landscape features of the site, as they appear to be associated with avifauna and amphibian species and therefore, should be avoided. The largest of the pans measures approximately 2000m^2 in size (Figure 14).

Figure 14: Ephemeral pan within the study area (this is the largest of all the pans)

Further south, approximately 2.7km outside the study area, is Kamfers Dam which measures 500ha in size. Kamfers Dam is thought to have previously been an ephemeral pan, only being inundated during high rainfall periods. It is now permanently inundated due to the constant inputs of effluent water from Kimberley in addition to the stormwater runoff from Kimberley through the Municipality's reticulation system. The dam probably supports the largest permanent population of Lesser Flamingos (*Phoeniconaias minor)* in Southern Africa with sometimes more than 80,000 individuals present (Anderson & Anderson, 2010).

6.6 Agricultural Potential

According to the ENPAT database the Droogfontein Site is dominated by red apedal soils formed from sedimentary 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 a moderate soil depth which is generally between 0.45 and 0.75m deep.

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 have a poor suitability for arable agriculture. The north-western portion of the study area, along the bank of the Vaal, is classified as having soils with an intermediate suitability for arable agriculture and this zone corresponds to an increase in cultivated lands and crop production when compared to the land found further to the south-east

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 moderate for grazing. The exceptions are the areas along north-west boundary of the study area which are associated with a high agricultural potential due to a reliable water irrigation source from the Vaal River.

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 study

The proposed site is situated immediately north of the Kimberley town, and borders the Vaal River. The site is approximately 12 000 Ha in area. It is located in quaternary catchment C91E, within Water Management Area 10 (Lower Vaal). The site is underlain mainly by a varying thickness of the Kalahari Sand Formation (Figure 15), which is in turn underlain by rocks of the Karoo Supergroup and the Ventersdorp Supergroup. Outcrops of the Ventersdorp Supergroup occur in the middle part of the site, suggesting that the Kalahari Sands may be very thin elsewhere over the site. The General Series Hydrogeology Maps of South Africa (sheet 2722 Kimberley) classify the aquifers (the solid rocks rather than the sands) underlying the 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 (Figure 16). See Vegter (1995) for more details. The hydrogeology maps classify the geology of the site as “argillaceous”, meaning a fine-grained sedimentary rock. 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. The Groundwater Harvest Potential Map of South Africa published by the Department of Water Affairs (Baron *et al*, 1998) classifies the area around Kimberley has having a harvest potential of 6000 to 10000 m^3/km^2/annum, defined as the maximum volume of groundwater that may annually be abstracted per square kilometer per annum without depleting the aquifers.

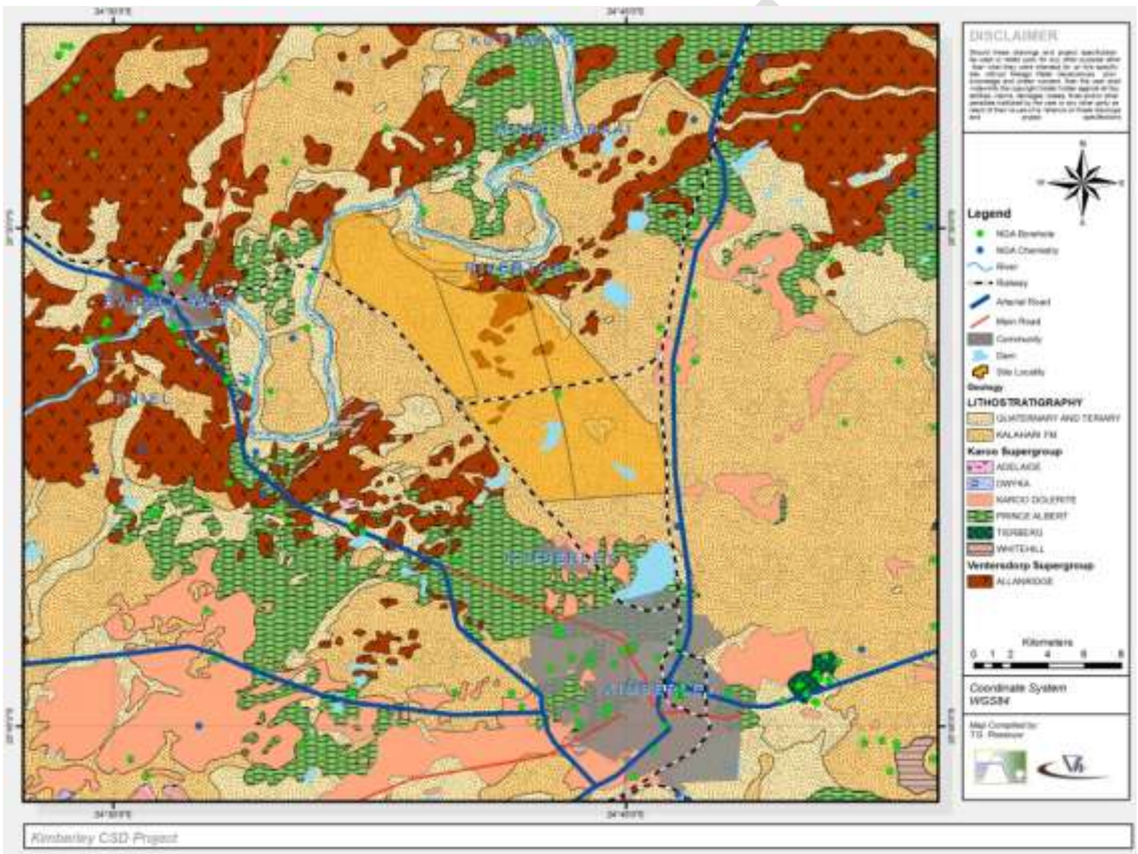

Figure 15: Geology map of the Kimberley site

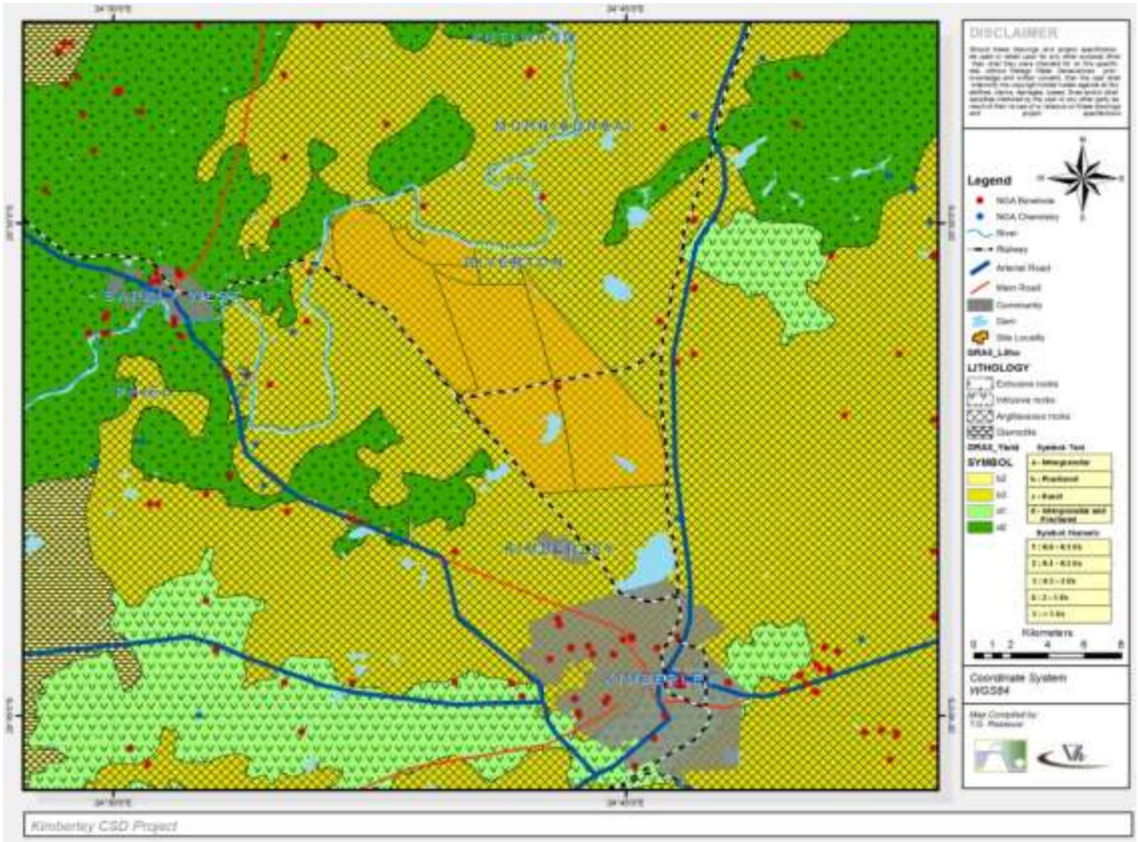

Figure 16: Hydrogeology map of the Kimberley site

6.8 Noise Study

6.8.1 Description of the site environments

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 grassland 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 receptors at the Droogfontein site are the agricultural plots at Alberlaine which lie adjacent to the planned CSP plant alternative one ii.

The typical number of components on site would be:

- 1 Cooling tower, with 11 fans;
- Heat transfer fluid pumps;
- 2 CW pumps (one in service at any time);
- 2 BF pumps (one in service at any time); and
- 1 Steam Generator (enclosed).

High voltage transmission lines and transformers (at the substation) generally cause low levels of noise. The noise level of a large transformer at 70 m is estimated to be approximately 40 dBA (L_{Aeq}) and, according to the project developer, approximately 20 dBA (L_{Aeq}) for a transmission line at a distance of 7 m.

On the PV plant, inverter noise levels at 3 meters could be as high as 80 dBA (L_{Amax}), for an inverter such as a Siemens SINVERT 1700 MS, to less than 65 dBA (L_{Amax}) for a Satcon PowerGate Plus 500 kW Commercial Solar PV Inverter. However, the inverters will be housed in steel and concrete enclosures which will provide significant attenuation of the noise radiated into the environment. Depending on the design and construction of these enclosures they could provide a reduction in noise emission levels of at least 15 dB. There would be 50 to 200 inverters located throughout the solar field in approximately 50 separate enclosures each serving up to 1 MW of the array.

Inverter transformers will be located adjacent to the inverters, either inside or outside the inverter enclosures. A typical transformer in such an installation would be a 1000 kVA liquid-immersed distribution transformer, which will, according to the National Electrical Manufacturers Association (NEMA) requirements (NEMA, 2000), result in average sound pressure levels of 58 dBA (L_{Aeq}) at the source. Any transformer used on site will conform to this requirement, resulting in an average sound pressure level of 58 dBA (L_{Aeq}) (at the source).

The Proposed Project will require the installation of up to 19,000 PV SunPower T20 Tracker units (or equivalents) with motors and associated electrical equipment, such as inverters, as well as electrical equipment at the proposed substation. Each of these components will be a new stationary source of noise in the environment.

Routine operational activities, such as the security vehicles driving along perimeter fire access roads, would generate intermittent maximum noise levels of approximately 75 dBA Lmax at 12 meters; 72 dBA Lmax at 25 meters. Security patrols would be of short duration and only occur intermittently.

Minor operational noise emissions from the project will be caused by security patrols, maintenance and wash crews. Security and maintenance staff would traverse the site in lightweight vehicles and all-terrain vehicles primarily along perimeter roads.

Panel washing crews would be scheduled to clean the panels approximately twice per year. They would traverse the site in a purpose-built lightweight to medium duty truck which would be fitted with a water tank and air compressor to operate a high-pressure sprayer and cleaning brush system. Even though these activities may occur infrequently, they could potentially cause localised noise levels substantially higher than the ambient noise level. For example, assuming a situation where up to three panel-washing crews would be operating simultaneously and in close proximity to one another, a noise level of approximately 73 dBA (L_{Aeq}) at 25 meters could be generated.

6.9 Visual Study

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

Generally speaking, the study area is characterised by a relatively flat, topographically featureless landscape which slopes down gradually in a north-westerly direction towards the Vaal River Valley (Figure 17). Variations in the topographical uniformity occur in the form of localised high points and ridges in the north and south-east of the site and slightly lower ground in the south-western portion of the site. The generally flat nature of the southern part of the site is indicated by the presence of a number of pans which only occur where the topography is too flat for surface drainage to flow away from the area.

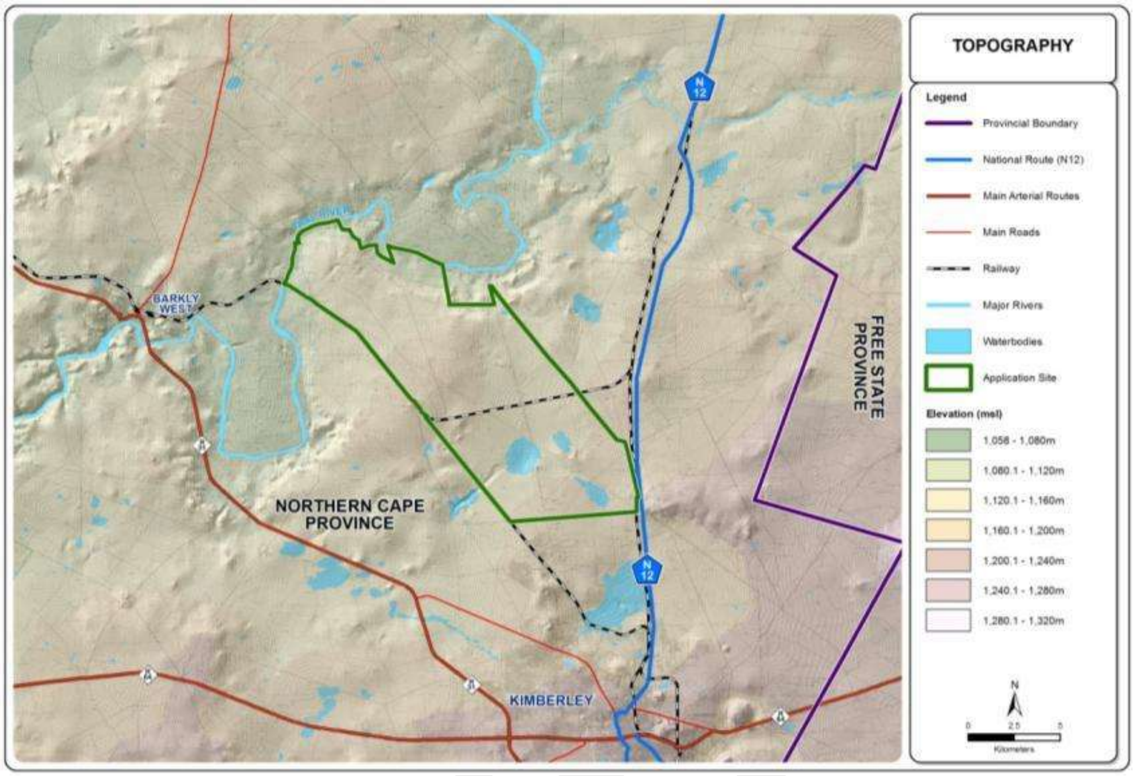

Figure 17: Topography within the study area

Visual Implications

The relatively flat topography on the site will result in typically wide-ranging vistas of the site, especially from locally higher elevations.

- Vegetation

The dominant vegetation unit in the study area is Kimberley Thornveld, which is characterised by a well developed tree and shrub layer with an underlaying grass layer (Figure 18) (Mucina and Rutherford, 2006). Much of this natural vegetation has however been previously cleared and replaced by open grasslands for agricultural purposes, except in the south-western parts of the site where natural thornveld vegetation is still present.

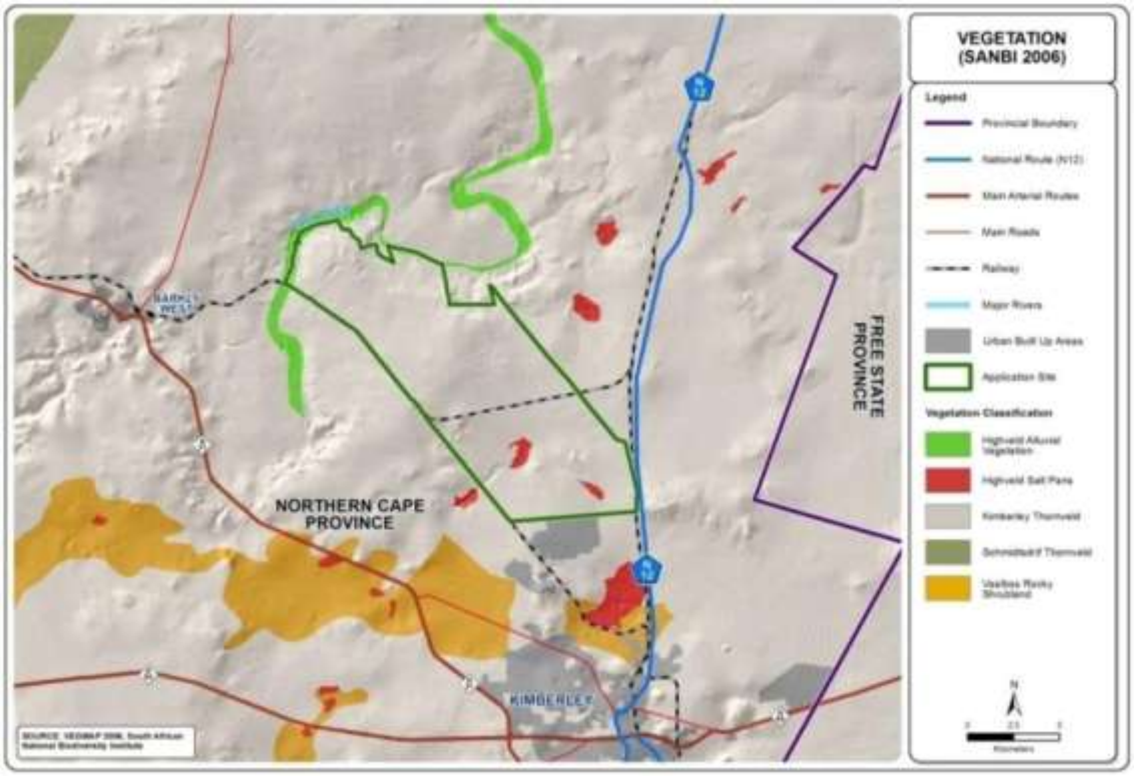

Figure 18: Vegetation within the study area

<u>Visual Implications</u>

The short open grasslands will promote wide open vistas of the proposed site. Where natural trees and shrubs are still present they will restrict views and effectively screen objects that are the same height or lower.

- Landuse

Most of the natural vegetation has been cleared from the proposed site and replaced by grassy plains used as grazing land for cattle. The surrounding area has been partly transformation by urban and suburban environments, with the town of Riverton directly to the north-east of the site along the Vaal River and the community of Roodepan situated to the south-west of the site. Intensive commercial agriculture occurs adjacent to the Vaal River, in and to the north of the site and mining activities which belong to the De Beers Consolidated Mines Ltd mostly occur to the south-east. Kimberley is the largest urban area and is located approximately 7km to the south of the site (Figure 19).

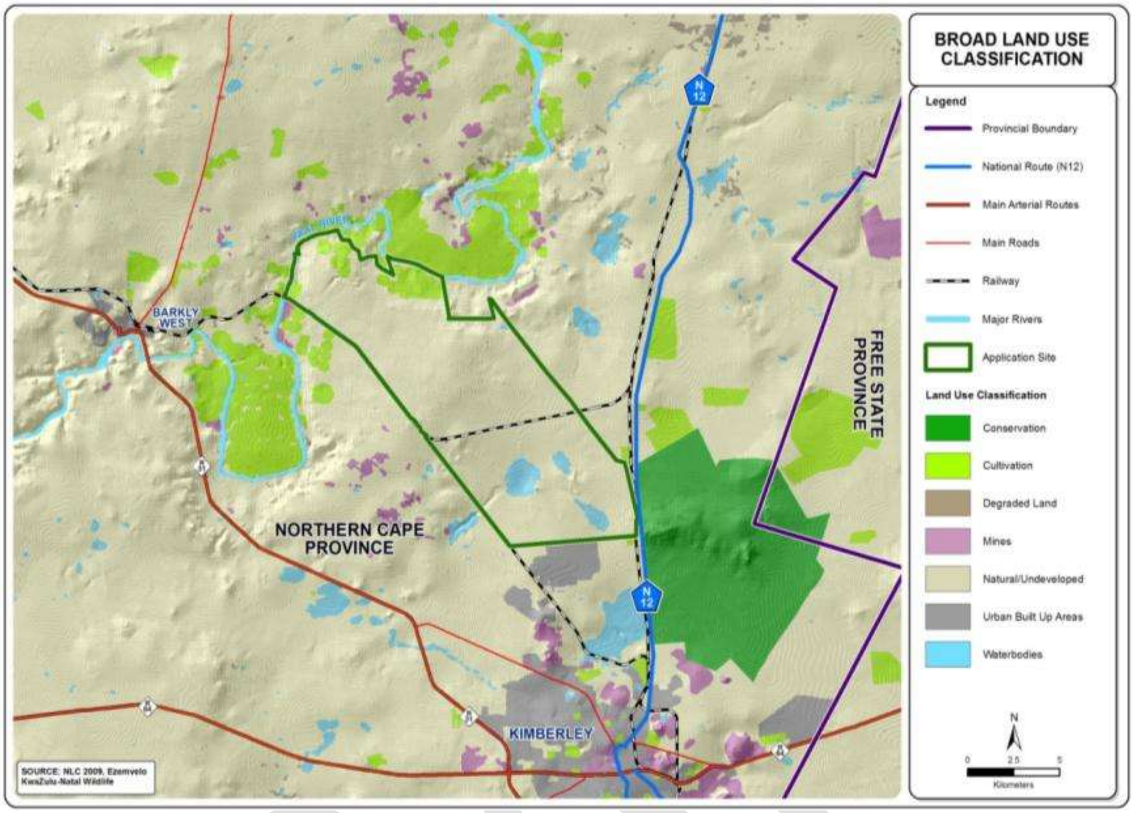

Figure 19: Landuse within the study area

<u>Visual Implications</u>

Clearance of the natural vegetation for urban and suburban landuses has partially transformed the natural visual character and resulted in wide open vistas.

- Visual Character

The above physical landscape characteristics as well as the presence of built infrastructure influences 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.

Most of the study area is considered to have a natural visual character with certain parts displaying a pastoral component where pasture land occurs, therefore introducing a solar field into this largely natural context is likely to alter the 'sense of place'.

Human infrastructure within the proposed site occurs at a low density and includes; transmission lines which traverse the site, the railway line on the western and eastern boundary, the road to Riverton on north-eastern boundary and the N12 highway on the eastern boundary. The surrounding landscape is relatively undisturbed with human transformation limited to agriculture and mining activities, scattered residential settlements, the N12 highway and the R31 to Barkly

West. The Dronfield Nature Reserve is located directly to the south-east of the site and contributes to the natural scenic character of the area by conserving the natural thornveld vegetation.

At present the area is largely undeveloped with a low density of human habitation and therefore the proposed solar energy facility is likely to degrade the natural visual character of the area. A large residential development, known as Northgate, has however been planned approximately 3km south of the proposed solar energy facility. Once erected, this residential development will increase the urban footprint and is likely to degrade the natural visual character of the study area.

- 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 area surrounding the proposed site has a largely natural visual character, with a very low density of human settlement. The wooded component of the natural vegetation will impede views toward the site from several places along the N12, however majority of the study area is assigned a low VAC value as these trees and shrubs are scattered and will offer incomplete visual screening.

6.9.2 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 existing infrastructure and visual character in an area, but also relates to the spatial distribution of potential receptors and likely value judgement of these 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 5 - Environmental factors used to define visual sensitivity classes

Visual Sensitivity Category	Visual Absorption Capacity	Presence and size of Existing	Presence of Sensitive	Visual Character	Other factors influencing visual sensitivity

		Infrastructure	Receptors		
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 are has a largely natural visual character, a low density of human infrastructure and a low VAC. Although there is limited human settlement in the immediate vicinity, the area is important from a tourism perspective as; the N12 on the eastern site boundary forms part of the Diamond Route, Dronfield Nature Reserve is located directly to the south-east and a number of recreational facilities associated with the Vaal River are located in Riverton. Due to these factors the area is categorised as having a high visual sensitivity.

6.10 Heritage

6.10.1 Archival findings

- Archaeology

At present no data could be obtained from the McGregor Museum on archaeological sites in and around the study area.

  - Nooitgedacht Rock Art Site

This National Monument is situated on the farm Nooitgedact (adjacent to the farm Droogfontein) and contains 3 sections of glaciated pavement with over 250 Bushman and Khoe rock engravings (Figure 20).

Figure 20: (Khoi)San Engraving of and Eland on glacial pavement at Nooitgedacht (http://commons.wikimedia.org/wiki/File:Rock_Art_at_Nooitgedacht.jpg)

- South African War

A study of archival information indicates the presence of the redoubts and encampments of the Boer forces during the South African war of 1899-1902 just outside the study area (Figure 21).

During the South African War, also referred to as the Anglo Boer war, Kimberley was besieged by Boer forces from 14 October 1899 to 15 February 1900. For four months, the Boer forces placed a total lock down on the town of Kimberley and besieged it until the town was relief by General French on 15 February 1900. For the Siege to be of any success the Boer forces needed to construct numerous redoubts and encampments around the town to control access in and out of town. Georefencing of available archival maps as shown in Figure 21 made it possible to plot these positions with relation to the proposed development area (Figure 22).

The southern western border of the study area is close to an Intermediate pumping station which was the area where the Head Quarters of the Boer command were established during the siege while the south eastern section is close to the vicinity of the low ridge just north of the Falstead farm where a set of boer redoubts where positioned (Figure 22).

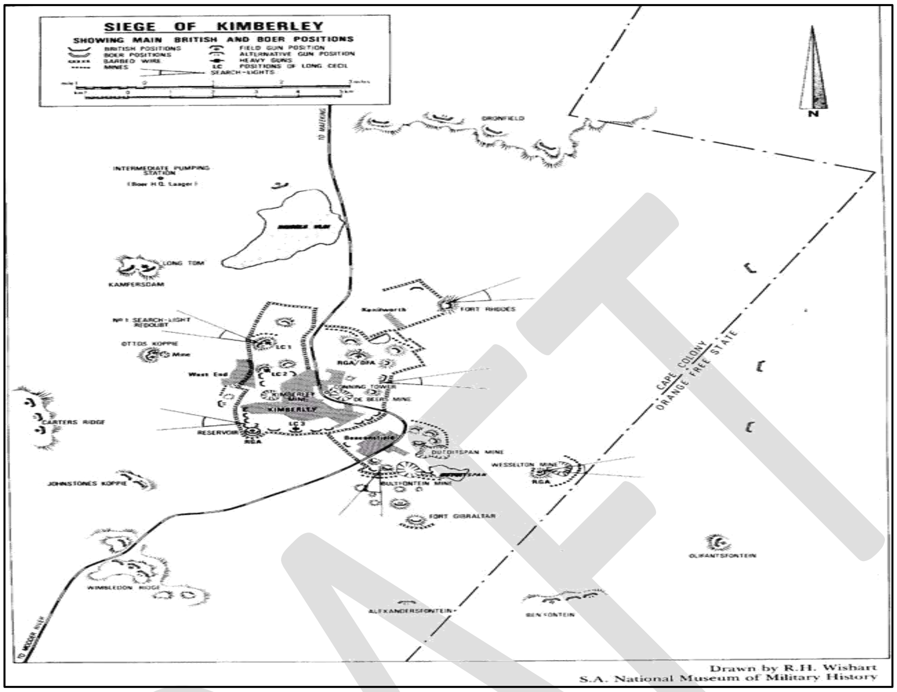

Figure 21 – Archival map of Kimberley Sieg - Georeferenced for plotting historical positions (www.boerwar.com)

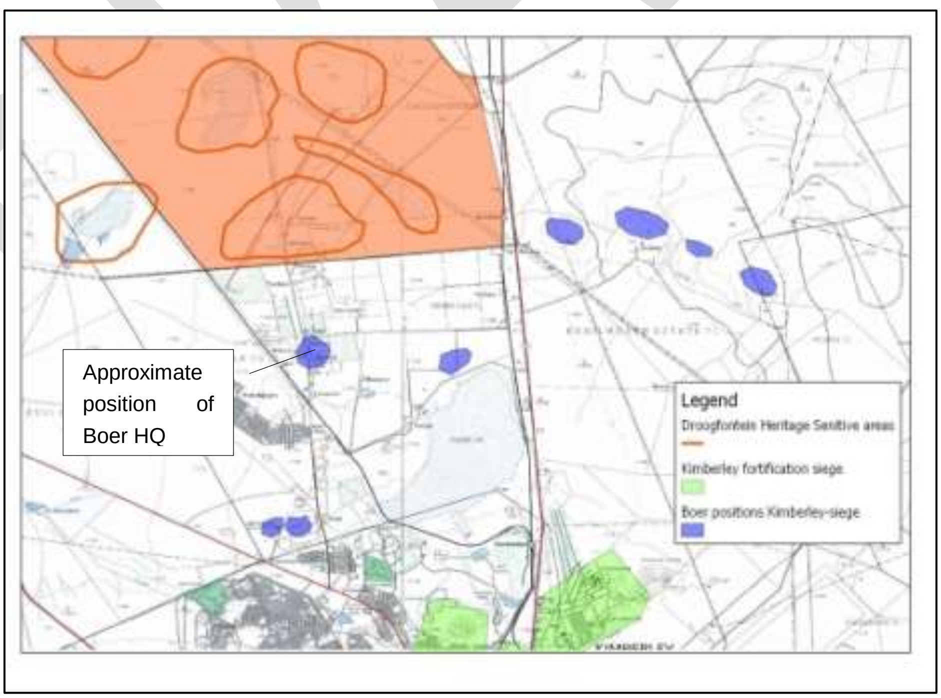

Figure 22 – Boer positions in relation to study area in red

6.10.2 Palaeoentological Heritage

The fossil heritage recorded within each of the main sedimentary rock successions represented within the Droogfontein study region north of Kimberley is outlined here. See also the summary of fossil heritage provided in Table 6 below.

- Fossils within the Prince Albert Formation

The fossil biota of the post-Dwykamudrocks of the Prince Albert Formation is summarized by Cole (2005) and Almond (2008a, b). Epichnial (bedding plane) trace fossil assemblages of the non-marine *Mermia*Ichnofacies, dominated by the ichnogenera*Umfolozia* (arthropod trackways) and *Undichna* (fish swimming trails), are commonly found in basinal mudrock facies of the Prince Albert Formation throughout the Ecca Basin. These assemblages have been described by Anderson (1974, 1975, 1976, 1981) and briefly reviewed by Almond (2008a, b). A small range of simple, horizontal to oblique endichnial burrows forming dense monospecific ichnoassemblages have been recorded from the Ceres Karoo, especially from those parts of the Prince Albert succession containing thin volcanic tuffs (Almond 2010). The presence of more diverse, but incompletely recorded, benthic invertebrate fauna in the Early Permian Ecca Sea is suggested by the recent discovery of complex arthropod trails with paired drag marks in the Prince Albert Formation near Matjiesfontein in the southern Great Karoo.These trackways might have been generated by small eurypterids (water scorpions), but this requires further confirmation. Poorly-defined invertebrate burrows are recorded from the Prince Albert Formation in the Kimberley sheet area by Bosch (1993).

Diagenetic nodules containing the remains of palaeoniscoids (primitive bony fish), sharks, spiral bromalites (coprolites, spiral gut infills*etc* attributable to sharks or temnospondyl amphibians) and petrified wood have been found in the Ceres Karoo (Almond 2008b and refs. therein). Rare shark remains (*Dwykaselachus*) are recorded near Prince Albert on the southern margin of the Great Karoo (Oelofsen 1986). Microfossil remains in this formation include sponge spicules, foraminiferal and radiolarian protozoans, acritarchs and miospores.

The most diverse, as well as biostratigraphically, palaeobiogeographically and palaeoecologically interesting, fossil biota from the Prince Albert Formation is that described from calcareous concretions exposed along the Vaal River in the Douglas area to the west of Kimberley (McLachlan and Anderson 1973, Visser *et al.,* 1977-78). The important Douglas biota contains petrified wood (including large tree trunks), palynomorphs (miospores), orthoconenautiloids, nuculid bivalves, articulate brachiopods, spiral and other “coprolites” (probably of fish, possibly including sharks) and fairly abundant, well-articulated remains of palaeoniscoid fish. Most of the fish have been assigned to the palaeoniscoid genus *Namaichthys* but additional taxa, including a possible acrolepid, may also be present here (Evans 2005). The invertebrates are mainly preserved as moulds.

- Fossils within the superficial deposits

The fossil record of the **Kalahari Group** is generally sparse and low in diversity. The **Gordonia Formation** dune sands were mainly active during cold, drier intervals of the Pleistocene Epoch that were inimical to most forms of life, apart from hardy, desert-adapted species. Porous dune sands are not generally conducive to fossil preservation. However, mummification of soft tissues may play a role here and migrating lime-rich groundwaters derived from the underlying bedrocks (including, for example, dolerite) may lead to the rapid calcretisation of organic structures such as burrows and root casts. Occasional terrestrial fossil remains that might be expected within this unit include calcretizedrhizoliths (root casts) and termitaria (*e.g. Hodotermes*, the harvester termite), ostrich egg shells (*Struthio*) and shells of land snails (*e.g. Trigonephrus*) (Almond 2008a, Almond &Pether 2008). Other fossil groups such as freshwater bivalves and gastropods (*e.g. Corbula, Unio*) and snails, ostracods (seed shrimps),charophytes (stonewort algae), diatoms (microscopic algae within siliceous shells) and stromatolites (laminated microbial limestones) are associated with local watercourses and pans. Microfossils such as diatoms may be blown by wind into nearby dune sands (Du Toit 1954, Dingle *et al*., 1983). These Kalahari fossils (or subfossils) can be expected to occur sporadically but widely, and the overall palaeontological sensitivity of the Gordonia Formation is therefore considered to be low. Underlying calcretes might also contain trace fossils such as rhizoliths, termite and other insect burrows, or even mammalian trackways. Mammalian bones, teeth and horn cores (also tortoise remains, and fish, amphibian or even crocodiles in wetter depositional settings such as pans) may be expected occasionally expected within Kalahari Group sediments and calcretes, notably those associated with ancient alluvial gravels.

The “Older” Vaal River Gravels (**Windsorton Formation**) of possible Miocene-Pliocene age have not yet yielded well-dated fossil biotas (Partridge *et al.,* 2006). A “sparse, poorly provenanced vertebrate fauna from diamond diggings” is noted herein by De Wit *et al.* (2000) who favour a Pliocene age (4.5-3.5 Ma). In contrast, a wide range of Pleistocene mammal remains (bones, teeth) as well as Acheulian stone tools are recorded from the “Younger” Vaal River Gravels or **Rietputs Formation** (Cooke 1949, Wells 1964, Partridge & Brink 1967, Butzer et al. 1973, Helgren 1977, Klein 1984, Bosch 1993). These are assigned to the Mid Pleistocene Cornelian Mammal Age and include various equids and artiodactyls as well as African elephant and hippopotamus (See MacRae 1990, De Wit 2008 for brief reviews, and Gibbon *et al.* 2009 for recent dating of the matrix).

Table 6: Summary of fossil heritage in the Kimberley area

GEOLOGICAL UNIT	ROCK TYPES & AGE	FOSSIL HERITAGE	PALAEONT-OLOGICAL SENSITIVITY	RECOMMENDED MITIGATION
Gordonia Formation *etc* KALAHARI GROUP	unconsolidated to semi-consolidated aeolian sands, locally calcretized at depth QUATERNARY	Calcretised rhizoliths & termitaria, ostrich egg shells, land snail shells, rare mammalian and reptile (*e.g.* tortoise) bones, teeth freshwater units associated with diatoms, molluscs, stromatolites*etc*	LOW	none recommended any substantial fossil finds to be reported by ECO to SAHRA
Prince Albert Formation ECCA GROUP	Basinal mudrocks with carbonate &phosphatic concretions, minor tuffs EARLY PERMIAN	marine invertebrates (esp. molluscs, brachiopods), coprolites, palaeoniscoid fish & sharks, trace fossils, various microfossils, petrified wood	LOW IN THIS AREA	none recommended any substantial fossil finds to be reported by ECO to SAHRA
Allanridge Formation VENTERSDORP SUPERGROUP	lavas and pyroclastics with minor siliciclastic lenses LATE ARCHAEAN (c. 2.7 Ga)	none	INSENSITIVE	none recommended stromatolites recorded from sediments of underlying Bothaville Formation

6.11 Tourism

6.11.1 Tourism Routes in Areas of the Proposed CSP and CPV/ PV Plants

The proposed development falls within the Frances Baard District Municipality (FBDM) which is made up of four local municipalities namely: Dikgatlong Municipality; Magareng Local Municipality; Phokwane Municipality and Sol Plaatje Municipality. The study site is located in Sol Plaatje Municipality.

Tourism in the FBDM is increasingly becoming a major contributor to the global economy (2009 Tourism Strategy for Frances Baard DM). As a destination for tourists, FBDM is the most visited regional destination in the Northern Cape. It is known for its key attractions such as the Kimberley Big Hole, Wildebeest Kuil Rock Art Centre, Galeshewe Activity Route, Kimberley Ghost Trail, McGregor Museum, Hartswater irrigation system and wine cellar and Anglo-Boer War battlefield.

Current visitation to the Northern Cape (i.e. holiday, VFR (Visiting Friends and Relatives) as well as business tourists) is concentrated between Kimberley and Upington. While Kimberley captures 40% of visitors, Upington captures 36% of visitors implying that the FBDM in general and Sol Plaatje Local Municipality in particular are the main beneficiary in tourism in the Province. Other visited areas in FBDM include; the Orange River, the Kalahari Gemsbok National Park, Augrabies Falls and De Aar (FBDM, 2009).

Tourism routes that could potentially be affected by the proposed development include the Anglo Boer War Route, the Diamond Route and the Diamond Birding Route as detailed below.

- Anglo Boer War Route

The war between Great Britain and the Boer Republic of Transvaal and the Orange Free State broke out on 11 October 1899 and those living in the Northern Cape region of the Cape Colony were plunged into three years of unimaginable hardship, with accompanying loss of liberty and even life.

The Northern Cape was to play a decisive role in the war, the major battles of the Western Campaign taking place within 120 kilometres of Kimberley. Within hours of the war's beginning, Boer commandos moved into Natal and the Cape Colony on three fronts. With Cecil Rhodes, the former Cape Premier, ensconced in Kimberley, the town was a prime target for the Boers and, by 14 October, Kimberley, under the command of Lieutenant-Colonel Robert Kekewich, was besieged.

The details of the siege, including the victories and setbacks suffered by the Relief Column under Lieutenant-General Lord Methuen, can be relived at the Magersfontein and McGregor Museums.

Boer guerrilla forces roamed the entire Northern Cape region until May 1902, with skirmishes between the Boer and the Brit being regular occurrences. By visiting the many battlefields and talking to the local inhabitants, a visitor is able to picture that distant war and bring it to life (Northern Cape Tourism Board, 2007).

- The Diamond Route

The Diamond Route was established by the Oppenheimer family in conjunction with De Beers (the international diamond mining company). The Route links eight sites across northern South Africa. It stretches from Namaqualand on the west coast, to Kimberley (Benfontein, Rooipoort and Dronfield), then north to Tswalu in the Kalahari, through Brenthurst Gardens in Johannesburg eastwards to Ezemvelo Nature Reserve and northwards to the Venetia Limpopo reserve in far Limpopo (De Beers 2010).

The route is geared for both ecotourism and general tourism, incorporating new and largely undiscovered natural wonders, as well as historical and cultural elements, including diamond mining. The route caters mainly for independent travelers or small groups. It offers a broad array of activities with expert trained guides, but also allows self-guided tourism at some destinations. Begun as a birding route, the route has a strong element of birding (De Beers 2010).

Although there are several tourism hotspots along the route, only the Kimberley node is highlighted in this report as it located closest to the study area. The Kimberley node encompasses tourism sites namely; Benfontein, Dronfield and Rooipoort. Tourism attractions per site include:

- Benfontein: Camping on historical sites, home of the black wildebeest, night-drives for rare mammals, birding.
- Dronfield: Cottages in Kalahari thornveld, vulture hide, and rare mammal programmes, Anglo-Boer war site.
- Rooipoort: Historical shooting lodge, safari camp, huge area, picturesque Vaal river frontage, petroglyphs.

All these sites are situated near the Big Hole diamond mining museum and world famous Kamfers' Dam flamingo breeding colony (De Beers 2010).

6.11.2 Tourism Trends and Land use

The area where the proposed CSP and CPV/ PV Plants are to be established is located approximately 15km north of the town of Kimberley. Kimberley is the nearest town that lies along the Diamond Route and the Anglo Boer War Route. The N12 (which is a portion of the diamond route) runs along the eastern side of the study area. In addition, bordering the study site to the east is the unidentified Road heading to Riverton, off the N12. This is also a potential route for tourists.

The Vaal River (where a number of tourism activities (and future development opportunities) exist including the Vaal Aquatic club) is to the north of study area.

The immediate surroundings of the study area are dominated by open areas of natural vegetation. Further north and northwest, the area is characterized by cultivated land. In addition, mining activities which belong to De Beers Consolidated Mines Ltd are mostly to the east of the study area.

The Dronfield Nature Reserve is located south east of the study area.

There is an industrial and commercial area on a small portion of land south west of the site.

Meanwhile residential areas are scattered to the south of the study area.

The study site is traversed by existing transmission lines of 275kV, 132kV, 66kV and 11kV.

- Tourism Supply

There are a variety of tourism activities around the study area (within a 25km radius), namely:

- The Vaal River to the north of the study area offers a number of tourism activities (and future development opportunities) including the Vaal Aquatic club.
- The vulture feeding site and a restaurant on Dronfield Farm.
- Dronfield Nature Reserve is situated south east of the study area.
- Ingelwood sable breeding establishment, Kamfers dam to the south and the vultures feeding site are major tourism attractions. Ecotourism and general lodges and cottages can be found on this portion.
- Kamfers dam in considered a Natural Heritage site due to its importance to water birds
- Kimberly Golf Club.
- The Big Hole in Kimberly further south is a world heritage site.
- The Diamond Route N12 (Transvaal Road) where a number of attraction spots are situated.

- Further south of the study area is the Kimberley city centre where various eco tourism lodges and Museums (McGregor Museum) are located. Several monuments and statues are found in the Kimberley.
- The Wildebeest Kuil Rock Art Center south west of the study area.
- There is a heritage site further south west of the study area. This is a potential tourist development destination.
- The current annual events in the district include: Gariep Festival, Kimberley Show, Barney Barnato Golf Week, Flea Market and Jones Street Mall (Tourism Strategy for FBDM 2009).

- Accommodation facilities

The supply of accommodation facilities is concentrated mainly in and around Kimberley which is approximately 15km away from the study site. Tourist accommodation facilities around the study area can be broken up into a number of different categories:

- Bed and breakfasts,
- Guesthouses,
- Hotels/motels/Inns/ lodges,
- Conference facilities,
- Youth hostels/ backpacker
- Caravan and Camping sites
- Chalets

A list of accommodation facilities is attached in appendix A of this report. They are important to the tourism in the area. There are approximately 106 accommodation facilities in Kimberly. However, only nine facilities within a 2km radius of the study area were interviewed. The total number of beds in the nine facilities is 324 and mostly business tourists are the main guests (Pers. Comm. 2010).

There is generally a significant number of tourism facilities in the wider area which indicates an excellent supply of tourist accommodation and facilities in the area (Figure 23). Much of this is concentrated the town of Kimberley. Dronfield Nature Reserve immediately south east of the study area offers self catering accommodation facilities (i.e. chalets sleeping between 2 to 4 guests) as well as conference facilities (accommodating up to 30 guests).

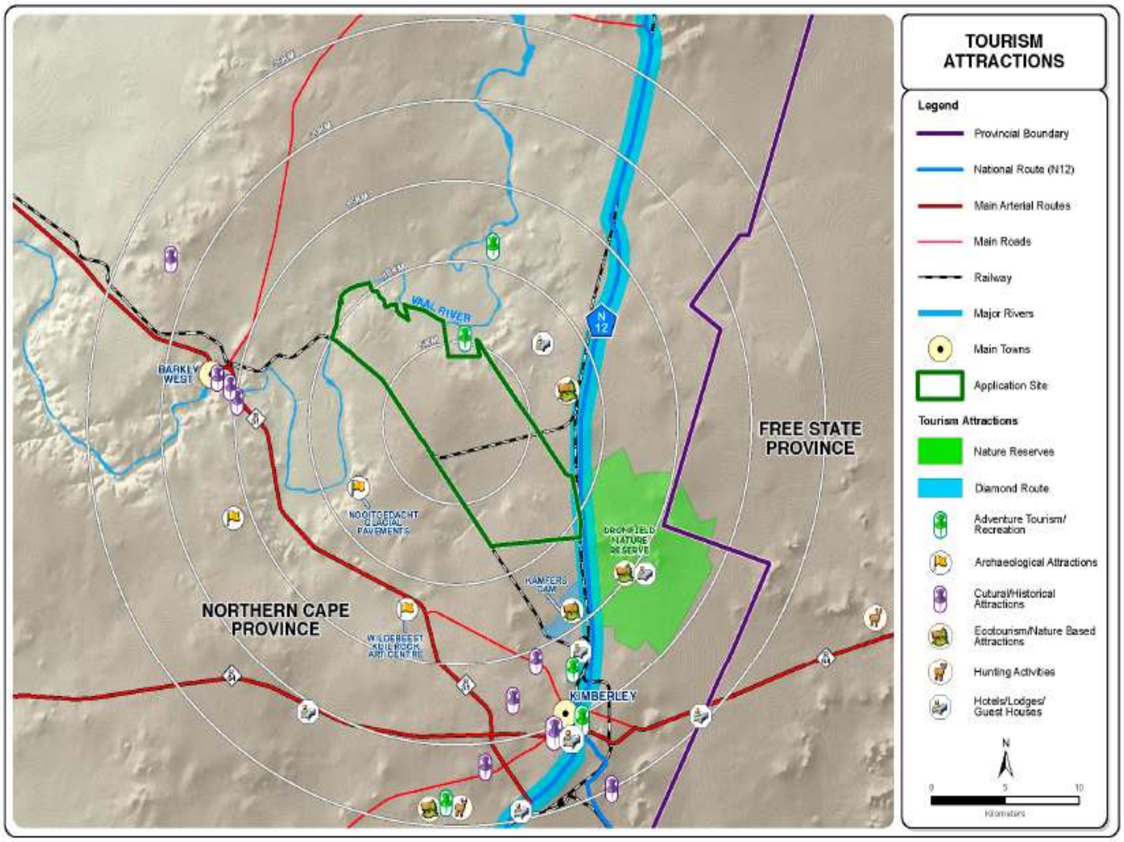

Figure 23: Tourism features within a 25km radius at the Kimberly site

6.12 Socio-economic

6.12.1 Site Location and Description

The Droogfontein site is located within the Sol Plaatje Local Municipality that forms part of the Frances Baard District of the Northern Cape. The approximate location of the Droogfontein site is reflected in Figure 24 below.

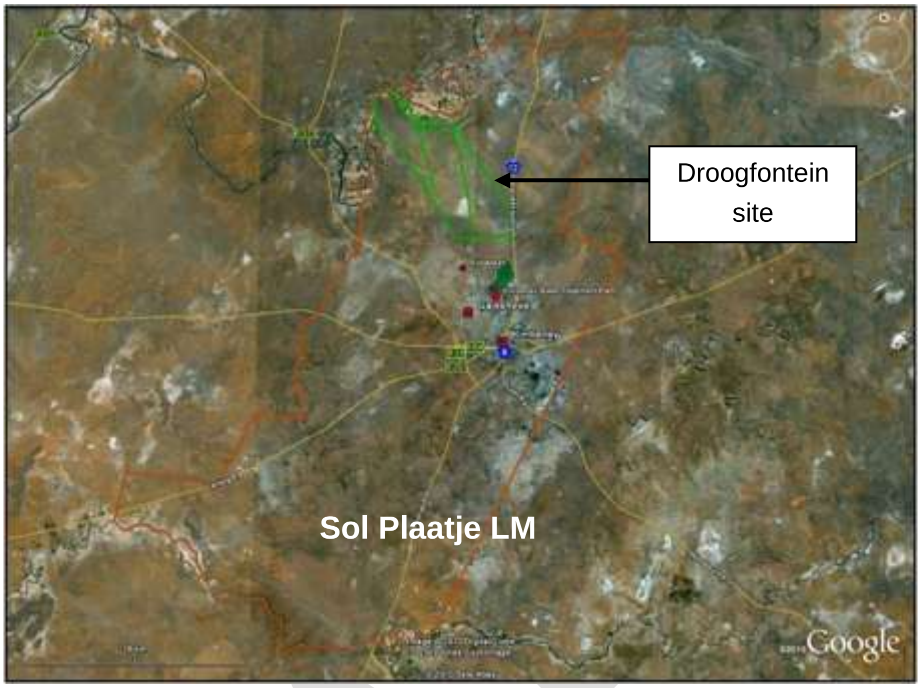

Figure 24*:* Proposed Droogfontein site within the Sol Plaatje Local Municipality

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 led 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 kilometer. 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 kilometer.

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's 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.

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. The EIA Newsletter will be distributed via email to all stakeholders as well as distributed in hard copy in the town of Kimberley. Stakeholders will be allowed a 14 day period to be reacquainted with the process.

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 will be placed in the local newspaper to advertise the public meeting and availability of the draft Environmental Impact Report. Site notices will also be placed within the town of Kimberley 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 mid June 2011 in Kimberley. This will take place during the review period of the report. 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 7: Focus Group meeting

Venue	Interested Parties	Date	Time
The Kimberley Club	Municipal officials and Land Owners	13 June 2011	09:00am

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 on the 13 June 2011 at 13:30 at the Kimberley Club.

Table 8: Key Stakeholder Workshop

Venue	Date	Time
The Kimberley Club	13 June 2011	13:30

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 9: Public Meetings / Open Days

Venue	Date	Time
Saint Clements Church, Riverton	13 June 2011	18:00

This meeting has been advertised in the Diamond Fields Advertiser 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 will be displayed at the public venues as advertised as well as various public places frequented by the public i.e. cafés. (Proof of the advertisement is included in Appendix 5C).

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 6th of June 2011 to the 5 of July 2011:

- Sol Plaatjie Local Municipality
- Sony Leon Public Library
- Sol Plaatjie Local Municipality Satellite Office

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

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

- Biodiversity
- Surface Water
- Groundwater
- Tourism
- Noise
- Visual
- Heritage (including palaeontology)
- Socio-economic

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

8.1.1 Flora in the study area

A list of plant species including Red Data species are presented in Appendix 1 of Appendix 6A. The prominent plant of concern within the study area is the Camel thorn (*Acacia erioloba*) which is common throughout the area. This is a protected tree species in terms of the National Forest Act, 1998 (Act No. 30 of 1998). Several of these trees are present on the site. Mitigation measures will thus need to be included within the EMPr and a permit applied for with the Department of Water Affairs should any of these species be affected.

- Kimberley Thornveld

This vegetation type is characterised by rolling topography but more often very flat. A well developed tree layer is present dominated by Camel thorn (*Acacia erioloba*), Umbrella thorn (*Acacia tortillis*) and Shepherds tree (*Boscia albitrunca*). Grass is present however a large amount of exposed soil is present. No Shepherds trees were noted during field work however these are very likely to be present.

Larger dominant species include *Acacia mellifera*, *Tarchonanthus camphoratus*, *Rhus lancea*, *Ehretia rigida* and *Diospyros pallens*. The herb layer is dominated by *Acacia hebeclada, Euclea crispa, Hermannia comosa, Melolobium microphyllum* and *Aloe hereroensis*.

Grass species occurring include *Eragrostis lehmanniana*, *Aristida congesta*, *Cymbopogon posposchilii, Digitaria eriantha, Enneapogon cenchroides, Themeda triandra* and *Eragrostis rigidior.*

The vegetation type is considered to be Least Threatened with 82.3% remaining however only 2% has been formally protected.

- Highveld Salt Pans

Highveld salt pans are characterised by being depressions in the landscape which contain temporary (some permanent) water. They are sparsely vegetated and are subject to heavy grazing pressure.

Low shrubs and herbs dominate the vegetation layers. Some of these species include *Atriplex vestita, Felicia filifolia, Felicia muricata, Pentzia globosa* and *Pentzia incana.* Succulent shrubs include *Salsola glabrescens, Lycium cinereum* and *Titanopsis hugoschlechteri*. Grass species include *Chloris virgata, Cynodon dactylon, Cyperus laevigatus, Cyperus marginatus, Eragrostis bicolour, Eragrostis chloromelas, Eragrostis plana, Hemarthria altissima, Juncus rigidus* and *Setaria incrassata*.

The vegetation type is considered to be Least Threatened with 96.5% remaining however only 0.2% are formally protected.

- Highveld Alluvial Vegetation

Located on the banks of the Vaal River this vegetation is characterised by riparian thickets.

Species present are dominated by *Acacia karroo, Salix mucronata, Ziziphus mucronata, Celtis Africana, Rhus lancea, Gymnosporia buxifolia, Rhus pyroides* and *Diospyros lycioides*.

The vegetation is considered to be Least Threatened with 75.7% remaining however only 9.2% is formally protected.

8.1.2 Floral environment

The following species dominated the site:

Table 10: Dominant species noted on site

Species name	Common name
GRASS	
Ennepogon cenchroides	Nine-awned grass
Stipagrostis uniplumis	Silky bushman grass
Eragrostis nindensis	Wether love grass
Anthephora pubescens	Wool grass
Themeda triandra	Red grass
Cynodon dactylon	Couch grass
Eragrostis trichophora	Hairy love grass
Eragrostis lehmanniana	Lehmann's love grass
Hyparrhenia hirta	Common thatching grass
Chloris virgata	Feathered chloris
Pogonarthria squarrosa	Herringbone grass
Aristida congesta	Tassel Three awn
Fingerhuthia africana	Thimble grass
Schmidtia pappophoroides	Kalahari sand quick
FORBS	
Eriocephalus ericoides	Kapok bush
Ledebouria sp.	
Protasparagus sp.	Wild asparagus
Cucumis africanus	Wild cucumber
Pentzia incana	Anchor karoo
Solanum sp	
Indigofera sp	
Commelina sp.	
Hermannia tomentosa	
Boophone distichia	Gifbol
Tarchonanthus camphoratus	Campher bush
Felicia muricata	White felicia
Walafrida sp	
Berkeya sp	
Aruja setifera	Moth catcher
TREES	
Acacia erioloba	Camel thorn
Grewia flava	Raisin bush
Elephantorrhiza elephantina	Elephants root
Ehretia rigida	Puzzle bush
Acacia hebeclada	Candle thorn
Ziziphus mucronata	Buffalo thorn
Acacia tortillis	Umbrella thorn
Acacia mellifera	Black thorn

- *Acacia erioloba* (Camel thorn)

Acacia erioloba commonly known as Camel thorn (Figure 25) is a declared Protected Tree (National Forests Act of 1998). In terms of this Act, protected tree species may not be cut, disturbed, damaged, destroyed and their products may not be possessed, collected, removed, transported, exported, donated, purchased or sold – except under license granted by the Department of Water Affairs (or a delegated authority).

The species is common in the northern and southern sections of the farm.

Applications for such activities should be made to the responsible official in a specific province. Each application is evaluated on merit (including site visits) before a decision is taken whether or not to issue a license (with or without conditions). Such decisions must be in line with national policy and guidelines.

Figure 25: *Acacia erioloba* (Camel thorn) in the northern portion of the study area

Acacia erioloba ranges from a 2m spiny shrub to a 16m robust tree. The stem is shiny reddish brown when young. The bark of a mature tree is grey to blackish brown and is deeply furrowed; bearing pairs of almost straight, whitish or brown spines. Spines often have swollen bases and appear at the bases of the leaves. The fully developed spines may be up to 60 mm long. The leaves are twice divided. There are normally 2 to 5 pairs of pinnae per leaf and 8 to 18 pairs of leaflets (pinnules) per pinna. They are hairless and have a prominent underside vein on the undersurface (SANParks, 2009).

The tree bears bright yellow ball-like flowers that are sweetly scented. They are borne in late winter and last through to summer. The fruit is variable and ranges from small and almost cylindrical to typically large, flat, thick, semicircular or half-moon-shaped pods. They are up to 130 mm long and 50 mm wide and are covered by velvety grey hairs. They are semi-woody, but spongy inside; the pods do not open even when ripe but fall to the ground in winter. Seeds are thick, robust and lens-shaped.

8.1.3 Fauna in the study area

8.1.3.1 Mammals

Various mammal species are likely to occur within the study area. Appendix 2 of 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*), Honey Badger (*Mellivora capensis*), and Geoffroy's Horseshoe Bat (*Rhinolophus clivosus*) are listed as Near Threatened and have been recorded in the study area. 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*) and the Plains Zebra (*Equus burchellii*).

Generally, several of the species recorded for the study area are not likely to occur due to the anthropogenic activities such as fencing etc that have taken place.

In this study, a few mammals (small mammals) were trapped in Sherman traps (Figure 26 and Figure 27). These include:

- Bushveld Gerbil (*Tatera leucogaster)*
- Striped mouse (*Rhabdomys pumilio*)

Figure 26: Bushveld Gerbil *Tatera leucogaster*

Figure 27: Striped mouse (*Rhabdomys pumilio*)

The low trapping rate in this study may be attributed to the high level of grazing observed at several sites. The presence of livestock has a negative effect on both small mammal species richness and abundance (Bergstrom, 2004). 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).

Other than the trappings, evidence of porcupines (*Hysterix africaeaustralis*) and Aardvark (*Orycteropus afer*) (Figure 28) was prominent on the site.

Figure 28: Aardvark excavations in the study site

8.1.4 Reptiles

Several reptile species are present in the study area. Table 11 highlights these species (Branch 1998). According to the current Red Data information, only two 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 in the study area.

Table 11: Red data reptiles in the study area

Common name	Scientific name	South African Red Data Status
Greater Padloper	*Homopus femoralis*	
Leopard tortoise	*Geochelone pardalis*	
Serrated or Kalahari tent tortoise	*Psammobates oculiferus*	
Marsh or Helmeted Terrapin	*Pelomedusa subrufa*	
Delalande's beaked blind snake	*Rhinotyphlops lalandei*	
Cape and Eastern Thread snake	*Leptotyphlops conjunctus conjunctus*	
Peter's thread snake	*Leptotyphlops scutifrons*	
Brown house snake	*Lamprophis fuliginosus*	
Aurora house snake	*Lamprophis aurora*	
Cape Wolf snake	*Lycophidion capense*	
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*	
Cape Cobra	*Naja nivea*	
Rhinkhals	*Hemachatus heamachatus*	
Puff adder	*Bitis arietans arietans*	
Cape spade-snouted worm lizard	*Monopeltis capensis*	
Thin tailed legless skink	*Acontias gracilicauda*	
Cape skink	*Mabuya capensis*	
Striped skink	*Mabuya striata punctatissima*	
Variable skink	*Mabuya varia*	
Variegated skink	*Mabuya variegata*	
Western three-stripped skink	*Mabuya occidentalis*	
Spotted sandveld lizard	*Nucras intertexta*	
Holub's Sandveld Lizard	*Nucras holubi*	

Spotted sand lizard	*Pedioplanis lineoocellata lineocellata*	
Yellow throated plated lizard	*Gerrhosaurys flavigularis*	
Giant girdled Lizard or Sungazer	*Cordylus giganteus*	Vulnerable
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*	
Flap neck Chameleon	*Chamaeleo dilepis*	
Bibron's Thick-toed Gecko	*Pachydactylus bibronii*	
Cape Thick-toed Gecko	*Pachydactylus capensis*	

Only one reptile individual i.e. the Western three-stripped skink (*Mabuya occidentalis*) (Figure 29) was trapped in a pitfall trap during field surveys. *Trachylepis occidentalis* is a terrestrial species which lives in open sandy veld and short burrows at night. It occurs in arid savannas among others vegetation types (Branch 1998).

Figure 29: Western three-stripped skink (*Mabuya occidentalis*)

8.1.5 Amphibians

Table 12 below presents amphibian species potentially distributed in the study area

Table 12: Amphibian species in the study area (Du Preez and Carruthers, 2009; Minter *et al.,* 2004)

Scientific	Common	Category
Poyntonophrynus vertebralis	Southern Pygmy Toad	Not threatened
Amietophrynus gutturalis	Guttural Toad	Not threatened
Amietophrynus poweri	Western Olive Toad	Not threatened
Kassina senegalensis	Bubbling Kassina	Abundant
Cacosternum boettgeri	Boettgers Caco	Not threatened
Phrynobantrachus natalensis	Snoring Puddle Frog	Extinct
Xenopus laevis	Common Platanna	Threatened
Africana angolenis	Common River Frog	Not threatened
Afrana fuscigula	Cape River Frog	Not threatened
Pyxicephalus adspersus	Giant Bullfrog	Near threatened
Tomoptena cryptosis	Tremolo Sand Frog	Abundant
Tomopterna tandyi	Tandy sand Frog	Not threatened

The only Red data amphibian present in the study area is the Giant Bullfrog (*Pyxicephalas adspersus*) which is considered Near Threatened (Du Preez and Carruthers, 2009). A juvenile was sampled during field surveys in the study area (Figure 30). The species breeds in seasonal shallow grassy pans, non-permanent vleis and other rain filled depressions in open flat areas of grassland or savanna (Du Preez and Carruthers, 2009; Minter *et al.,* 2004). *Pyxicephalus adspersus* stays buried approximately 1m underground for most of the year (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 (Minter *et al.,* 2004; Du Preez and Carruthers, 2009).

Figure 30: Giant Bullfrog (*Pyxicephalus adspersus*) – Juvenile

- Western Olive Toad (*Amietophrynus poweri*)

Amietophrynus poweri (Figure 31) was also sampled during field surveys. It occurs around vleis and pans in thornveld savanna where rainfall is relatively low (less than 600mm per annum) (Du Preez and Carruthers, 2009).

Figure 31: Western Olive Toad (*Amietophrynus poweri*)

Figure 32: Unspecified rain frog (*Breviceps* spp)

8.1.6 Invertebrates

Several invertebrates were trapped in pitfall traps and sweep nets within the study area while others were recorded around the study area (Table 13).

Table 13: List of invertebrates in the study area

Order: Family	Common name	Scientific name
Coleoptera: Carabidae	Unspecified Ground beetle	Unspecified
Coleoptera: Carabidae	Velvet Ground Beetle	*Graphipterus limbatus*
Coleoptera: Scarabaeidae	Unspecified	Unspecified
Coleoptera: Tenebrionidae	Armoured Darkling Beetle	*Gonopus tibialis*
Coleoptera: Tenebrionidae	Tar Darkling Beetle	*Somaticus aeneus*
Coleoptera: Meloidae	CMR Bean Beetle	*Mylabris Oculata*
Coleoptera: Silvanidae	Lunate Ladybird	*Cheilomenes lunata*
Coleoptera: Lycidae	Unspecified	Unspecified
Hemiptera: Reduviidae	Unspecified	Unspecified
Hemiptera: Pentatonidae	Unspecified	Unspecified
Hemiptera: Coreidae	Unspecified	Unspecified
Hymenoptera: Formicidae	Unspecified	Unspecified
Orthoptera: Acrididae	Burrowing Grasshopper	*Acrotylus*
Orthoptera: Acrididae	Unspecified Grasshopper	*Orthoctha dasycnemis*
Orthoptera: Acrididae	Common Stick Grasshopper	*Acrida acuminata*
Orthoptera: Acrididae	Unspecified	Unspecified
Orthoptera: Pyrgomorphidae	Elegant Grasshopper	*Zonocerus elegans*
Neuroptera: Myrmeleontidae		*Neuroleon*
Lepidoptera: Arctiidae	Crimson – speckled footman	*Utetheisa pulchella*
Araneae: Araneidae	Unspecified orb-web spider	Unspecified

Figure 33: Unspecified orb-web spider within the study area

It is important to note that invertebrate species are mobile in nature and are not likely to be affected by the construction of a solar power plant. In addition, no unique larval habitat is present on the site which could be affected by the proposed development. Mitigation measures to reduce habitat destruction will aid in the preservation of habitat for invertebrate species.

Invertebrate information for the study area is limited although several species are anticipated to be present.

8.1.7 Diplopoda (millipedes)

A significantly larger number of millipedes (class Diplopoda) were recorded in the northern most portion of the study area, near the Vaal River, compared to other parts of the study area (Figure 34). While an average of three individuals were recorded per transect in other parts of the study area, the northern section of the study area presented an average of 40 individuals. The large number of individuals in the northern section of the site is perhaps attributed to moist habitat which is typical of this area given that it is in close proximity to the Vaal River. Millipedes can be found in a variety of habitats but prefer moist protected places such as under stones, rotten logs, leaves or bark.

Figure 34: Millipedes trapped in the northern portion of the study area.

8.1.8 Avifauna

Two Important Bird Areas (IBAs) are in close proximity to the study area and bird life in the area is fairly diverse (SABAP 2). African White Backed Vultures (*Gyps africanus*) were noted to be breeding on the site on both site visits. The species is common in the study area.

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 14: Bird species noted on site

Robert's No.	Scientific name	Common name
123	*Gyps africanus*	African White-backed Vulture
237	*Eupodotis ruficrista*	Red-crested Korhaan
239	*Eupodotis afraoides*	Northern Black Korhaan

354	*Streptopelia capicola*	Cape Turtle Dove
465	*Tricholaema leucomelas*	Pied Barbet
497	*Mirafra africanoides*	Fawn-coloured Lark
498	*Mirafra sabota*	Sabota Lark
506	*Chersomanes albofasciata*	Spike-heeled Lark
529	*Hirundo fuligula*	Rock Martin
541	*Dicrurus adsimilis*	Fork-tailed Drongo
548	*Corvus albus*	Pied Crow
595	*Myrmecocichla formicivora*	Southern Anteating Chat
615	*Cercotrichas paena*	Kalahari Scrub-robin
621	*Parisoma subcaeruleum*	Chestnut-vented Tit-babbler
681	*Cisticola fulvicapillus*	Neddicky
698	*Sigelus silens*	Fiscal Flycatcher
706	*Stenostira scita*	Fairy Flycatcher
716	*Anthus cinnamomeus*	Grassveld Pipit
732	*Lanius collaris*	Common Fiscal
799	*Plocepasser mahali*	White-browed Sparrow-weaver

The study area is located adjacent to two Important Bird Areas (IBAs), namely the Dronfield (SA 031) and Kamfers Dam (SA032). The Dronfield IBA is approximately 7880 ha and is a nature reserve. Kamfers Dam is approximately 400h in size and is centred around the Kamfers Dam, a proposed Ramsar site.

Bird lists associated with these areas are included in Appendix 3 of Appendix 6A. A total of 199 species have been recorded for Dronfield and 198 species have been recorded for Kamfers Dam. This makes up a large percentage of the total number of birds occurring in the Northern Cape (445). 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 15: 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

A number of flight paths were noted. Firstly waterbirds were observed flying northwards over the site, presumably from Kamfers Dam towards the Vaal River. This was waterbird species such as African Sacred Ibises, Glossy Ibises etc. Importantly these birds were observed to be flying at a relatively high level (i.e. not close to ground level), so they are unlikely to interact with any ground-level structures. These birds however may spot the evaporation ponds and drop down.

Interestingly species other than water species were also noted flying northwards – i.e. Lesser Kestrels and small flocks of Speckled Pigeons (Rock Doves). These are probably more random than the warterbirds linking between Kamfers Dam and the Vaal.

The more important flight path noted was that of hundreds of Barn Swallows; these birds were noted to fly in large numbers at / very close to ground level northwards at dawn. These birds are presumably flying north from a roost in reedbeds at Kamfers Dam to foraging areas to the north and closer to the Vaal River. The ground level flight path is important as this brings in the potential for collisions with CSP-related structures. It is the opinion of the specialist that the risk of collision is low as the birds will see the structures. However in order to mitigate this, it is suggested that larger structures such as buildings (control centres) be placed on the southern side of the CSP / PV field.

- Areas of avifaunal sensitivity:

There is a marked difference between the areas of thornveld vegetation and the grasslands on the site in terms of avifaunal sensitivity with the former being much higher sensitivity. This is because the bird sampling found a much greater species diversity, and probably also a greater number of actual birds in this habitat. The grasslands do however provide habitat for bird species depending on this habitat i.e. Northern Black Korhaans which were noted in abundance on the site.

In the thornveld areas, there is a good diversity of birds. Very importantly, these woodland areas are the areas where the White-backed Vultures are known to breed.

Vulture activity on the site is limited to the thornveld areas as well as the existing power lines on the site. Several vultures were noted at Dronfield during field work and it is thus assumed that they will fly between the two properties. Flight will however take place at a high level.

The habit of vultures to bathe on a regular basis places them at risk of utilising the evaporation ponds for this purpose. Mitigation measure will thus be required for this.

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.

Sensitive spots of the study area have been identified. The pans that are present on the site are considered to be sensitive and no go zones from a biodiversity perspective. These pans provide essential habitat for certain species such as the bullfrog and birds. These provide an important ecological function in the greater study area. Their linkage also remains important in the greater context.

The stands of Camel thorn (*Acacia erioloba*) and small hills within the study area are also considered to be sensitive. .

Due to the dominance of the *A. erioloba* which is a protected tree species in South Africa in terms of the National Forest Act, 1998 (Act No. 30 of 1998), suitable mitigation measures will need to be put in place (included within the EMPr) and a permit applied for with the Department of Water Affairs.

It is important to note that large parts of the site have been transformed by cattle grazing activities and it is these areas that will be favoured for siting the proposed infrastructure (Figure 35).

A sensitivity map is included below.

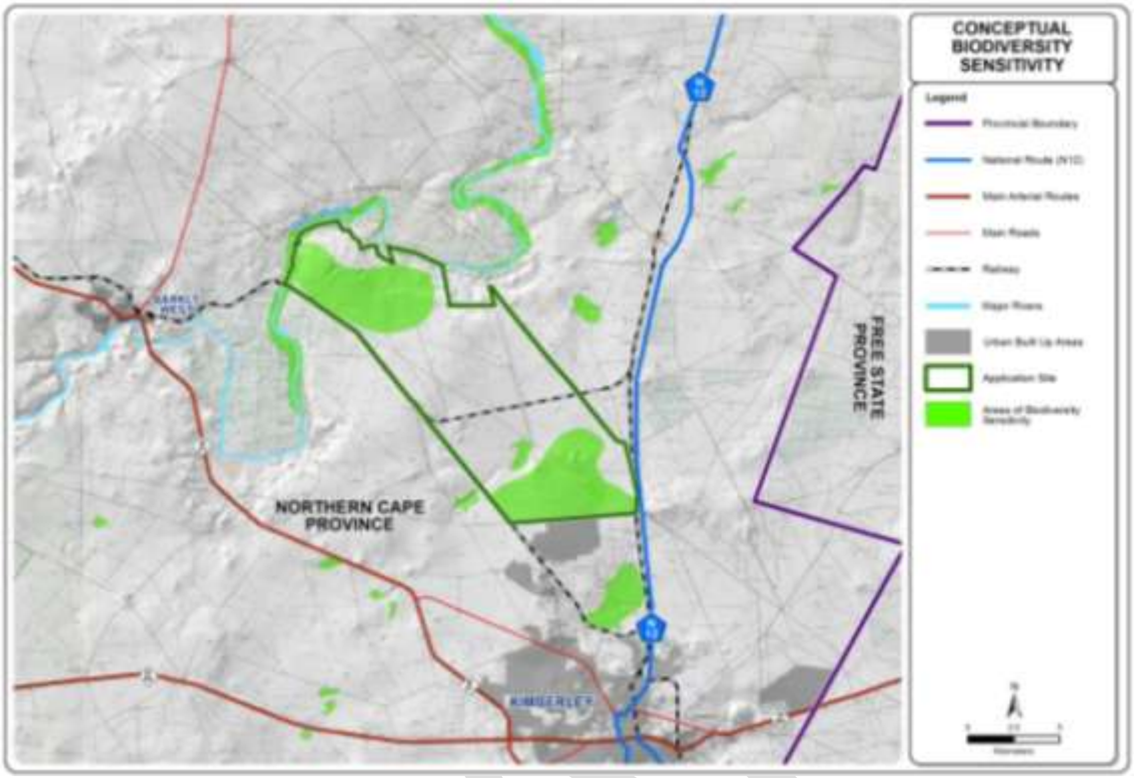

Figure 35: Conceptual biodiversity sensitivity map

The map concentrates on areas of intact vegetation, riparian vegetation and pans.

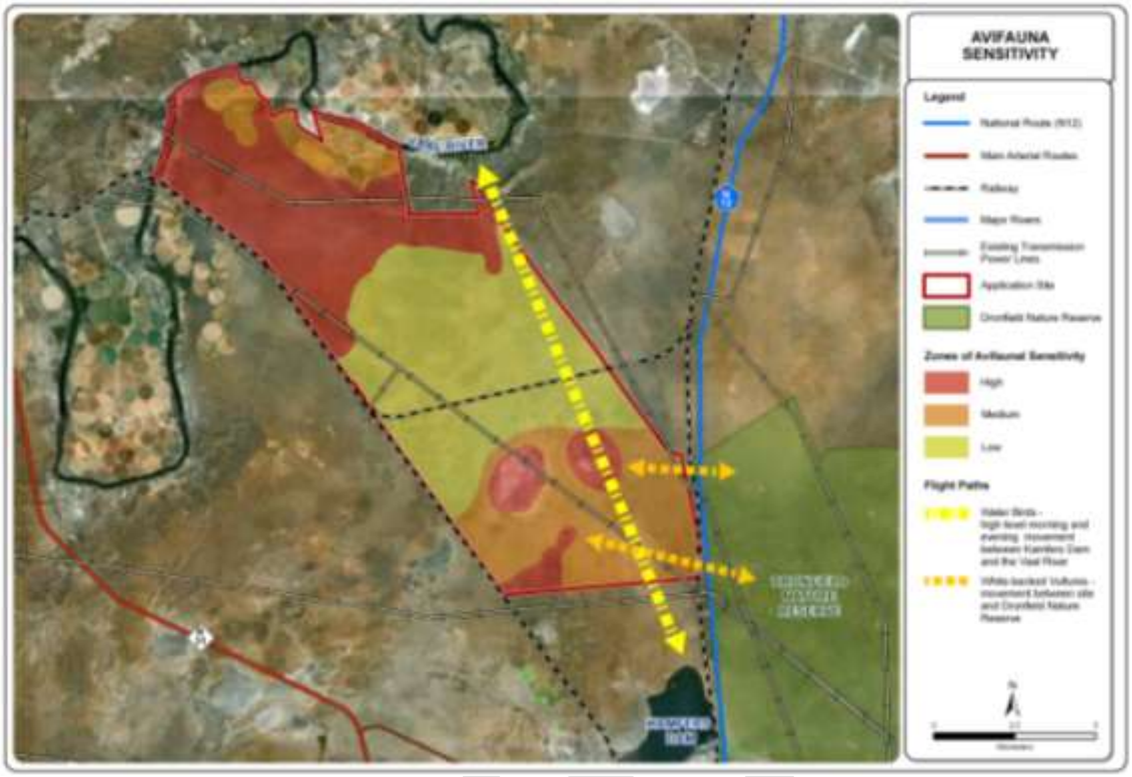

Figure 36: Avifaunal sensitivity areas

The map above (Figure 36) highlights the areas which are sensitive from an avifaunal perspective.

* The full Biodiversity Impact Assessment Report is included in Appendix 6A.

8.2 Surface Water

8.2.1 Desktop Delineated Wetlands

The occurrence of surface water features on the study site and their proximity to the proposed development areas (Figure 37- red squares) were identified at a desktop level. According to the National FEPA (2011) database, only four wetlands can be identified on the site. The northern-most smallest wetland according to the database is classified as being a depression wetland. The Southern-most large wetland on the other hand is classified as a channeled valley bottom wetland. The two remaining large wetlands are classified as un-channeled valley bottom wetlands. The vegetation units for all wetlands of the study area are classified as Eastern Kalahari Bushveld. The wetlands of concern in this case according to the NFEPA database, relate to the three large wetlands located to the south of the study site near the areas earmarked for the construction of the CSP and CPV/PV plants (Figure 37). The sizes of these wetlands are relatively large and may have some impact on the proposed construction areas. The wetland to the north of the study site, on the other hand, is relatively small and does not fall within the proposed development areas and as such can be excluded from the analysis. It is sufficiently distanced from the proposed construction areas and will therefore not be affected by the proposed development.

The Vaal River can be observed to the north of the study area although this area of the site does not interfere with the areas earmarked for the construction of the CSP and CPV/ PV plants and can also therefore be excluded from the analysis. No river systems can be found to the south of the site according to the NFEPA database.

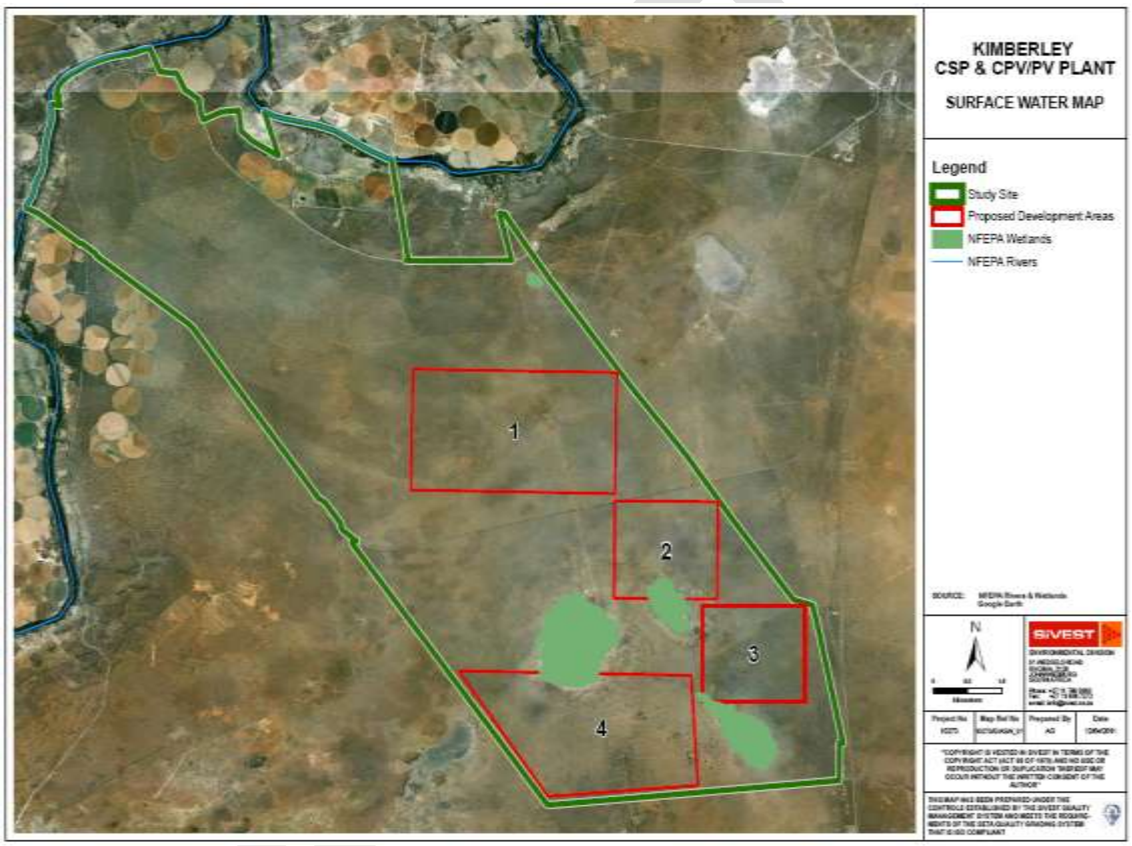

Figure 37: Surface Water Features in the Study Area

8.2.2 Field-assessed Wetlands

The field assessment identified the occurrence of five wetlands on site either within or nearby the proposed construction areas to a lesser or greater extent (Figure 38). In accordance with the DWAF (2005) methodology, soil samples were drawn from each of the wetlands. The specific topographical and soil characteristics are evaluated separately for each identified wetland.

- Large Wetland 1

    i. Wetland Terrain and Soils

Table 16 (Photo 1 to 6) contains the relevant photographic evidence of the wetland assessment.

Large Wetland 1 is situated adjacent to a low hill located south of the pan wetland. The topography surrounding the wetland is predominantly flat with low undulating terrain. The wetland is therefore positioned in a topographic depression within the landscape. The wetland is isolated.

The soil samples drawn from Large Wetland 1 indicate a temporary zone and a more permanent zone in contrast to the samples drawn from the other study pans. The temporary zone of this wetland contains soils that are mostly light brown in colour and sandy in structure. These characteristics were found near the surface of the soil profile constituting the A horizon. This particular horizon can be described as an Orthic A horizon (Photo 1). The underlying layer is similar in colour and characteristics in that it is sandy and light brown. However, there is an appreciable increase in carbonate precipitates with depth in the profile (approximately 1,2metres). This layer can be described as a Neocarbonate B horizon (Photo 2). Together the soil horizons can be said to indicate the Augrabies soil form. This soil form is not recognised as a typical wetland soil type.

The samples drawn from deeper within Large Wetland 1 revealed a different soil composition and soil type. The topsoil horizon (A horizon) was dark in colour and appeared to contain a higher organic content. The structure of the horizon was fairly well developed containing variable amounts of clay and sand (dominant). This horizon can be described as a Melanic A horizon (Photo 3). In contrast, the underlying layer was predominantly light brown and grey with signs of wetness (red\orange iron and black manganese accumulations) as well as carbonate precipitates (white concretions). This layer can be described as a G horizon (Photo 4). The combination of both soil horizons may be described as the Willowbrook soil form. This soil type is typical of more permanently inundated wetland systems.

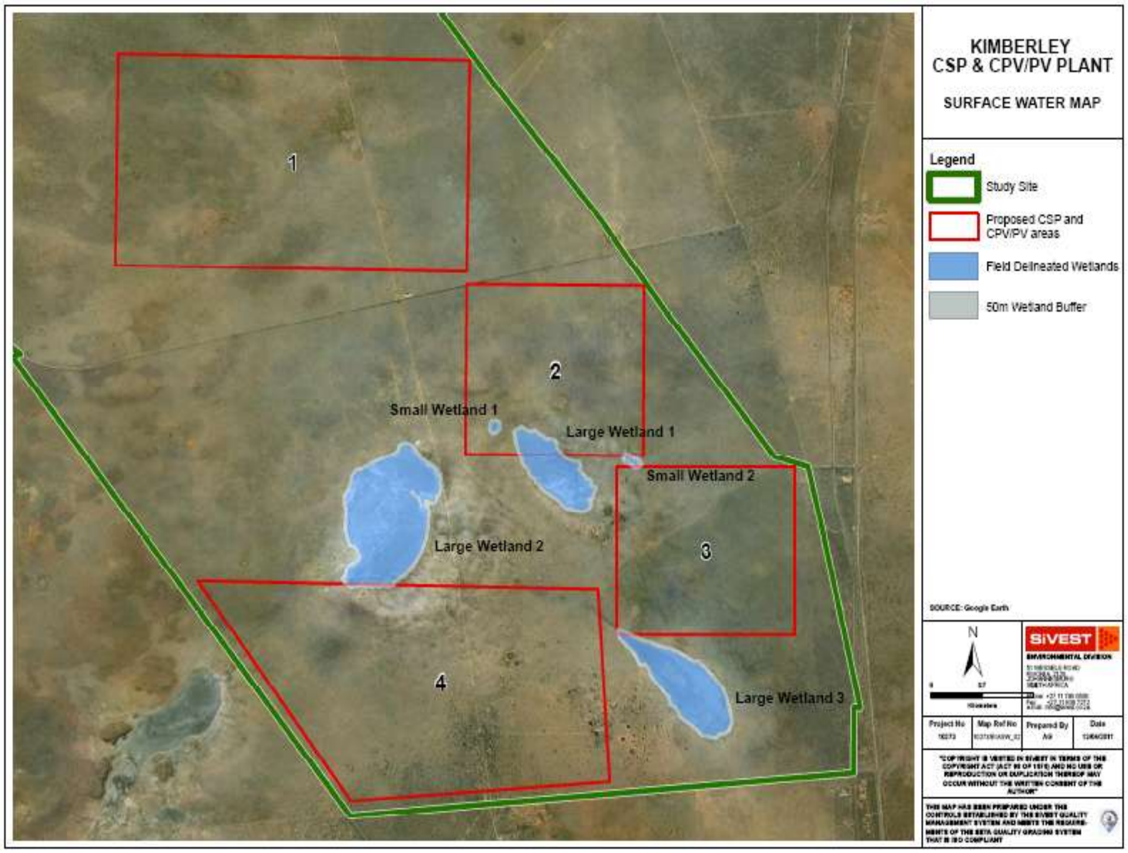

Figure 38: Field assessed and identified wetlands occurring within and nearby the proposed construction areas.

Table 16: Photographic evidence of the wetland assessment of Large Wetland 1

		
Photo 1. Light brown sandy soils (Orthic A horizon) extracted near the temporary zone of Large	Photo 2. Deeper sample drawn from the temporary zone of Large Wetland 1. Note the presence of carbonate	Photo 3. Dark coloured organic topsoil (Melanic A) horizon drawn from the more permanent zone of Large Wetland 1.

Wetland 1.	precipitates (red circle).	
		
Photo 4. Underlying "G Horizon" extracted from within the more permanent zone of Large Wetland 1.	Photo 5. Rush-like species found within the more permanent zone of Large Wetland 1.	Photo 6. Jungle rice (E. colona) found within the more permanent zone of Large Wetland 1.

Taking the context of the landscape into account, this wetland is significant in that functional soil biogeochemical processes can be identified in both the temporary and more permanently inundated zones. In addition to this, many bird species were observed in the wetland itself. The wetland is therefore significant in terms of habitat and biogeochemical cycling processes. A minimal buffer zone of 50metres is to be applied to the wetland.

ii. Wetland Vegetation

Although the degree of ground cover was not excessively depleted, Large Wetland 1 was heavily grazed making vegetation identification difficult. Regardless, several species could be identified. The predominant vegetation species of the temporary zone of Large Wetland 1 appeared to be blue-seed grass (*Tricholaena monachne*) whilst the more permanent zone of saturation contained several types of hydrophytic grasses (excessively grazed and unidentifiable) and rushes (Photo 5). Jungle rice (*Echinochloa colona*) was also present (Photo 6) which is known to be associated with pans (Van Oudtshoorn, 2004).

- Large Wetland 2

i. Wetland Terrain and Soils

Table 17 (Photos 7 to 15) contains the relevant photographic evidence of the wetland assessment.

Large Wetland 2 is isolated and positioned at a low point in the landscape surrounded by low hills within a topographic depression (Photo 7). However, due to its proximity to an adjacent low hill, it may be regarded as lying in a valley bottom (Photo 8). For the purposes of this report, it has been described as depression wetland in correspondence with the classification proposed by Ewart-Smith *et al*. (2006). The transition from terrestrial land to wetland is distinct. Interestingly, a linear series of unconnected small islands extend into the wetland (Photo 9).

The characteristics of the soil in the upper 20 to 30cm of the soil profile drawn from within Large Wetland 2 show light brown sandy soils, indicating an Orthic A horizon (Photo 10). Beneath this diagnostic topsoil horizon, sesquioxide concretions in the form of red and dark coloured mottles reveal iron and manganese accumulations respectively interspersed amongst iron depleted particles giving character to the otherwise light brown sandy soils and indicating a Soft Plinthic B horizon (Photo 11). The soils of this horizon are relatively firm but friable (having a loose or slightly firm consistence - McVicar *et al*. 2006). The presence of these two soil horizons is enough to suggest the Westleigh soil form. This soil form is characteristic of soils that are periodically saturated. Hence, the wetland can be deemed seasonally or temporarily saturated. In the central regions of Large Wetland 2, a Hard Pan Carbonate layer could be observed exposed at the surface (Photo 12).

Taking the context of the landscape into account, this wetland is significant in that functional soil biogeochemical processes can be identified by the diagnostic horizons and soil form of the wetland. Additionally, a juvenile Giant Bullfrog (Pyxicephalus adspersus) (Photo 13) was found nearby the wetland indicating that the wetland is likely to be significant from an amphibian perspective. The wetland may therefore likewise be ecologically significant for other organisms in the surrounding landscape. A minimal buffer zone of 50metres is to be applied to the wetland.

- Wetland Vegetation

Three main types of species could be found comprising the vegetation of Large Wetland 2 including speckled vlei grass (Eragrostis bicolor) (Photo 14), blue-seed grass (Tricholaena monachne) and tassel three-awn (Aristida congesta subsp. congesta) (Photo 15). Other species were present, although each could not be identified due to the effect and extent of grazing. Hence, the dominant species were not particularly evident and could not be specified as such.

Table 17: Photographic evidence of the wetland assessment of Large Wetland 2

		
Photo 7. Large Wetland 2 positioned in a topographic depression. Note the sharp transition in vegetation from the upland terrestrial land into the wetland (red line).	Photo 8. Low hill adjacent Large Wetland 2 (red circle).	Photo 9. Small islands unconnected but in series extending into the wetland.
		
Photo 10. Top 30cm of soil sample drawn within the Large Wetland 2. Note the transition from the Orthic A horizon into the Soft Pllnthic B where mottling occurs (red circles).	Photo 11. Characteristic red iron and dark manganese accumulations in the Soft Plinthic B horizon of Large Wetland 2.	Photo 12. Exposed hard pan carbonate horizon observed within Large Wetland 2.

		
Photo 13. Juvenile Giant Bullfrog (*P. adspersus)* found nearby Large Wetland 2.	Photo 14. Speckled vlei grass (*E. bicolor*) found within Large Wetland 2.	Photo 15. Tassel three-awn (*A. congesta* subsp. *congesta*) found within Large Wetland 2 (red circle).

- Large Wetland 3

    i. Wetland Terrain and Soils

Table 18 (Photo 16 to 21) contains the relevant photographic evidence of the wetland assessment.

The terrain of the greater southern region of study area is not significantly elevated, barring low undulating hills. The surrounding terrain of Large Wetland 3 similarly, is not significantly elevated although raised to some extent. Hence, the position of the wetland can be described as lying in a topographic depression (Photo 16). Large Wetland 3 is an isolated system.

The soil profile drawn from within the wetland revealed soils that were sandy and firm in texture, being light brown in colour near the surface (<20cm). This layer could be identified as an Orthic A horizon (Photo 17). The layer immediately below showed a drastic change in soil composition containing a significant amount of clay particles. The presence of this layer indicates illuviation processes (downward movement of fine soil materials by, and deposition from, water to give rise to cutanic character – McVicar *et al.* 2006) taking place in the topographic depression (i.e. in the pan wetland). The colour of this horizon expressed a light brown complexion similar to that of the A horizon. The horizon, located relatively close to the surface, is well developed with a blocky angular structure (Photo 18) suggesting a Pedocutanic B horizon. 'Cracks' in the surface of the soil indicates that the clays are likely to have expansive and shrinking properties (Photo 19). Combining the two soil horizons is sufficient to suggest the Vaals rivier soil form. Strictly, this soil form is not recognised as a wetland soil type.

Taking into account the topography of the surrounding terrain, the position of the wetland in the landscape (topographic depression) and the presence of a relatively impermeable layer (pedocutanic B horizon containing clay), it is possible that water may accumulate seasonally for short periods but not long enough for hydromorphic soils to develop. The lack of hydromorphic characteristics may alternatively be related to the chemical properties and physical characteristics of the soil in the wetland. Investigating the lack of hydromorphism in the wetland however, falls beyond the scope of this wetland assessment. Despite these findings, the wetland should be regarded as an ephemeral pan\depression wetland system and the relevant conservation measures are to be applied to it. A minimal buffer zone of 50metres is to be applied to the wetland.

ii. Wetland Vegetation

Dominant vegetation species within the pan wetland appeared to comprise of tick grass (Eragrostis echinochloidea) and blue-seed grass. Tick grass (Photo 20) was the least dominant of the two species and found mainly fringing the pan. Accordingly, Van Oudtshoorn (2004) confirms that this species is commonly found in the vicinity of pans. Blue-seed grass (Photo 21) was the most dominant species found within the pan wetland. This species grows normally in moist soil types, although more so in sandy soils and it is a good indicator of disturbance (Van Oudtshoorn, 2004). This corresponds well with the results observed in the field as extensive cattle grazing took place during the field assessment. Van Oudtshoorn (2004) furthermore states that this species is considered an important grazing grass in arid parts when it occurs in dense stands. This was also particularly evident on the field visit.

Table 18: Photographic evidence of the wetland assessment of Large Wetland 3

		
Photo 16. Location of Large Wetland 3 in a depression in the landscape.	Photo 17. Top 30 cm of the soil profile indicating Orthic A horizon in Large Wetland 3.	Photo 18. Blocky angular structure of the sub-surface B horizon of the soil profile within Large Wetland 3.

		
Photo 19. 'Cracking' soils within Large Wetland 3.	Photo 20. Tick grass (E. echinochloidea) found fringing Large Wetland 3.	Photo 21. Blue-seed grass (T. monachne) found fringing Large Wetland 3.

- Small Wetland 1

   i. Wetland Terrain and Soils

Table 19 (Photo 22 to 27) contains the relevant photographic evidence of the wetland assessment for Small Wetland 1.

Small wetland 1 is positioned in a topographic depression at the crest of the low undulating hills of the greater landscape (Photo 22). It is isolated and endorheic (inward closed drainage).

The soils of Small Wetland 1 commonly contained carbonate precipitates both at the surface and increasingly lower in the soil depth profile. Three separate horizons were evident from the soils samples. The top 10cm of the soil samples drawn can be described as an Orthic A horizon. This horizon was light brown in colour and consisted of sandy materials. Below this horizon, a neocarbonate B horizon was observed (Photo 23). This particular horizon expressed similar characteristics to that of the topsoil in that it contained light brown sandy particles although, with the presence of carbonate precipitants. Underlying this horizon, unspecified material with signs of wetness prominent (Photo 24). Combining these layers one could attribute the Montagu soil form to Small Wetland 1. The presence and type of hydromorphic features within the soil profile indicate that Small Wetland 1 is likely to be seasonal or temporary.

Taking the context of the landscape into account, this wetland is significant in that functional soil biogeochemical processes were be identified. A minimal buffer zone of 50metres is to be applied to the wetland.

- Wetland Vegetation

Small Wetland 1 can be described as a grassland wetland in that, given its location at the crest of the landscape, the vegetation cover is dominated by typically grassland species. The condition of the vegetation is moderately to highly disturbed, reflected by the mix of vegetation species within the wetland. The most prominent species identified include gongoni three awn (*Aristida junciformis*) (Photo 25), nine-awned grass (*Enneapogon cenchroides*) (Photo 26), red grass (*Themeda triandra*) and tassel three-awn (*A. congesta* subsp. *congesta*). Importantly, pan dropseed grass (*Sporobolus ioncladus*) was observed, which subsequently serves as a very important grazing grass that occurs in and around pans, as well as in soil with a pure salt crust (Van Oudtshoorn, 2004) (Photo 27).

Table 19: Photographic evidence of the wetland assessment of Small Wetland 1

		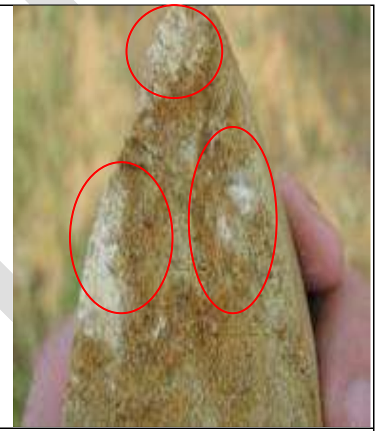
Photo 22. Position of Small Wetland 1 within a depression in the landscape.	Photo 23. Evidence of the neocarbonate B horizon. Note the prevalence of carbonate precipitates in the soil sample (red circle).	Photo 24. Evidence of the third soil horizon expressing unspecified material with signs of wetness. Note the higher occurrence of carbonate precipitations in the sample.

		
Photo 25. Gongoni three-awn (*A. junciformis*) found within Small Wetland 1.	Photo 26. Nine-awned grass (E. cenchroides) found within Small Wetland 1.	Photo 27. Pan dropseed grass (S. iocladus) found within Small Wetland 1.

- Small Wetland 2

  i. Wetland Terrain and Soils

Table 20 (Photo 28 to 33) contains the relevant photographic evidence of the wetland assessment for Small Wetland 2.

Small wetland 2 is situated on predominantly flat terrain (Photo 28) and can be described as an isolated flat or depression wetland according to Ewart-smith *et al.* (2006).

Broad scale controls (i.e. climate and topography) have a considerable influence on the nature of wetlands in the study area. High temperatures and evaporation rates in addition to geological constraints and soil composition combine to influence the hydrology and soil characteristics of the wetlands. Small wetland 2 characteristically serves as an example expressing the effect control factors have on the soil profile of temporarily and/or ephemerally inundated wetland systems.

Salt accumulation is a common phenomenon in hydrological systems where the evapo-transpiration (the sum of evaporation and transpiration by plants) rate exceeds the precipitation rate thereby resulting in an increase in total dissolved solids, which is a process also known as evapo-concentration (Bauer-Gottwein *et al*. 2007). Bauer-Gottwien *et al*. (2007) maintain that as evapo-concentration proceeds, most of the water is removed at the surface leading to a hydro-dynamically unstable concentration distribution with water of higher density being located on top of lower-density water, which can initiate density driven flow and therefore, a downward transport of salinity against the upward flow established by evapo-transpiration, resulting in mineral precipitation as wetting and drying phases are experienced. These effects were observed to a large degree in the soil samples of Small Wetland 2 whereby carbonate precipitation was found to increase with depth with a resultant Hard Pan Carbonate horizon found in the sub-surface.

The predominantly light brown sandy soil samples drawn from within the wetland initially show minimal carbonate precipitates at the surface increasing with depth in the soil profile transitioning from an Orthic A into a neocarbonate B horizon (Photo 29). The depth of the B horizon is limited by the presence of a Hard Pan Carbonate C horizon (Photo 30) where maximum precipitation is likely to have taken place over time to the extent that the precipitation layer constitutes a layer in itself. This layer was exposed in random areas of the pan as well as lining along the inner regions of Small Wetland 2 (Photo 31). Together the three soils profiles can be said to represent the Prieska soil form.

Taking the context of the landscape into account, this wetland is significant in that functional soil biogeochemical processes take place within the wetland. The characteristics of the soil of Small Wetland 2 do not express the typical forms of hydromorphism as more permanently inundated wetland systems. However, given the climatic region, the wetland can be recognised as a temporary wetland system that does perform a unique function within the landscape and is ecologically significant as such. A minimal buffer zone of 50metres is to be applied to the wetland.

ii. Wetland Vegetation

The highly disturbed state of the vegetation cover within and surrounding the wetland indicate severe grazing pressure by cattle. Of the species observed, tassel three-awn (*A. congesta* subsp. *congesta*) was present as it was for many of the study pans. Narrow-leaved turpentine grass (*Cymbopogon plurinodis*) (Photo 32) and bent grass (*Agrostis lachnantha*) (Photo 33) were also present. Several forbs and shrubs were relatively prevalent within Small Wetland 2 underlining furthermore the disturbed state of the vegetation.

Table 20: Photographic evidence of the wetland assessment of Small Wetland 2

		
Photo 28. Position of Small Wetland 1 within a depression	Photo 29. Evidence of the neocarbonate B horizon. Again,	Photo 30. Evidence of the third soil horizon consisting of

in the predominantly flat landscape.	note the prevalence of carbonate precipitates in the soil sample.	hard carbonate mineral precipitants. This particular example was exposed at the surface
		
Photo 31. Photo illustrating the exposed Hard Pan Carbonate layer (red line) along the transition from the inner to the outer boundaries of the wetland.	Photo 32. Narrow-leaved turpentine grass (C. plurinodis) found within Small Wetland 2.	Photo 33. Bent grass (A. lachnantha) found within Small Wetland 2.

8.2.3 Comment on State and Functionality of Wetlands Assessed

Activities noted to have been taking place on the study site were chiefly in the form of cattle herding, pastoral grazing and game farming. No other impacts were observed to have a notable impact other than the grazing impacts experienced to a lesser or greater extent in each wetland. Table 21 summarises the current impacts, condition and functions of each wetland assessed. Overall, each wetland can be said to be in a moderate condition mainly due to the severity of impact exerted by grazing. In terms of biogeochemical cycling and hydrological processes, the wetlands appear to be functional at present.

Table 21: Functional state of the wetlands assessed in the field

Wetland	Condition	Primary Functions
Large Pan Wetland 1	Moderate – Current impacts include severe grazing and moderate trampling impacts.	Habitat, biogeochemical cycling, sediment trapping, vegetation provides food source for resident herbivores (game and cattle) and relevant avifauna.

Large Pan Wetland 2	Moderate – Current impacts include severe grazing and moderate trampling impacts.	Habitat, biogeochemical cycling, sediment trapping, vegetation provides food source for resident herbivores (game and cattle).
Large Pan Wetland 3	Moderate – Current impacts include severe grazing and limited trampling impacts.	Habitat, biogeochemical cycling, sediment trapping, vegetation provides food source for resident herbivores (game and cattle).
Small Pan Wetland 1	Moderate – Current impacts include moderate grazing impacts.	Habitat, biogeochemical cycling, sediment trapping, vegetation provides food source for resident herbivores (game and cattle).
Small Pan Wetland 2	Moderate – Current impacts include severe grazing and trampling impacts. Highly disturbed vegetation.	Habitat, biogeochemical cycling, sediment trapping.

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

- Excavation trenches through wetlands

The first impact that is evaluated addresses the potential impact associated with the excavation of trenches for water pipelines through wetlands. It must be noted that this potential impact will only be minimal if the water pipeline routing circumvents the majority wetland areas. Moreover, where absolutely necessary, if the water pipeline is to affect a minimal portion of the wetlands, with the suggested appropriate mitigation measures, the impact will be minimal if the correct procedures and stipulated measures are carried out.

- Inappropriate construction activities

The Impact Tables in Section 9.2 address the potential impacts that can be anticipated with general inappropriate construction activities. This umbrella term encompasses activities such as physical destruction of wetlands caused by humans, excavation and degradation of wetlands by construction machinery, use of wetlands for sanitary facilities and ablutions, construction of access roads through wetlands and dumping of materials and litter into wetlands. The simple prevention of such inappropriate activities can be achieved by limiting access to wetlands and restricting construction activities within the proposed development areas identified. Where the proposed development encroaches on the wetlands, the wetlands will need to be fenced off to prevent any access and potential impacts occurring. 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 wetlands which can impact on the water and sediment quality of these sensitive systems. Mitigation measures that prevent these substances entering the wetland 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 Kimberely, can be difficult to rehabilitate since vegetation might not establish very quickly due to the lack of water supply. The eroded areas can therefore extend into the wetlands 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.

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 with the acceleration and generation of run-off which can impact on nearby wetlands through the onset of erosion at the interface between the proposed development and the wetlands.

- Oil pollution risks to nearby wetlands

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

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

The CSP solar field including the troughs and the associated piping contains 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 wetlands

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

* The full Surface Water Impact Assessment Report is included in Appendix 6B.

8.1 Groundwater

8.1.1 Water sampling

The site was visited by a team from Metago Environmental Engineers in early February 2011, and one water sample was taken (Table 22).

Table 22: Water samples taken at Kimberley

Point	Site	Latitude	Longitude	Water use type	Water level (mbgl)	EC (mS/m)	pH	Sample taken?
kms02	Kimberly	x-3164817	y-0025756	Pan	-	20	7,4	**Yes**
kms04	Kimberly	x-3168364	y-0022347	BH	-	-	-	No
kms01	Kimberly	x-3165122	y-0025748	Pan	-	-	-	No
kms05	Kimberly	x-3168669	y-0022313	BH	17,06	-	-	No
kms03	Kimberly	x-3158478	y-0027994	BH	23,7	-	-	No

Figure 39 shows available macro-element chemistry for all samples in the Department of Water Affairs' National Groundwater Archive (NGA) for quaternary catchments C33C, C51L, C52L, C91D and C91E plotted on a trilinear diagram. The chemistry shows a fair range of macro-element compositions, as would be expected over a relatively large area with a range of hydrogeochemical processes affecting groundwater chemistry.

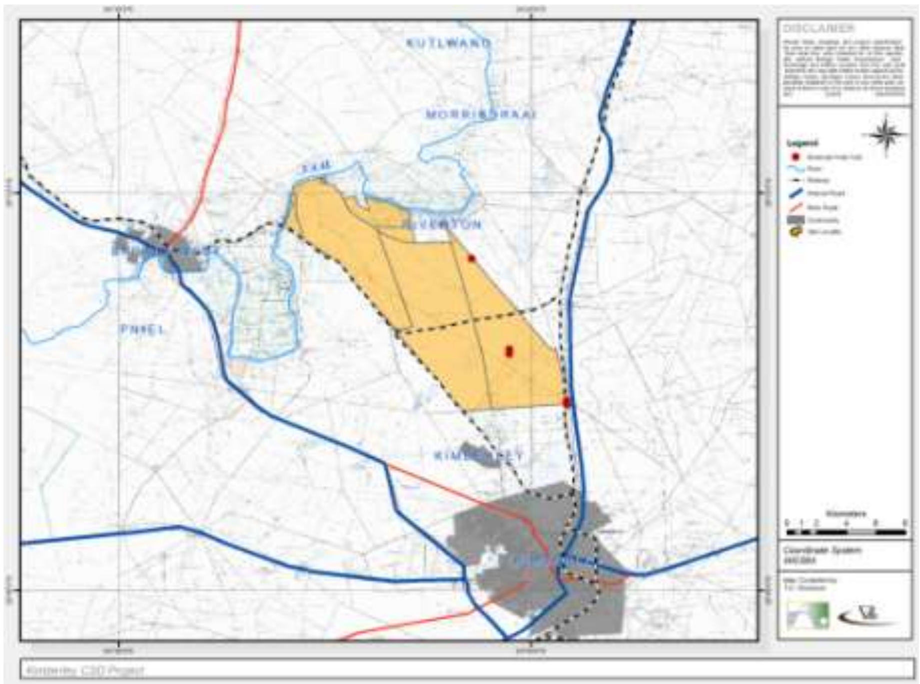

Figure 39: Field locations visited at Kimberley

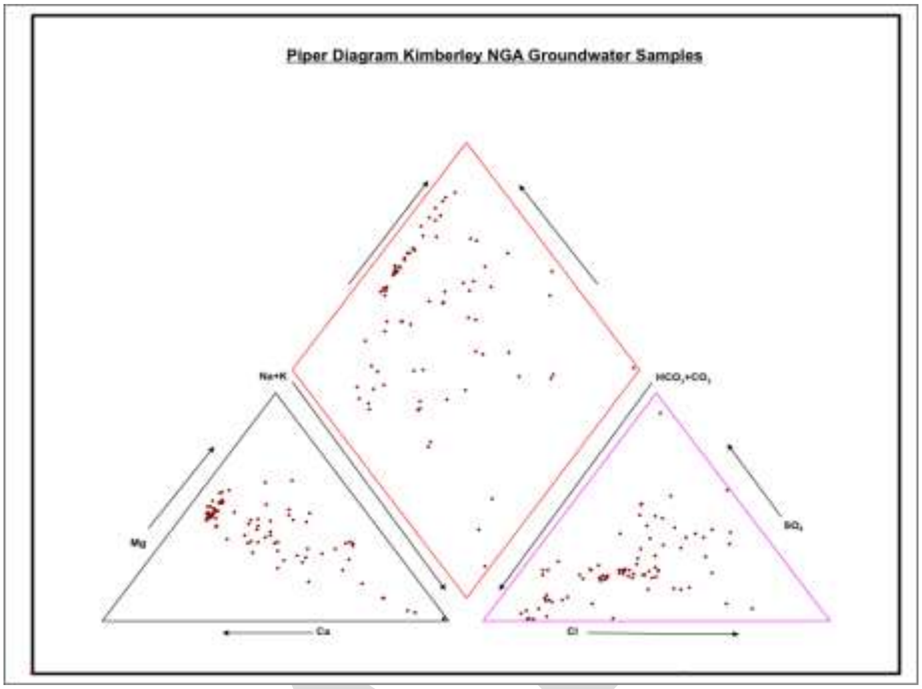

Figure 40: Trilinearplot of groundwater samples for the Kimberley area

8.1.2 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.

8.1.3 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 of to 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.

Impacts for the site are presented in section 9.2.5 of this report:

* The full Groundwater Study is included in Appendix 6C.

8.2 Noise

8.2.1 Site visit

The site visit was conducted in January 2011 during which a number of baseline noise level measurement samples were made. The locations of the measurement points are illustrated in. (The four grey blocks on the map (Figure 41) in are based on the site alternatives as illustrated in Figure 8.)

Figure 41: Droogfontein measuring points

8.2.2 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}) set to the fast response, 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.

8.2.3 *Sample calculations*

The typical sound power emission levels of the equipment given in Table 24 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.

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 (Figure 42) of the resulting ambient noise level as a function of distance from the source.

8.2.4 *Assessment of the measurement results*

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

8.2.5 *Noise Study Results*

- Description of the site environments

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 grassland 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 receptors at the Droogfontein site are the agricultural plots at Alberlaine which lie adjacent to the planned CSP plant alternative one ii.

- Droogfontein noise measurement results

The results of the ambient noise level measurements at Droogfontein are presented in Table 23.

Table 23: Droogfontein noise measurement results

Measuring point	LAeq (15 min) dBA	Comments
Droogfontein1	30	Gentle breeze, distant insects, vehicles on Riverton Road
Droogfontein2	47	Very gentle wind, distant insects, vehicles on Riverton Road about 100m away.
Droogfontein3	39	Very gentle wind, distant insects, vehicles on Riverton Road
Droogfontein4	42	Very gentle wind, distant insects, vehicles on Riverton Road
Droogfontein5	44	Very gentle wind, distant insects, vehicles on Riverton Road

The results given in Table 23 reveal that:

- The ambient noise levels vary from a low of 30 dBA to a high of 47 dBA.
- When the guidelines of SANS 10103, Table 2: *Typical rating levels for noise in districts* are considered, the measurements lie within the typical range of rating levels for noise in “rural districts” at measurement points Droogfontein 1, 3, 4 and 5, and “suburban districts with little road traffic” at measurement point Droogfontein 2.

- Estimated general ambient noise level

For the purpose of calculations a general baseline ambient noise level of 31dBA is used. This value is 1 dBA above the lowest measured value of 30 dBA measured at location Droogfontein1 and conforms to a conservative approach of recognising that the area under investigation is mostly rural in nature, with few human sounds.

- Sample calculation results

The sample calculation results are given in Figure 42. The new ambient[1] noise can be estimated from this graph.

[1] Ambient noise is the totally encompassing sound in a given situation at a given time, and is usually composed of sound from many sources, both near and far. Ambient noise includes the noise from the noise source under investigation.

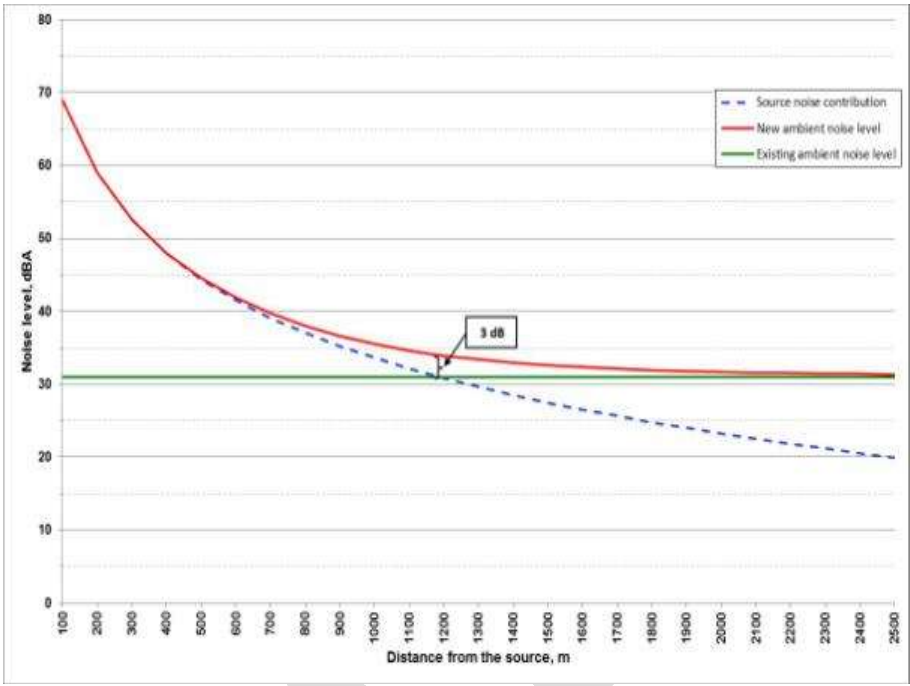

Figure 42: Graph of the calculated noise levels as a function of distance from the source.

The results in Figure 42 show that, the increase in ambient noise level will exceed 3 dB, i.e. become significant, at distances closer than 1200 m from the source. In the case of the agricultural plots at Alberlaine, located closest to the CSP plant alternative one, at an estimated distance of about 100m, the new ambient noise level is predicted to rise to about 68 dB which is about 23dB above the typical rating noise level for rural districts.

At the SANDF base about 800m away, the calculated noise level would rise to about 38dB. This is below the typical rating level for noise in urban districts.

Roodepan, which is about 2200m away, is not expected to be impacted by noise from the plant.

8.2.6 Construction Details – Expected Noise Sources

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 Droogfontein, about 100MW). Detailed schedules and working hours are not available. However, 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;
- Excavation of borrow pits;
- 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.

8.2.7 Operational Details – Expected Noise Sources

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 (see Table 24).

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 24: Equipment Noise Emissions (as provided by the developer)

Equipment Description	Sound power level, dB re 1 pW, at octave band centre frequency, Hz									dBA (1m)
	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 full Noise Study is included in Appendix 6D.

8.3 Visual

8.3.1 Assessment Methodology

- Field work and photographic review

On the 26th and 27th of March 2011 the proposed site was visited in order to;

- verify the landscape characteristics identified during the scoping phase visual study;
- capture photos to be used to visually model the solar plant (Figure 43);
- verify the sensitivity of visual receptors previously identified during the scoping phase; and
- identify any additional visually sensitive receptors within the study area.

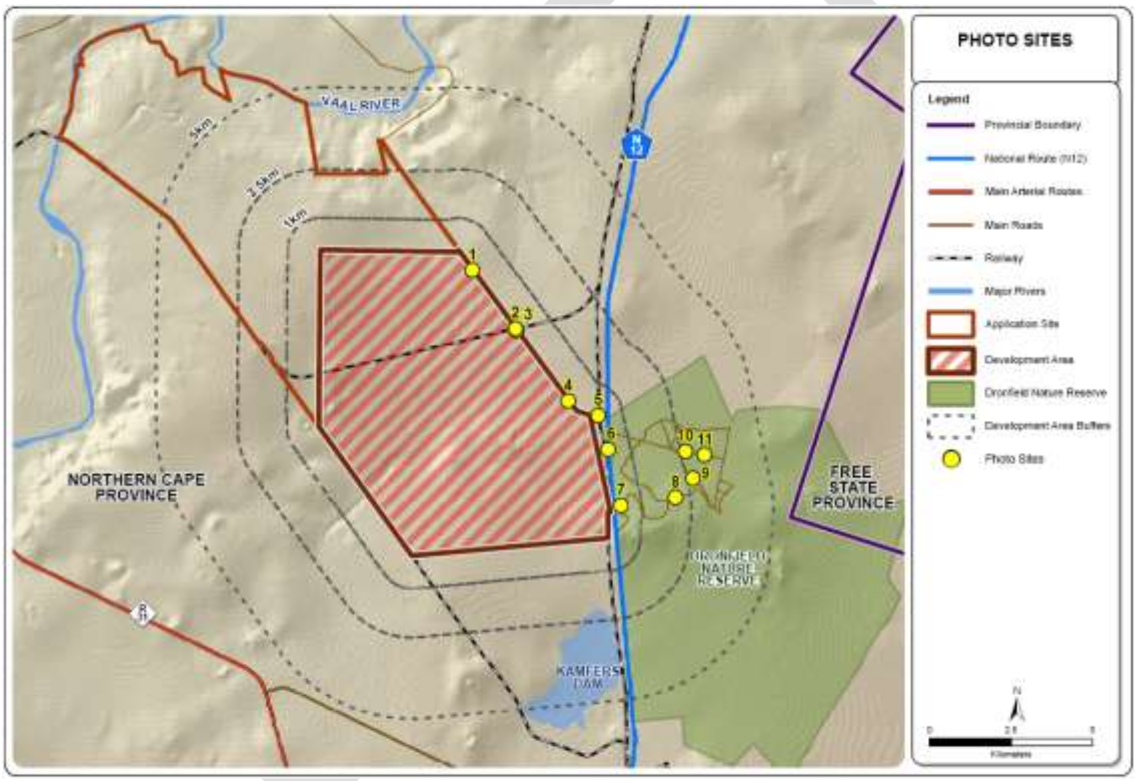

Figure 43: Location of photo sites within the study area

- Physical landscape characteristics

Site visits and digital information from spatial databases such as ENPAT and SANBI were sourced to provide information on the topography, vegetation and landuse in the study area. These physical landscape characteristics are important factors which influence the visual character, the visual absorption capacity and visual sensitivity of the study area.

- Identification of sensitive receptors

During the field investigation potentially sensitive visual receptor locations and routes within the study area, such as any scenic routes, tourism facilities and residences, were identified as these may potentially be sensitive to the visual impacts associated with the proposed development.

- Impact Assessment

A rating matrix was used to objectively evaluate the significance of the visual impacts associated with the proposed development, both before and after implementing mitigation measures. Mitigation measures were identified (where possible) in an attempt to minimise the visual impact of the proposed development. The rating matrix made use of a number of different factors including geographical extent, probability, reversibility, irreplaceable loss of resources, duration, cumulative effect and intensity in order to assign a level of significance to the different categories of visual impact during the various phases of the project (e.g. planning, construction, operation and decommissioning). A separate rating matrix was used to assess the visual impact of the proposed solar energy facility on sensitive receptor locations. This matrix is based on the distance of a receptor from the proposed development, primary orientation of a receptor and presence of screening factors. The layout alternatives within the study area were thereafter comparatively assessed in order to ascertain preferred alternative from a visual perspective.

- Visualisation modeling

Visual simulations were produced from specific viewpoints in order to support the findings of the visual assessment. The CSP troughs and CPV/PV panels were modelled at the correct scale and superimposed onto the landscape photographs which were taken during the site visit. These were used to accurately demonstrate the visibility of the solar facility from various sensitive locations and to assist with the visual impact assessment.

- Consultation with I&APs

Continuous consultation with Interested and Affected Parties (I&APs) undertaken during the public participation process will be used to help establish how the proposed solar energy facility will be perceived by the various receptor locations and the degree to which the impact will be regarded as negative. Although I&APs have not as yet provided any feedback during the EIA-stage, the report will be updated to include relevant information as and when it becomes available.

8.3.2 Assumptions and Limitations

For the purpose of this visual study, a development area incorporating all the proposed layout alternatives was been defined within the boundaries of the application site. The study area is assumed to encompass a zone of 5km from this development area. This area was assigned as distance is a critical factor when assessing visual impacts and beyond 5km the impact of the solar fields will be insignificant, and therefore not necessary to investigate.

Due to the varying scales and sources of information as well as the fact that only 20m contours were available to establish the Digital Terrain Model (DTM); maps and visual models may have minor inaccuracies.

No viewsheds were generated during this visual study as detailed digital data was not available and the topography within the study area is relatively flat. Generating viewsheds from coarse-grained DTMs would only take the large scale topographical variations into account and not minor topographical features, vegetative screening, or man-made structures which are important factors influencing the severity of visual impacts in this context.

Feedback received during the scoping phase public participation process has been incorporated into this report and any additional feedback relevant to the visual environment received during the EIR-phase public comment period will be incorporated into further drafts of this report.

It should be noted that the 'experiencing' of visual impacts is subjective and largely based on the perception of the viewer or receptor. The presence of a receptor in an area potentially affected by the proposed development does not thus necessarily mean that a visual impact will be experienced.

8.3.3 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 a proposed project.

During the EIA Phase, it was confirmed that relatively few potentially sensitive visual receptors are present within the study area (Figure 44). This is mainly due to the limited human settlement within the immediate vicinity of the site.

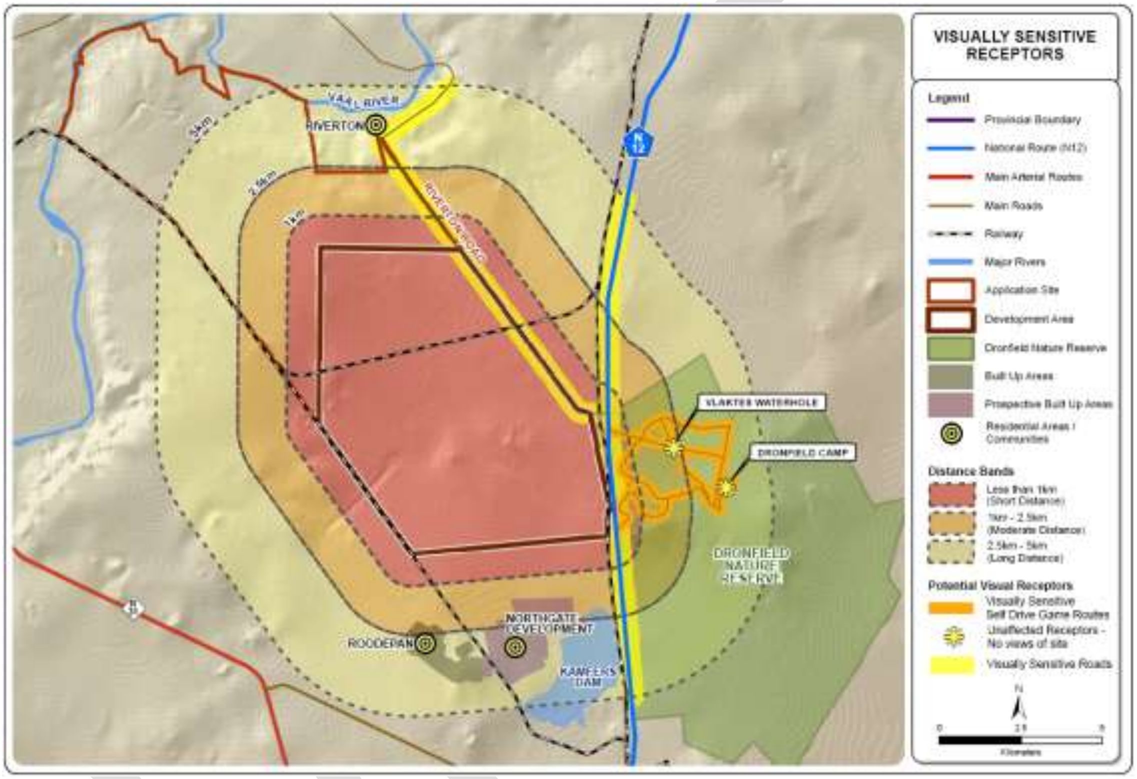

Figure 44: Visual Receptors within the study area

As depicted above, distance bands have been assigned from the development area of the proposed project as the visibility of the solar energy facility will diminish exponentially over distance. The proposed solar energy facility will be more visible to receptors located within a short distance and as a result these receptors will experience a higher adverse visual impact than those located at a moderate or long distance from the proposed solar energy facility. The distance of visually sensitive receptors from the development area will be taken into account when rating the visual impact of the proposed project on these 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 these distance bands are as follows:

- 0 – 1km (Short distance)
- 1km – 2.5km (Moderate distance)
- 2.5km – 5km (Long distance)

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

Table 25: Visually sensitive receptors in the study area

Name	Receptor Type	Primary Orientation	Distance from the proposed site
Dronfield self drive routes	Recreational activity	Partially toward proposed site	Moderate distance
N12 highway	National route	Partially toward proposed site	Short distance
Riverton road	Secondary road	Partially toward proposed site	Short distance

- Receptor Roads

Roads that form tourist routes can be regarded as sensitive receptor locations as they are frequently accessed as a way of appreciating the natural beauty of an area or to access tourism facilities. The N12 Highway is regarded as a visually sensitive receptor as it forms part of the Diamond Route, which links eight important sites across the northern parts of South Africa, and more significantly it is an important arterial route between Gauteng and the Western/Northern Cape. The solar power plant in this context will have a transient visual impact on motorists travelling along this route as they bypass the study area. Although the N12 runs directly along the eastern site boundary for approximately 3km in the southern portion of the site, natural wooded vegetation will partially restrict views of the proposed solar energy facility from this section of road (Figure 45).

Figure 45: View from the N12 showing vegetative screening in the southern portion of the application site

The Riverton road runs along the north-eastern site boundary and is considered a visually sensitive road as it is used to access the water sporting activities (e.g. fishing and boating) which take place on the banks of the Vaal River to the north of the proposed site. The vegetation in this part of the proposed site is dominated by short grassy plains which do not provide any visual screening and therefore motorists travelling along this route will be highly exposed to the visual impacts associated with the proposed solar energy facility. A high point is encountered as this road crosses the railway line. Wide-ranging vistas of the proposed solar fields and associated infrastructure will be experienced from this point (Figure 45).

Figure 46: View south south-west from the rail overpass on the Riverton road toward the application site (Photo Site 3 on Figure 43)

- Receptor Locations

Tourism in the vicinity of the study area is also an important factor in determining visually sensitive receptor locations which may be impacted by the proposed development. Unlike roads, tourism facilities will be subject to permanent visual impacts if a proposed development is visible from them. The Dronfield Nature Reserve is located directly east of the southern portion of the proposed site. It is valued as a breeding site for the White-backed Vulture and for preserving endangered antelope which breed in the reserve. The reserve boasts a restaurant, an accommodation and conferencing facility and self drive game routes. Although it is situated directly opposite the proposed site, it covers an extensive area and thus large portions of the reserve will be situated at a distance from where the visual impact of the proposed solar energy facility will be negligible (beyond 5km). The natural thornveld vegetation within the reserve will also restrict visibility from the camp and the Vlaktes Waterhole and views of the site from the main offices will be screened by a ridge within the reserve.

The self drive game routes in the western portion of the reserve are regarded to be visually sensitive as visitors travelling these routes will be visually exposed to the proposed solar energy facility. The visual impact of the proposed solar energy facility will be most prominent where the Vlaktes self drive game route gets relatively close to the western boundary of the reserve. This portion of the site is however not regarded to be particularly scenic as the visual character has already been degraded by the existing powerlines, the railway line and the N12 highway. Trees and shrubs will also partially restrict views and limit visibility toward the development area from sections of these self drive game routes (Figure 47).

Figure 47: Thornveld vegetation restricting visibility of the site from the self drive game route within Dronfield Nature Reserve

The town of Riverton and the banks of the Vaal River were identified as a potential visual receptor location in the visual study undertaken during the scoping phase. Although water sporting activities occur in this area, this town is not regarded as a sensitive receptor location as extensive wooded vegetation and a ridge in the northern reaches of the site will screen the proposed solar energy facility from this area.

Northgate is a prospective residential development located approximately 3km to the south of the proposed solar energy facility. Although the proposed solar power plant may be viewable from parts of this development once it has been erected, it has not been assessed as a visually sensitive receptor location in this visual study as it is still in the early stages of development and no construction activities have commenced. It should also be noted that this residential development is located directly east of Roodepan which is not regarded to be visually sensitive, as the proposed site is not visible from this location.

8.3.4 Visual Modelling

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

Visual models were created of views toward the proposed site from the N12 highway and selected points along the Riverton road. These photo sites were chosen in order to illustrate how views from these visually sensitive receptors will be transformed by the proposed development once erected. Views from the self drive game drives in Dronfield Nature Reserve were not modeled as it was established that large portions of the solar facility will be restricted by the wooded vegetation both within the reserve and in the southern portion of the site.

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

- In order to support the findings of the comparative assessment of alternative, visualisation modeling was undertaken for both alternative 1 and 2 of the CSP and CPV/PV site positions.

- 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 some trees and shrubs may 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 – West from the N12 Highway (Photo Site 6 on Figure 43)

This photo site is situated on the N12 highway directly opposite the eastern site boundary. The view is indicative of what motorists travelling along the N12 highway would see when looking in westerly direction toward the site. Alternative 1 of the CSP and CPV/PV solar fields have been visually modelled from this point (see Figure 48 and Figure 49).

Figure 48: Existing panoramic view toward CSP and CPV/PV alternative 1 from the N12 highway

Figure 49: Visually modelled post-construction panoramic view toward CSP and CPV/PV alternative 1 from the N12 highway

As depicted above, portions of the solar energy facility will be visible from this point, particularly the PV solar field which is situated within close proximity. The natural wooded vegetation will provide partial visual screening and the presence of the railway line reduces the natural scenic quality of views from this road. The solar energy facility will therefore have a medium visual impact on motorists travelling along this section of road.

View 2 – West from the Riverton Road (Photo Site 4 on Figure 43)

This photo site is situated on the bend of the Riverton road directly opposite the north-eastern site boundary. The view is indicative of what motorists travelling along the Riverton road would see when looking in westerly direction toward the site. Alternative 2 of the CSP and CPV/PV solar fields have been visually modelled from this point (see Figure 50 and Figure 51).

Figure 50: Existing panoramic view toward CSP and CPV/PV alternative 2 from bend on the Riverton Road

Figure 51: Visually modelled post construction panoramic view toward CSP and CPV/PV alternative 2 from bend on the Riverton Road

As depicted above, a portion of both the CSP and CPV/PV solar fields will be visible from this road, with the PV solar field appearing in the foreground as it is situated directly west of the road. The short nature of the grassy plains will offer no visual screening and as a result the solar energy facility will have a high visual impact on motorists travelling along this road.

View 3 – South-west from the Riverton Road (Photo Site 1 on Figure 43)

This photo site is situated further north on the Riverton road to the east of CSP alternative 2. This view is indicative of what motorists travelling along the Riverton road would see when looking in south-westerly direction toward the site. Alternative 2 of the CSP and CPV/PV solar fields have been visually modelled from this point (see Figure 52 and Figure 53).

Figure 52: Existing panoramic view toward CSP and CPV/PV alternative 2 from the Riverton Road (further north)

Figure 53: Visually modelled post construction panoramic view toward CSP and CPV/PV alternative 2 from the Riverton Road (further north)

As indicated above, the CSP solar field will become more visible as one travels further north along the Riverton Road. The vegetation remains short and as a result the solar energy facility will have a high visual impact on motorists travelling along this road.

It should be noted that although the solar energy facility will be highly visible to motorists travelling along the Riverton and partially visible to motorists travelling along the N12 highway, it may not necessarily be perceived negatively, as renewable solar energy is a new concept in South Africa which may evoke curiosity.

* The full Visual Impact Assessment Report is included in Appendix 6E.

8.4 Heritage

8.4.1 Findings of the Heritage Scoping Document

Evaluation of aerial photography has indicated the following area that may be sensitive from an archaeological perspective (Figure 54). Archaeological surveys and studies in the Northern Cape have shown rocky outcrops, dry rivers, riverbanks and confluence to be prime localities for archaeological finds and specifically Stone Age sites as these area where utilized for settlement of base camps close to water and hunting ranges.

Figure 54: Possible heritage sensitive areas

To be able to compile a heritage management plan to be incorporated into the Environmental Management Plan the following further work will be required for the EIA.

- Archaeological walk through of the areas where the project will be impacting, with specific attention given to the areas around pans and outcrops;

8.4.2 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 Figure 8 & Figure 57) as the foot print areas of the development.

The study area for this project covers approximately 11 000 hectares with impact areas of approximately 3500 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 3 days on foot and by vehicle by two archaeologists of PGS.

The site is predominantly covered in Savanna grassland and falls within Northern Cape Savanna Biome (Figure 55). The landscape is also generally flat and is dominated by red sands (Figure 56). There is a sparse scatter of low sand dunes (between 1m to about 2.5m high) that forms along small exposed rock intrusions and along the banks/border of sparsely distributed salt pans (Figure 57). Acacia trees have colonised some of the sand dunes (Figure 58). In areas clear of vegetation through either natural soil erosion or anthropogenic processes such as quarrying, the undelaying calcrete layer has been exposed (Figure 59).

Figure 55: Type of grass cover at the site (note the flatness of the landscape), Block 2.

Figure 56: Type of sands found at the site (red sands), Block 2.

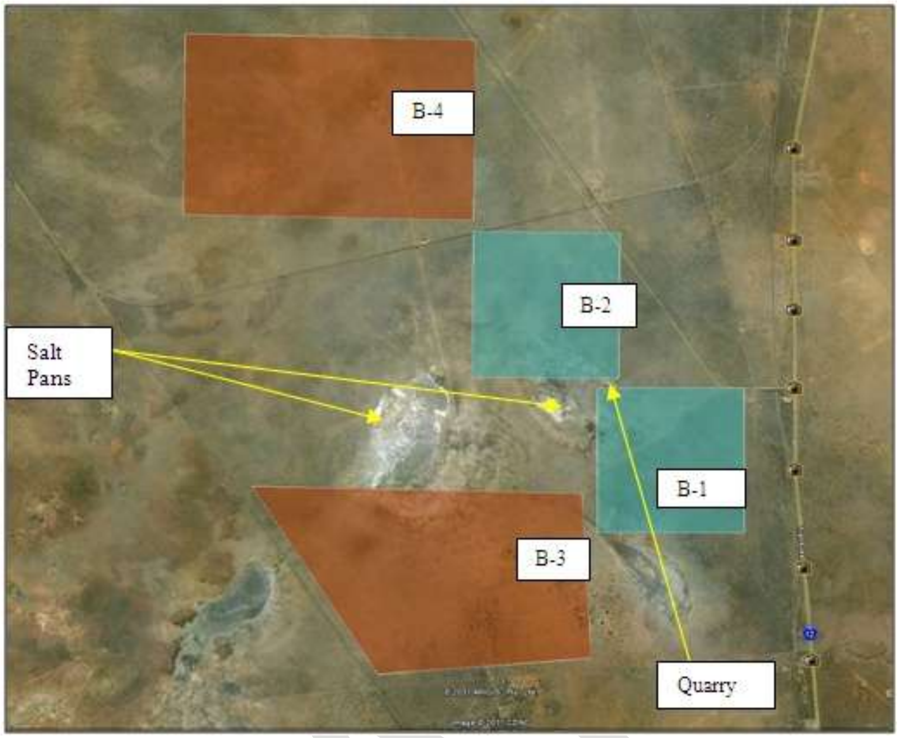

Figure 57: Google Map of the site, Droogfontein: note the distribution of salt pans and the position of the quarry in relation to the pans and surveyed area. (B: Block & 1-4 represent a sequential survey of individual blocks).


Figure 58: High raised sand dune. Note the cover by acacia trees and grass species, Block 4

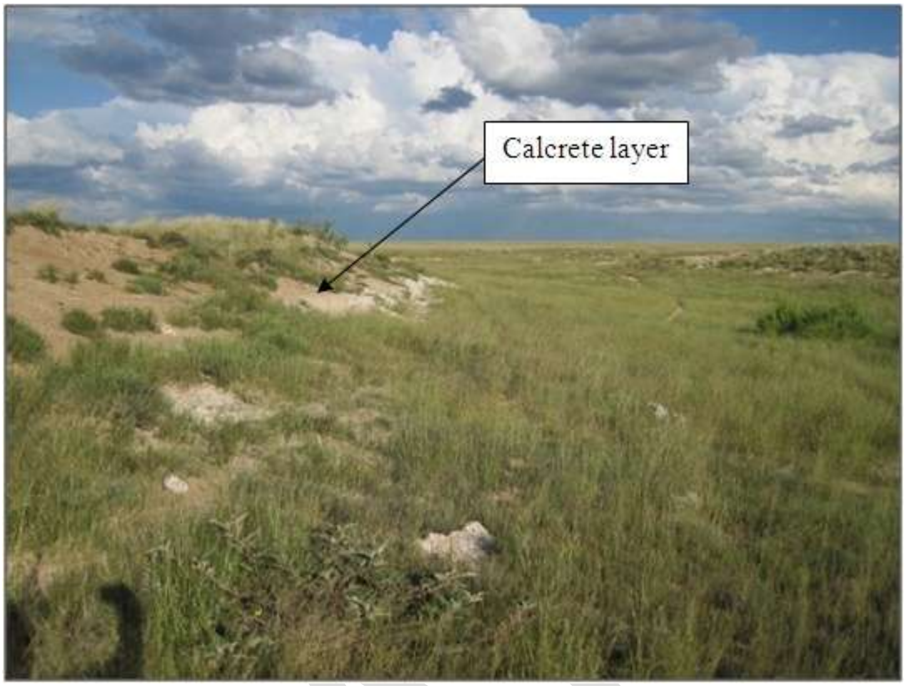

Figure 59: Calcrete layer in the quarry, Block 1

8.4.3 Archaeological Sites

The survey yielded five archaeological sites. Refer to Figure 60 for positions relative to development blocks

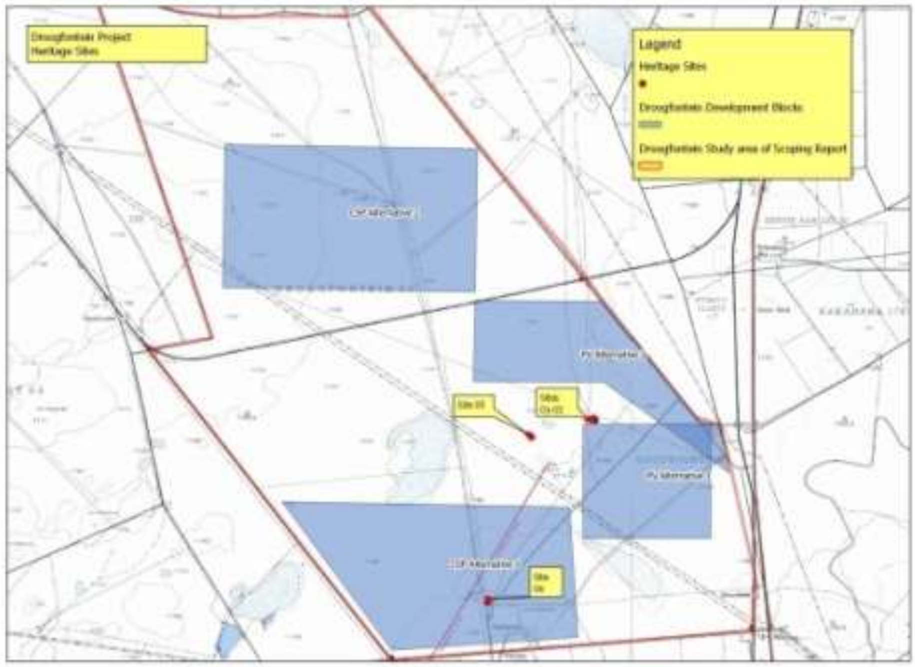

Figure 60: Droogfontein Solar Park Heritage Sites

- Site 01

GPS Co- ords: S28 35 51.5, E24 44 34.8

Site 01 is an open scatter and is located in the calcrete layer of the quarry, about 2m from the surface of the quarry which is approximately 3.5m to 5m deep. The site itself is approximately a meter in diameter and consists of two Middle Stone Age artefacts; a utilized multipurpose tool (approx. 5.5cm x 4cm) and a snapped blade (approx. 4cm x 3.6cm) (Figure 61). It is located on the northern edge of the quarry and on the southern slope (Figure 64 – red circle). The quarry is located in Block 1 of the study area (Figure 57). Based on the type of sands - aeolian sands of the Kalahari Group (Gordonia Formation) forming dunes that overlay the calcrete layer- the approximate relative age of the two artefacts (and other lithic artefacts located in the vicinity) are 80Ky (eighty thousand years) as the sands in the area are dated to approximately that age. The two artefacts seem to have washed/rolled down from the sandy layer of the quarry to their current context, putting them in Secondary Context. There is no indication of smaller flakes or flake debris to suggest a primary context.

No immediate threats to the site were identified with exception to possible sand cover as a result of wind that is prevalent in the region. The two artefacts were found approximately a meter apart and they were only grouped together for the purpose of photography.

The site is of low archaeological significance. However, mitigation measures to document the artefacts and the site have been taken by recording the site/artefacts on the landscape by means of a GPS, a sketch measuring their size using a centimeter scale and photography for inclusion in the PGS and SAHRA Archaeological Resources Sites Database.

Figure 61: Site 01, Stone tool scatter (piece of a broken blade & a flake), in the quarry, Block 1.

- Site 02

GPS Co - ords: S28 35 52.1, E24 44 36.0

Site 02 is a stone scatter and consists of one big utilized blade piece (Figure 62). The blade is approximately 4.5cm x 4cm big and is located in the calcrete layer of the quarry, approximately 1.5 meters from the quarry surface. The quarry is located between Blocks B1 and B2 of the study area (Figure 57). The blade piece seems to have washed/rolled down from the sandy layer of the quarry to its current context, placing it in Secondary Context. The site is located on the eastern edge of the quarry and on the western slope (Figure 64 – yellow circle). Based on its current stratigraphic position the artefact is found in, it would seem that it belongs to the same age as the two artefacts found in Site 01.

No immediate threats to the site were identified with exception to possible sand cover as a result of wind that is prevalent in the region and which is evident with the formation of sparsely scattered sand dunes.

The site is of low archaeological significance. However, mitigation measures to document the artefacts and the site have been taken by recording the site/artefacts on the landscape by means of a GPS, a sketch, measuring their size using a centimeter scale and photography for inclusion in the PGS and SAHRA Archaeological Resources Sites Database.

Figure 62: Site 02, Stone tool (i.e. utilised flake), in the quarry, Block 1

- Site 03

GPS Co -ords: S28 35 52.1, E24 44 34.0

Site 03, like Site 01 and 02, is located in the calcrete layer of the quarry between Blocks B1 and B2 (Figure 57). It consists of a surface scatter of three stone tools. These were grouped together for photographic purposes (Figure 63) Artefacts include: a utilized (reworked) core (approx. 4cm x 3.7cm) and two flakes (4.2cm x 4cm & 3cm x 3cm). It is located on the western edge of the quarry and on its eastern slope (Figure 64 – blue circle). Based on the stratigraphic layer that the three artefacts were found in it is suggestive that they are of the same category (Middle Stone Age) and age (80Ky) as Sites 01 and 02.

The three artefacts are of low archaeological significance and were found out in Secondary Context. No immediate threats to the site were identified with exception to possible sand cover as a result of wind that is prevalent in the region and which is evident with the formation of sparsely scattered sand dunes.

Mitigation measures to document the artefacts and the site have been taken by recording the site/artefacts on the landscape by means of a GPS, a sketch, measuring their size using a centimeter scale and photography for inclusion in the PGS and SAHRA Archaeological Resources Sites Database.

Figure 63: Site 3, Stone tool scatter (a core & 2 flakes), in the quarry, Block 1.

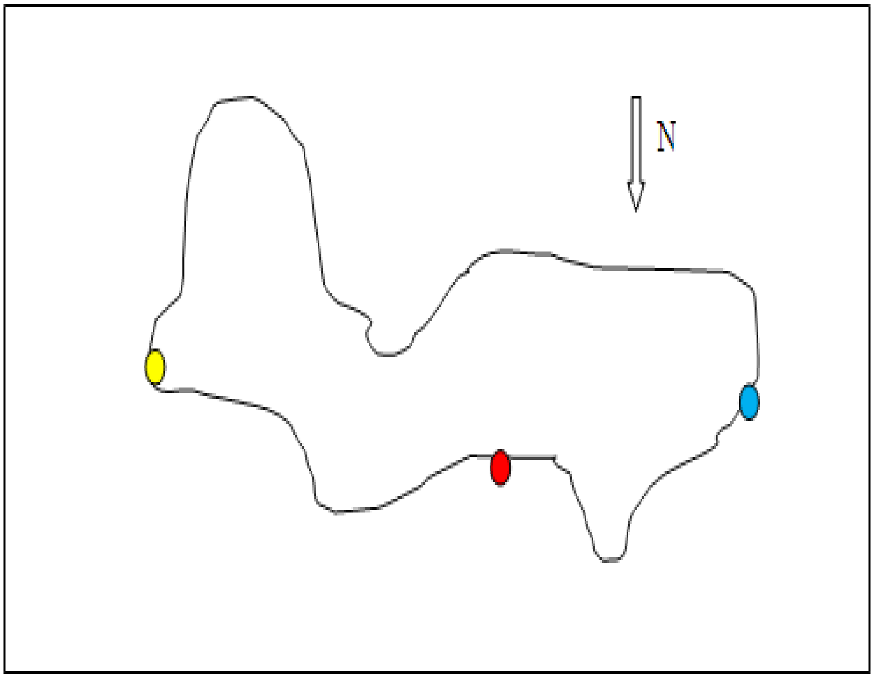

Figure 64: Sketch of the quarry and the location of site 01 (red), 02 (yellow), and 03 (blue) in the quarry.

- Site 04

GPS Co - ords: S28 37 40.1, E24 43 29.9

Site 04 (a-c) is a recent cattle stead. Based on structural features it looks to have been built in the 1980s or early 1990s giving them an approximate date of 20-30 years. It is approximately 140m in diameter and consists of the following built environment and landscape features: cattle dip (Figure 65), cattle feed (Figure 66) and cement foundations leading to the dip. The site is located in Block 3 and southern end of the study area (Figure 57). The cattle dip and, feed are still in good condition

Based on its age the site is of no historic significance. However, it was deemed necessary to document it on the landscape for inclusion in the PGS and SAHRA Archaeological Resources Sites Database by means of a GPS, a plan sketch and photography.

Figure 65: Site 4a Recent, Disbanded, Cattle Dip, Block 3.

Figure 66: Site 4b, Cattle feed, Block 3

Figure 67: Site 4c cement foundations leading to the dip, Block 3.

- Site 05

GPS Co - ords: S28.60064, E24.73241

Site 05 is a low density surface scatter consisting of three stone artefacts: two flakes (both approx. 5cm xc2cm) and a utilized tool (side scraper – approx. 4cm x 2cm). The site measures approximately 10m in dimension and is located on the western end of a dried pan (Figure 68) south of Block 3 of the study area. The tree artefacts (Figure 69) are from the Middle Stone Age and are likely to be of the same age as those found in Sites 01, 02 and 03 if we take into account the relative age of the sands that have formed the sparsely distributed sand dunes in the area. The pan is located some 20 to 30m from the base of one of the sand dunes in the study area.

The three artefacts were grouped together for the purpose of photography and the site is of low archaeological significance. However, mitigation measures to document the artefacts and the site have been taken by recording the site/artefacts on the landscape by means of a GPS, sketch and photography for inclusion in the PGS and SAHRA Archaeological Resources Sites Database.

Figure 68: Site 5 in the pan. Note the position of stone tool scatter put together and a scale

Figure 69: Stone tool scatter on the western edge of a dried up pan

8.4.4 Potential Impacts during Construction

ISSUE	Impact on archaeological sites
POTENTIAL IMPACTS	Unidentified archaeological 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 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

8.4.5 Potential Impacts during Operation

Same as construction

* The full Heritage Impact Assessment Report is included in Appendix 6F.

8.5 Tourism

8.5.1 Impact assessment relating to the Tourism Industry

The proposed CSP and CPV/ PV site is located in close proximity to a major tourist route (the diamond route - N12) which runs along the eastern side of the study area and Dronfield Nature Reserve located to the south east of the study area. As such, the anticipated impact on the tourism industry is expected to be significant.

The four major environmental impacts likely to result from the power plants include Visual impacts, Noise impacts, land use change impacts and corporate demand. These are elaborated below.

- Visual Impact Relative to Tourism

The visual impact relative to tourism is expected to be significant as the CSP and CPV/ PV site is located in close proximity to the N12/ diamond route (a major tourist route); Riverton road and the Dronfield Nature Reserve. The diamond route/ N12 comprises of a number of tourism nodes/ hotspots. More important of these in this case is the Kimberley node which represents hotspots such as the Dronfield Nature Reserve and the Kimberley Big hole among others. Being a major tourist route, the diamond route is critical for a lot of passing through tourists travelling to and from various tourist hotspots along the route. In addition, Riverton road is considered a potential tourist route due to the presence of a number of adventure and water sport activities at the Riverton Pleasure Resort on the banks of the Vaal River, to the north of the study area. Some sections of the N12 and Riverton road are screened from the site by vegetation, such as along the N12 close to the Riverton road turnoff where a strip of thornveld vegetation between the road and railway would screen views to the site. However stretches of the Riverton road are immediately adjacent to currently open grassy parts of the site, and the development would be highly visible if placed in this area, particularly if viewed from localised high points on the road which offer a much wider vista.

Because the N12 and Riverton road are frequently accessed by tourists as a way of appreciating the natural beauty of the areas they traverse or to access tourist facilities, they are considered sensitive visual receptors.

Furthermore, Dronfield Nature Reserve a popular tourist destination where leisure tourism is practiced to the south east of the study area. According to the scoping phase visual report, in certain parts in the north-west of the Dronfield Nature Reserve, the higher topography and north/north-west facing aspect may allow views towards the southern parts of the study site.

Clear views to the solar field from self drive locations in this part of the reserve may be highly intrusive, and could potentially negatively affect the sense of place associated with the conserved natural area.

Generally, the natural character or scenic beauty of an area such as Dronfield Nature Reserve plays an important role in attracting tourists to the area. Therefore owners of the Nature Reserve as well as visitors to the reserve may perceive the power plants as a visual intrusion that could degrade the areas' natural character and scenic beauty. Furthermore, this visual intrusion could potentially compromise the practising of tourism activities in the area.

- Noise Impact Relative to Tourism

Noise will be a factor during the construction phase. This phase will be temporary and it is not likely to be a significant factor impacting the tourism facilities in the area. No noise impacts are expected during the operational phase.

- Land Use Change Relative to Tourism

The land use in the study area is characterized by agriculture dominated by cattle grazing. It is traversed by existing 132kV existing transmission lines. Due to the presence of active cattle grazing within the study area, it is degraded and therefore does not exhibit a natural character. As such, from a tourism perspective and in the context of scenic value, introducing CSP and CPV/ PV power plants and associated infrastructure would not be viewed as a change in land use or a change in natural character.

It is however acknowledged that the study area is surrounded by important tourism features i.e. the diamond route which is mostly for passing through tourists to/from popular tourist destinations along the route (e.g. Namaqualand diamond coast, Kimberley node, Tswalu Kalahari Reserve, Brenthurst Gardens, Ezemvelo Nature Reserve and Venetia Limpopo Nature Reserve) to the eastern side of the study area; the Dronfield Nature Reserve a popular tourist destination to the south east of the study area and residential areas scattered to the south where a number of tourist accommodation facilities are concentrated.

Therefore, it should not be ruled out that owners of the Dronfield Nature Reserve, managers of various tourist attraction facilities (e.g. the Kimberley Big Hole) as well as owners of various accommodation facilities in Kimberley may raise their concerns.

8.5.2 Corporate Demand

The corporate demand for tourism facilities is likely to increase in the area as a result of the proposed development (assuming this proposed development is approved and constructed). Various professional persons such as technical surveyors, engineers, environmental specialists, and rehabilitation teams as well as the management / maintenance teams are likely to spend nights at various accommodation facilities in the study area. This is expected during the pre-construction, construction, operation and decommissioning phases of the project. Furthermore the above teams are expected to visit various restaurants (which is a component of leisure tourism) while in the area. In general, the impact of the proposed development on corporate demand for tourism facilities is anticipated to be minimal as the professional team on the project is expected to be small.

* The full Tourism Impact Assessment Report is included in Appendix 6G.

8.6 Socio-economic

In order to address the overall objective of this study, it was necessary to compile a detailed description of the study area. Each subsection first 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.

Although the Sol Plaatje Municipality (SPM) is the provincial capital of the Northern Cape, the municipal area is not large enough to be considered as a metropolitan municipality. Furthermore, it does not have enough weight to form part of the 9-member cities network. The SPM includes Kimberley, which is the largest urban area in the Northern Cape and also a major historical site for the first mineral discoveries in South Africa.

- Provincial Spatial Development Strategy

Some of the strategic elements of the Provincial Spatial Development Strategy (PSDS) for the SPM as highlighted in their Integrated Development Plan (IDP) of 2008-2011 included the following:

i. Established growth centres

"The major established growth centres are located in the Kimberley-Postmasburg sub-region. These are likely to remain the main economic driving force for the foreseeable future and will continue to attract rural and urban migrants. This growth in population often exceeds the growth of service provision thereby increasing backlogs. The implication of this is that development priorities in these areas should be the reinforcement of growth in established economic sectors through diversification, SMME development and increased levels of service provision."

ii. Land reform areas

"A number of land restitution and redistribution cases in the Northern Cape are in close proximity to the Kimberley-Postmasburg and Upington areas. In most settled cases this has led to services being provided in previously under- or non-serviced areas. In many cases, the economic potential of land is inadequate as a source for economic livelihoods and this will have to be addressed in any future consideration of infrastructure investment and development. As a result, the development priorities should be maximisation of LED opportunities, promoting integration and linkages with the surrounding economy and the provision of appropriate levels of service."

- Spatial Development Framework

According to the SPM's Spatial Development Framework (SDF), the municipal area is divided into three main functional areas, namely:

- The River Corridor;
- The Rural Area; and
- Settlement Areas.

These functional areas are depicted in Figure 70, together with an approximate location of the current study area.

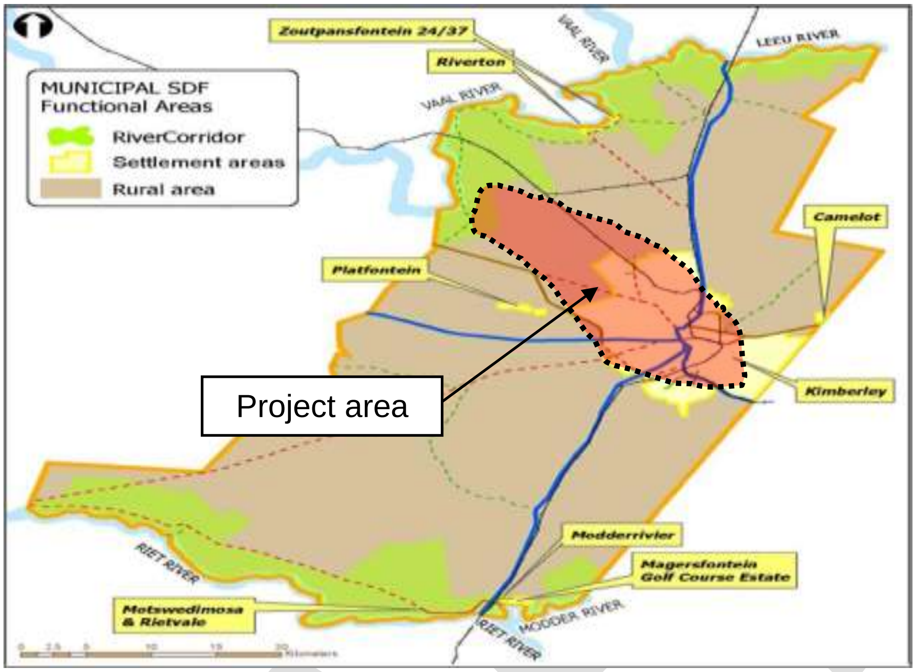

Figure 70**:** Functional areas within the Sol Plaatje Municipality
Source: Sol Plaatje SDF (2008-2012)

As is evident from Figure 70 above, the project area is partially located within a river corridor and partially within a rural functional area.

i. River Corridor Areas: Refers to all properties bordering on the main rivers that form the northern and southern boundary of the SPM. The river corridor areas have been divided into the northern river corridor (all land bordering on the Vaal and Leeu Rivers) and the southern river corridor (all land bordering on the Modder and Riet Rivers). The role and function of the river corridor areas are to:
    - Contribute to the alleviation of local, regional and national demand for food security;
    - Contribute to the supply of tourism and recreational facilities without compromising its ability to contribute to the demand for food security;
    - Protect and enhance the ecological and archaeological heritage of the area; and
    - Intensifying and expanding the range of crops under irrigation along the river corridor areas.

ii. Rural Areas: Refers to all the land between settlement areas and the river corridors. The role and function of the rural areas are to:
    - Contribute to the improvement of the local, regional and national demand for food security;
    - Protect and enhance the natural fauna and flora;

- Contribute to the supply of tourism and recreational facilities; and
- Protect and enhance the ecological and archaeological heritage of the area.

iii. Settlement Areas: Refers to all areas where urban settlement has taken place, or where the natural area has been disturbed by large scale mining operations, or areas where urban development will be permitted. Settlement areas have been subdivided into three main focus areas, namely:
   - **Rural support**: includes the settlements of Rietvale, Motswedimosa, Modderriver, Platfontein, Riverton and Camelot. The role and function of these areas are to support agricultural developments. Growth and investment initiatives within these areas should promote and improve sustainable local job creation.
   - **Isolated development**: includes the Magersfontein Golf Estate and the Zoutpansfontein Residential Settlement. The Magersfontein Golf Estate commemorates the battle of Magersfontein, whereas there is no rule and function for the Zoutpansfontein Residential Settlement.
   - **Economic concentration**: represents the economic hub of the SBM and generally consists of the major mining areas Kimberley, Galeshewe, Roodepan and Lerato Park. These areas remain a major servicing hub for the surrounding areas. It also serves as a cultural tourism centre and gateway to the Northern Cape.

8.6.1 Demographical Processes

The Sol Plaatje Municipality covers a geographical area of 1 877 km2 and is located on the eastern border of the Northern Cape Province. The municipality is landlocked and is bordered by the Magareng Municipality to the north, Dikgatlong Municipality to the northwest, the Northern Cape District Management Area 09 to the west, the Pixley ka Seme District to the south, and the Lejweleputswa and Xariep Districts of the Free State Province to the east.

- Population Characteristics

In 2001, Sol Plaatje had a total population of 201 457 people. The population size increased by some 41 558 people between 2001 and 2007, so that, in 2007, the population size was estimated at around 243 015 people. This represents a population increase of around 20.5% over the 6-year period between 2001 and 2007. The population density in 2001 was quite high at around 107.3 persons per km2, which increased to approximately 129.5 persons per km2 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 Kimberley, would be much higher than that of the rural areas.

Sol Plaatje has a fairly young population and in 2007 just over a quarter of the population (28.8%) 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 (65.8%) 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 31 882 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.

The population groups within Sol Plaatje are quite diversified. In 2001, just over half of the population (54.5%) belonged to the Black African population group, followed by Coloured at 31.7%. During the next 6 years the Black African population group decreased significantly, so that in 2007, it accounted for only 46.2% of the population. During the same time the Coloured population group increased significantly to 40.3% of the total population. The White and Indian/Asian population groups remained relatively unchanged at around 13% (White) and 1% (Indian/Asian). There are slightly more females (50.5%) than males (49.5%) in the municipal area. Interesting to note is that the majority of people who entered the area were male (28 942 males against 23 587 females), but is unclear why this phenomenon occurred.

In 2001, Sol Plaatje had a total of 51 100 households[2], with an occupancy rate of approximately 3.9 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 52 120 households, increasing the occupancy rate to 4.7 persons per household.

Table 26 provides an overview summary of the population demographics of the local municipal area in relation to South Africa, the Northern Cape and the Frances Baard District.

Table 26**:** Summary of Population Characteristics

	South Africa	**Northern Cape**	**Frances Baard District**		**Sol Plaatje**	
	2001[3]	2007	2001	2007	2001	2007
Area size (km^2)	1 219 912	361 830 (29.7% of SA)	12 349 (3.4% of the NC)		1 877 (15.2% of the FBD)	
Total population	48 502 063	1 058 060 (2.2% of SA)	324 814	353 198 (33.4% of the NC)	201 457 (62.0% of the FBD)	243 015 (68.8% of the FBD)
Population density (people per km^2)	39.8	2.9	26.3	28.6	107.3	129.5

2 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"*.
3 Census 2001 data (2007 data not readily available)

	South Africa	**Northern Cape**	**Frances Baard District**		**Sol Plaatje**	
	2001[3]	2007	2001	2007	2001	2007
Total households	12 500 610	264 654 (2.1% of SA)	85 544	82 886 (31.3% of the NC)	51 100 (59.7% of the FBD)	52 120 (62.9% of the FBD)
Avg. persons per household	3.9	4.0	3.8	4.3	3.9	4.7
Predominant Population Groups	Black African (79.5%)[4]	Coloured (50.0%)	Black African (60.5%)	Black African (51.7%)	Black African (54.5%)	Black African (46.2%)
	-	Black African (39.8%)	Coloured (27.1%)	Coloured (36.0%)	Coloured (31.7%)	Coloured (40.3%)
Predominant Gender	Female (50.8%)[9]	Female (50.9%)	Female (51.8%)	Male (50.5%)	Female (52.1%)	Female (50.5%)
Predominant Age Group	Working age (62.9%)	Working age (65.1%)	Working age (64.7%)	Working age (66.4%)	Working age (65.8%)	Working age (67.4%)

- 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 71.

[9] Census 2001 data

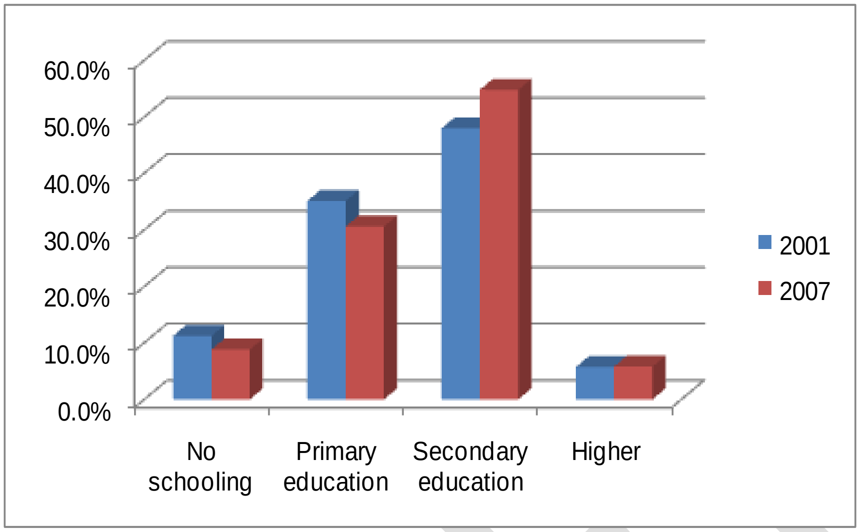

Figure 71**:** Overview of the Education Profile of the Sol Plaatje municipality (2001 and 2007 compared)

In 2001, just over a tenth (11.2%) of the population had no form of schooling. Coupled with those individuals who only completed some form of primary education (a further 35.1%), this means that, in 2001, close on a half (46.3%) of Sol Plaatje's population had limited educational skills, which in turn would hinder their employability on the general job market. However, approximately the same amount of people (48.0%) completed some form of secondary education, which could enhance their employability. Only 5.7% of the population went on to obtain a tertiary qualification.

The situation only improved marginally between 2001 and 2007: Although the number of people who had no form of education decreased from 11.2% to 8.8%, those who completed some form of primary or secondary education now accounted for the majority of the population (85.4%). Those individuals who obtained some form of tertiary education remained unchanged at 5.7%.

- 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 the Table 27 below:

Table 27: 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 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	The project must fulfill 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
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.

- Baseline Economic Processes

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 the 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%. The industry contribution to the regional economy of the Frances Baard DM area is reflected in Figure 72 below.

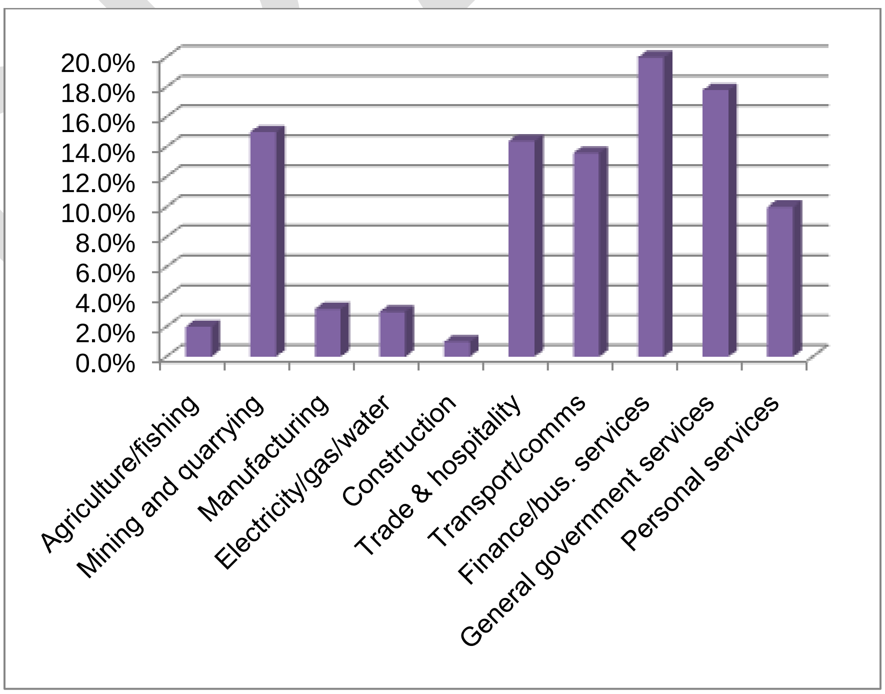

Figure 72**:** Contributions of different industries to the Frances Baard DM GGP

The Frances Baard area contains a historically important mining node in the province, namely the Kimberley area, and therefore mining is likely to play an important role in the regional economy. According the Frances Baard DM Local Economic Development (LED) plan (Urban Econ, 2009) mining is the second biggest contributor to the district economy (after finance and business services) and contributes 14.9% of district level GGP. The mining industry has showed some decline in the province and especially in the Frances Baard DM area due to the decline in diamond mining (Sol Plaatje LM, 2009). In general the Frances Baard DM area seems to be more economically diversified and therefore more stable than in the past, with notable contributions in financial or business services, trade and hospitality and personal services.

The Frances Baard DM Local Economic Development (LED) document and the Frances Baard DM Integrated Development Plan (IDP) both indicate that a small local population, a limited disposable income and a lack of infrastructure represent the biggest challenges to development. A small population and limited disposable income constrains the ability of businesses to profit sustainably from local customers. A lack of infrastructure limits economic growth as this factor 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 a 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.
- Expansion of downstream enterprises that would beneficiate agricultural and mineral resources locally, ensuring value is created in the region rather than elsewhere. Examples would be jewellery making or that 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 to ensure better access to the respective regions.

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 see potential opportunities for revenues, employment and business opportunities locally.

- Local Employment

With regards to the Droogfontein site local and district level employment closely mirrors that of the province, with a high level of economic non-participation. This may be due to the major contribution of the area to provincial economic activity. In 2006, 25.9% of the people employed in the Northern Cape were employed inside the Sol Plaatje Local Municipality.

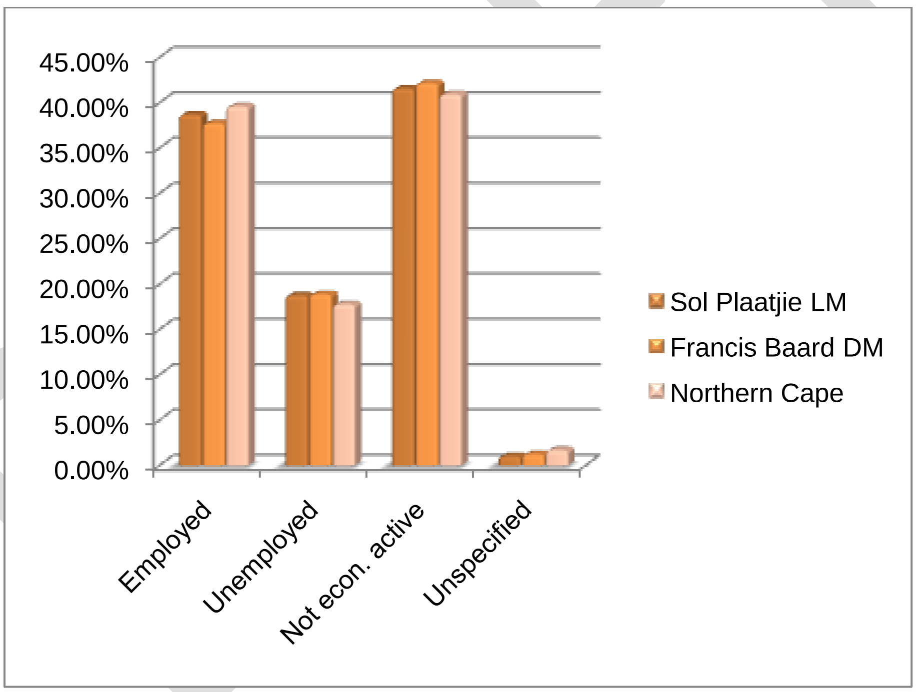

Figure 73**:** Regional and local employment for the Droogfontein Site amongst those aged 15 to 65

- 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 Droogfontein site access to income is disturbingly low but generally in line with provincial levels. There seems to be slightly more individuals locally in the R 3201 - R 12 800 range, probably to higher economic activity in the LM area. There seems to be a the lack of opportunity for both the unemployed as well as the highly skilled, which may explain the combination of the skills and employment profiles above and the local income profile.

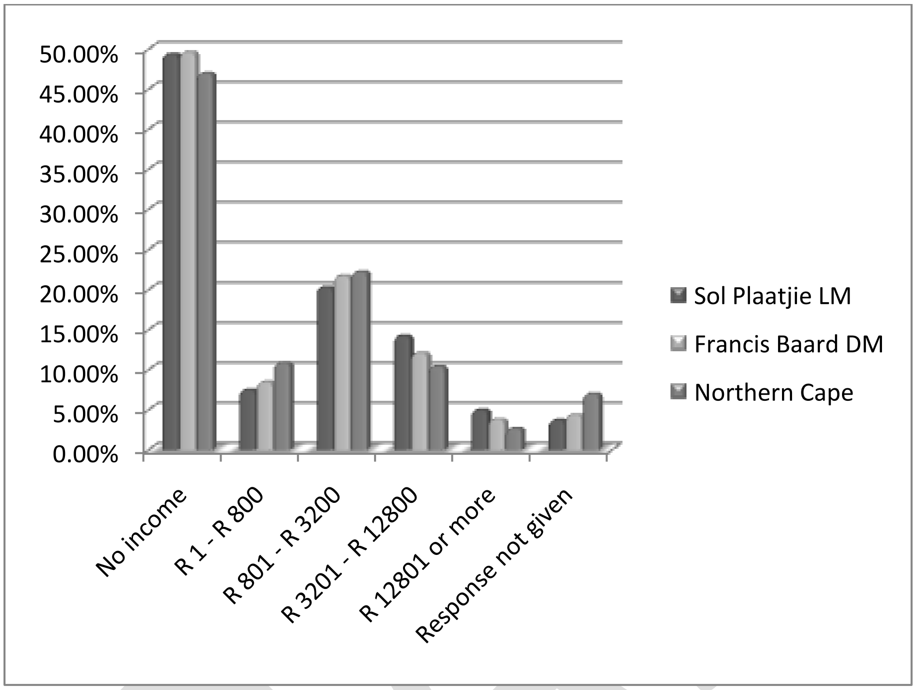

Figure 74**:** Regional and local monthly income for the Droogfontein site amongst those aged 15 to 65.

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 (R3200 and above), during the operations phase.

- Site Economic Activity

The Droogfontein site seems to have been used in for stock grazing in the past and several watering points can be found on the properties concerned. There are also areas which seem to be used as holding pens (kraals) for livestock. The type of livestock is unknown.

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 28 below provides an overview of the municipal services of the Sol Plaatje area in relation to the Frances Baard District and the Northern Cape Province as a whole. No data could be obtained for the overall municipal service delivery in South Africa.

Table 28**:** Overview of Municipal Service Delivery

	South Africa	**Northern Cape**	**Frances Baard District**		**Sol Plaatje**	
	2007		2001	2007	2001	2007
Energy Cooking	-	Electricity (77.2%)	Electricity (59.1%)	Electricity (77.2%)	Electricity (62.4%)	Electricity (81.9%)
Energy Heating	-	Electricity (64.9%)	Electricity (57.0%)	Electricity (67.2%)	Electricity (61.6%)	Electricity (71.6%)
Energy Lighting	-	Electricity (86.8%)	Electricity (77.9%)	Electricity (84.5%)	Electricity (82.5%)	Electricity (89.2%)
Refuse	-	Removed once a week (69.9%)	Removed once a week (71.7%)	Removed once a week (79.9%)	Removed once a week (91.2%)	Removed once a week (91.8%)
Sanitation	-	Equal or above RDP standard (81.6%)	Equal or above RDP standard (77.4%)	Equal or above RDP standard (87.6%)	Equal or above RDP standard (86.2%)	Equal or above RDP standard (90.8%)
Water	-	Equal or above RDP standard (80.3%)	Equal or above RDP standard (76.8%)	Equal or above RDP standard (85.6%)	Equal or above RDP standard (89.8%)	Equal or above RDP standard (92.3%)

Overall the municipal profile of the Sol Plaatje 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 Sol Plaatje 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 Sol Plaatje Municipal area is serviced by 5 police stations, one in Galeshewe, one in Kagisho (this station split from the Galeshewe station in 2008), one in Kimberley, one in Modder River and one in Roodepan. 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 243 015, theoretically this means that there are approximately 1 240 police officers deployed throughout the area.

According to statistics supplied by the Crime Information Management Services of the South African Police Service[5], 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 75 below provides a general overview of the crime profile in the Sol Plaatje area.

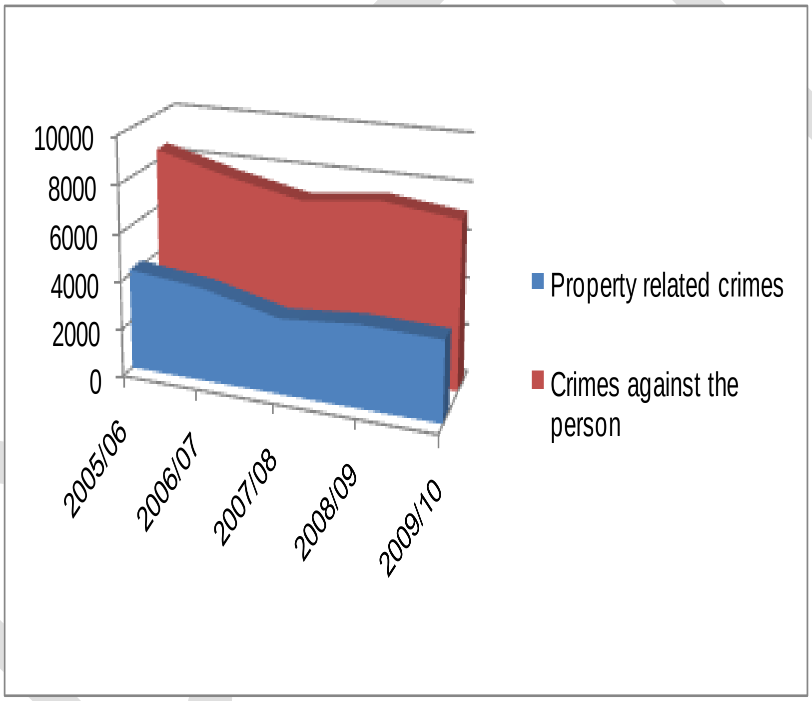

Figure 75**:** General Overview of the Crime profile in the Sol Plaatje Municipality

During the period under review a total of 17 950 crimes against the person and 37 603 property related crimes were reported. A breakdown per police station is provided in Figure 76 below.

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

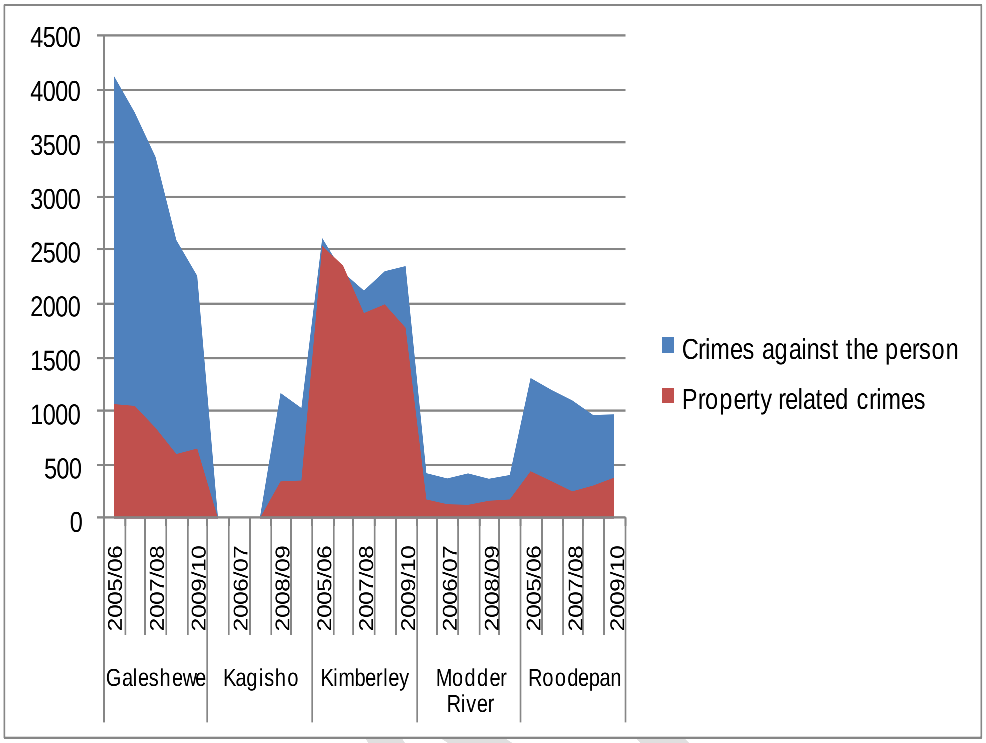

Figure 76**:** Crime Profile per Police Station in the Sol Plaatje area

From this profile it is evident that Galeshewe has the highest crime rate, followed by Kimberley, Roodepan and Modder River. Even though the Kagisho police station has only been operational since 2008, the crime rate in this area is more or less on par with Roodepan. 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, most notably in Galeshewe where the majority of reported cases were crimes against the person.

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

The Sol Plaatje Municipality through its Emergency Services renders fire fighting, rescue and disaster management services to the community. The emergency services functions from three fire stations within the municipal area, namely the Main station in Kimberley and two satellite fire stations in Ritchie and Galeshewe, respectively.

According to the municipality's website, Sol Plaatje is serviced by three hospitals – one provincial hospital and two private hospitals.

8.6.2 Socio-Cultural Processes

Kimberley is a settlement rich in history and diversity and one which has an array of socio-cultural processes to show for that.

In 1866 Erasmus Jacobs found a pebble on the banks of the Orange River at the farm De Kalk, this 'pebble' turned out to be a 21.25 carat diamond. Three years later Schalk van Niekerk found another diamond in the same vicinity – The Star of South Africa. Soon afterwards (in 1871) an 83.5 carat diamond was found on the farm Vooruitzigt which belonged to the De Beers brothers. These findings sparked off a mineral 'rush'. The Cape Colony, Transvaal, Orange Free State and the Griqua leader Nikolaas Waterboer all laid claim to the diamond fields. The Free State Boers in particular wanted the area as it lay inside the natural borders created by Orange and Vaal Rivers. Following the mediation that was overseen by the governor of Natal, the Keate Award went in favour of Waterboer, who placed himself under British protection. Consequently, the territory known as Griqualand West was proclaimed on 27 October 1871.

This is an indication of the cosmopolitan nature of Kimberley at the time, in fact British colonialists of that time could not pronounce the name Vooruitzigt and therefore named the settlement Kimberley (after Lord Kimberley, British Secretary of State for the Colonies).

From a historical commercial perspective Kimberley was important for two reasons, (1) the various smaller mining companies were amalgamated by Barney Barnato into De Beers, and The Kimberley under Cecil Rhodes and Charles Rudd. In 1888, the two companies merged to form De Beers Consolidated Mines, which to this day still retains a monopoly over the world's diamond market; (2) Kimberley was home to South Africa's first stock exchange in 1881. Furthermore it was the first town to install electric street lighting in the world (1882). Before this time Kimberley had become the second largest town in the country (1873) and was a bustling cosmopolitan centre with South Africa's first school of mines opening here in 1896 (later being incorporated in The University of The Witwatersrand). The large scale mining operations in the area drew a large number of migrant and permanent labourers from both South Africa and Africa.

The prosperous and growing nature of Kimberley was upset in 1899 when it came under siege during The Second Boer War. The war only ended three years later by which time the British had built a concentration camp in the area for Boer women and children.

Under Apartheid the citizens of Kimberley suffered many of the same fates as their counterparts in other South African towns, with the Group Areas Act resulting in the formation of new townships, Bantu Education ending in segregated schooling and the erection of new schools catering to different racial groups, and The Reservation of Separate Amenities Act meaning that different groups had access to differing portions of the facilities available in Kimberley. This centre also played host to many acts and actors of defiance against the policies of that period, most notably:

- The defiance campaign led by doctor Arthur Letele as early as 1952;
- The Mayibuye Uprising of 1952 which ended in mass death;
- Anti-Apartheid activist Phakamile Mabija and later provincial premiers Manne Dipico and Dipuo Peters were based here;
- The well known Robert Sobukwe, founder of The Pan African Congress, was resident in Kimberley;
- Finally Benny Alexander (later Khoisan X) was prominent in the area.

Kimberley is home to many monuments, museums, and places of interest such as:

- The Big Hole, previously known as the Kimberley Mine Museum, is a recreated townscape and museum, with Big Hole viewing platforms and other features, situated next to the Kimberley Mine ("Big Hole").
- The McGregor Museum, which celebrated its centenary in 2007, curates and studies major research collections and information about the history and ecology of the Northern Cape, which are reflected in displays at the museum's headquarters at the Sanatorium in Belgravia and nine branch museums.
- The William Humphreys Art Gallery.
- The Kimberley Africana Library.
- Dunluce and Rudd House Museums.
- Pioneers of Aviation Museum: In 1913, South Africa's first flying school opened at Kimberley and started training the pilots of the South African Aviation Corps, later to become the South African Air Force. The museum is located on the site of that flying school and houses a replica of a Compton Paterson bi-plane, one of the first aircraft to be used for flight training. The first female on the African continent to receive her pilot's license, Ann Maria Bocciarelli, was trained at this facility.
- Robert Sobukwe's Law Office.
- The Sol Plaatje Museum is located in the house where Sol Plaatje lived and wrote Mhudi.
- Transport Spoornet Museum.
- Clyde N. Terry Hall of Militaria.
- Freddie Tate Museum.

- On the outskirts of Kimberley, on the Barkly West Road, the Wildebeest Kuil Rock Art Centre, as well as Nooitgedacht Glacial Pavements. To the south of the city, the Magersfontein Battlefield Museum, while blockhouses can be seen at Modder River.
- The Miners' Memorial, also known as the Diggers' Fountain, located in the Oppenheimer Gardens and designed by Herman Wald. It was built in honour of all the miners of Kimberley. The memorial consists of five life-sized diggers lifting a diamond sieve.
- The Honoured Dead Memorial commemorates those who died defending the city during the Siege of Kimberley in the Anglo-Boer War.
- World War I memorial in Kimberley.
- The Cenotaph erected originally to commemorate the fallen of World War I, with plaques added in memory of fallen Kimberley volunteers in World War II. There is a memorial dedicated to the Kimberley Cape Coloured Corps who died in the Battle of Square Hill during World War I. Consisting of a gun captured at the battle, it originally stood in Victoria Crescent, Malay Camp, but, post-1994 was moved to the Cenotaph.
- The Concentration Camp Memorial remembers those who were interned in the Kimberley concentration camp during the Second Boer War, and is located in front of the Dutch Reformed Mother Church.
- The Henrietta Stockdale statue, by Jack Penn, commemorates the Anglican nun, Sister Henrietta CSM&AA (her reinterred remains are buried alongside), who petitioned the Cape Parliament to pass a law recognizing nursing as a profession and requiring compulsory state registration of nurses - a first in the world.
- The statue of Frances Baard was unveiled by Premier Hazel Jenkins on Women's Day, 9 August 2009.
- The Sol Plaatje Statue was unveiled by South African President Jacob Zuma on 9 January 2010, the 98th anniversary of the founding of the African National Congress. Sculpted by Johan Moolman, it is at the Civic Centre, formerly the Malay Camp, and situated approximately where Plaatje had his printing press in 1910-13.
- Burger Monument near Magersfontein Battlefield.
- Mayibuye Memorial.
- Rhodes equestrian statue.
- Malay Camp Memorial.

Kimberley boasts a rich sporting history with many of its inhabitants having represented their country at the highest level of numerous sports, particularly cricket, rugby, and swimming. This may be due, in part, to the centre's many well established schools.

Today's Kimberley is one which reveals an integration and melting pot of races, creeds and cultures as a result of the settlement's interesting history. As was mentioned previously in this report, the dominant population group is Black, constituting approximately 45% of the total population of the local municipal area, followed closely by Coloureds (40%), with the remainder being mostly White people. The places of attraction mentioned above are significant tourist sites for both local and foreign visitors, although tourism is not the largest source of employment in the municipal area. Religions currently practised in the area are numerous with locals attending Protestant, Catholic, Hindu, Jewish, and Muslim places of worship in Kimberley. Interestingly there is also a Masonic temple in Du Toitspan Road. Locally Kimberley is host to all manner of arts and cultural activities from writing festivals and local school fares, to major sporting activities and large museum exhibits.

8.6.3 Potential Impacts during Construction

The categories of expected change processes and resultant impacts during the construction period are as follows:

- **Geographical processes** refer to the processes that affect the land uses of the local area, of which all of the impacts would occur during the operational and maintenance phase.
- **Demographical processes** refer to the movement and structure of the local community, of which most impacts would be due to the influx of people to the area in the form of the construction team and the in-migration of unemployed job seekers.
- **Economic processes** refer to the livelihood of people in the area, and could entail a number of impacts, but during the construction period this would mostly be limited to employment opportunities.
- **Institution and Legal processes** refer to the processes that affect service delivery to the local area and could entail the possible displacement/relocation of people, a change in housing needs, which in turn could cause an additional demand on municipal services.
- **Socio-cultural processes** refer to the processes that affect the local culture of an affected area, i.e. the way in which the local community live (however, sometimes different cultural groups occupy the same geographical area and these groups are seldom homogenous). During the construction phase changes would mostly be limited to possible conflict situations between local residents and newcomers to the area, most notably where there is a marked dissimilarity in social practices.

- **Demographical Changes**

It is expected that the construction of the proposed 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 29 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 worst case scenario, it is expected that the bulk of these positions will be filled by skilled employees appointed by the contractor (i.e. from beyond the local arena). This means that a construction team consisting of a total of 750 people would enter the area for a period between 6 and 10 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 in Table 29.

Table 29: 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	Limited	Limited
Employment opportunities: Youth	Good	Good
Skills levels required	Unskilled/semi-skilled	Unskilled/semi-skilled

N.B: 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 transmission lines. This construction team is significantly smaller than the PV and CSP plant teams, so that, during the height of construction there will only be 90 people active on the substation site as reflected in Table 30 below.

Table 30**:** 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 transmission 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 remain 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). However, it is likely that most job seekers would be from the area (Galeshewe, Kimberley and surrounds) – in some circumstances individuals might let their families from elsewhere know that there are potential job opportunities available, which can lead to, what is expected, a minimal influx of job seekers. The presence of job seekers from elsewhere, who are not related to any of the locals, can lead to the creation and/or expansion of informal settlements, as discussed elsewhere.

- **Economic Changes**

Due to limited access to sites, low likelihood of major economic impacts and the lack of finalised feasibility information economic impacts were assessed at a 'detailed' scoping level rather than at a full impact assessment level.

- 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.

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 intensively 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). This may be partially or fully compensated for by rent payable to the landowners.

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

Direct Procurement Expenditure	R4.5 billion
National Direct Procurement Expenditure (60%)	R2.7 billion
Indirect/Induced	R8.96 billion
Total New Business Revenues	**R11.66 billion**
Total Contribution to GDP	**R3.29 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% (R2.7 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 R11.66 billion. The total value added to the economy (measured as GDP) will be R3.3 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 Sol Plaatje Local Municipality in its IDP has set for itself a number of goals, namely:

  - The eradication of infrastructure backlogs, specifically in terms of housing, electrical and water services;
  - To ensure local economic growth by 2014;
  - To halve poverty by 2014;
  - Upgrading uneconomical infrastructure;
  - The development of new infrastructure;
  - The creation of sustainable job opportunities in an effort to alleviate poverty; and
  - Improving the socio-economic conditions of the community at large.

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

  - Displacement and/or relocation of households;
  - Increase in housing needs; and
  - Additional demand on municipal services.

In addition to these change processes, the risk for social mobilisation against the project has also been considered and assessed.

- Displacement and relocation of households

As reflected in Figure 77 below, the Droogfontein site is located North-North-West of Kimberley and largely consists of a ‘greenfields area’. As far as could be determined, the site is mostly devoid of formal structures. The four centre pivots in the North-Western segment of the site indicate the presence of irrigated farmland, which points to high value commercial agricultural land.

The displacement of formal homes/households does not appear to be of particular concern although it is possible that small, isolated, and perhaps even temporary, homesteads belonging either to a farmer or farm workers may be present. Therefore, overall, the displacement of households does not appear to be a topic of major concern as there is no clear sign thereof, although the presence of commercial farmland may be of equal concern since it too would indicate private ownership of land which would, for the development proposed mean that:

(a) Compensation for the owner in question would be necessitated;
(b) It is preferable that the development steer clear of the North-Eastern section to prevent the sterilization of commercial farmland.

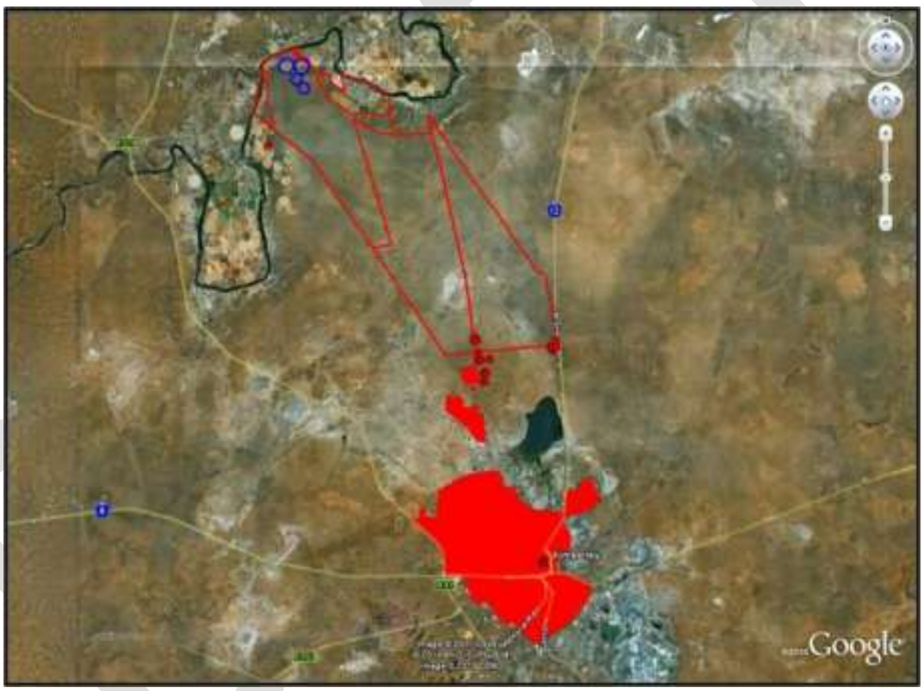

Figure 77**:** Location of structures on the Droogfontein site

- 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) can create a housing need in the Sol Plaatje area (specifically in Kimberley/Galeshewe as the nearest urban settlements) and further impact on the existing housing backlogs. However, it should be noted that the majority of the housing backlogs mostly pertains to the conversion of informal houses and therefore it is unlikely that this backlog would affect the project and vice versa. The likelihood of this impact occurring is further reduced if construction workers are primarily sourced from the local community, as local community members are already resident in the area.

By road, the Droogfontein site is a short journey from Kimberley. This would render Kimberley an economical option for accommodation as it is regarded as quite near to travel everyday to and from site. Temporary accommodation in the form of guest houses, hotels and Bed & Breakfast establishments are abundant in the area of Kimberley but may not be a preferred source of accommodation for the construction team.

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 access to water, electricity and other services. Where construction workers are housed within the local community, a few important rules have to be laid down, namely:

- No movement in the village at night.
- Be aware of alcohol abuse in the village.
- Where feasible, construction workers should 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. If the prospect of hotels, bed and breakfasts and the like is viewed as too costly or practically unviable from the perspective of the construction team then the creation of a construction village may present a possible solution. However, often a construction village creates another set of problems, some of which entail the following:

i. An increase in prostitution: disempowered and desperate local women often view construction workers as financially well-off and therefore as a source of income to the women who, quite frequently has to support her own family. Apart from the willful act of prostitution, other women are willing to enter into sexual relationships with construction workers believing that they will gain financially, which is often not the case. This leads to an increase in pregnancies and teenage pregnancies and more often than not, both woman and child is left behind in the community without any financial support when the construction worker moves out of the area.

ii. An increase in casual sexual relationships has the obvious health implication of an increase in sexually transmitted infections, including HIV. Human beings are mobile which means that these infections are spread further when they enter a new area and engage in a new casual sexual relationship.

iii. Infrastructure and services (e.g. water and sanitation) that are not managed and maintained properly within a construction camp can lead to waterborne diseases such as cholera. Within concentrated living conditions, diseases are easily spread within not only the confines of the camp, but also to the surrounding community.

iv. Construction workers seldom spend their free time in the camp, but would rather venture into town in search of entertainment, which normally results in alcohol abuse leading to an increase in conflict and violence, as well as an increase in causal sexual relationships as outlined above.

v. A positive impact associated with a construction camp that is often highlighted, is the fact that construction workers spend money in town and therefore have a positive economic impact on the town, albeit for a short period.

vi. It has been asserted by a director from The Department of Health that alcohol abuse is currently a major problem. Increasing incomes and placing workers in a large social and communal living space may exacerbate this in the absence of educational, supportive and/or aversive treatment circumstances.

In this regard, Table 31 below provides a comparison between the different forms of accommodation for construction workers.

Table 31**:** 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	If not managed properly it could lead to unhygienic living conditions. A Health and Safety Policy will be compiled prior to construction.

	ADVANTAGES		DISADVANTAGES	
ISSUE	**Local community**	**Construction village**	**Local community**	**Construction village**
			absenteeism and a delay in the construction programme.	
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	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	Conflict amongst residents is more intense as the conflict point is more

	ADVANTAGES		DISADVANTAGES	
ISSUE	**Local community**	**Construction village**	**Local community**	**Construction village**
	dispersed.	construction village and therefore easier to contain.	opportunities away from the local community. Conflict points are spread over community and are not easy to contain.	concentrated.
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	If housed within existing structures, little to no additional strain is placed on services. Upgrade of sewage treatment works will benefit the local community. Lease paid to the municipality will improve revenue for service	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.

	ADVANTAGES		DISADVANTAGES	
ISSUE	**Local community**	**Construction village**	**Local community**	**Construction village**
	provision.			
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 local community, i.e. economic investment takes place.	Provided for at construction village. Prevents absenteeism of workers who do not return to camp after a night out.	Misuse of recreational facilities might lead to conflict with members of the local community.	Misuse of recreational facilities might lead to conflict with fellow construction village residents.

As the closest urban or semi-urban centres to the site, Kimberley, Galeshewe and perhaps Roodepan would most probably bear the brunt of a construction village. There are currently in the region of 6,400 informal homes in Sol Plaatje and an influx of unemployed work seekers can hasten the expansion of informal settlements giving rise to numerous other problems. These other issues relate mostly to service delivery and social degradation. 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. Although the Sol Plaatje Local Municipality will be able provide these services, it is the contractor's responsibility to install and remove the (temporary) infrastructure required to access these services.

The IDP states that electricity is provided by Eskom, who believe that the local usage is on the rise and that further electrical infrastructure expansion is required. This should not cause a problem for the construction process as the extra supply will be aimed at future expansion and does not indicate a current shortage.

Although most households' refuse is removed once a week, the IDP identified 2 249 households which lacked solid waste removal. According to Community Survey (2007), only 3% of residents experienced water access below RDP standard (i.e. connected to a waterborne sewerage system or a Ventilated Improved Pit [VIP]). This implies that there is a very small backlog in the provision of effective sanitation services within the municipal area and an additional demand on these services should not be a major cause for concern.

- Risk for Social Mobilisation

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

[6] http://www.sacities.net/2004/UrbanRenewalPart2.pdf

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 Sol Plaatje and its human settlements that will be affected by the construction and operation of the proposed PV plant. At this stage Mainstream Renewable Power has a ‘clean slate’ in the area, but to maintain a trust 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 local residents are disregarded. If social mobilisation does occur, it could not only severely delay the construction process, but also lead to intense situations of conflict that ultimately affects 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 expected during the construction phase. 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

It was posited by a Director from the Department of Health that a section on health and safety is provided in order to look into possible threats. 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.

The Northern Cape Provincial Government has set HIV/AIDS as a major point of concern and has indicated that one of their core aims is to reverse the HIV prevalence rate by 2014. In terms of the Local Municipality, The Social Development Unit in the Directorate: Community and Social Development Services deal with issues such as TB/STI/HIV/AIDS programmes and poverty alleviation and as such the Unit provides voluntary counseling and testing services and is also involved in the following activities:

- Provision of responsive reaction to TB/STI/HIV/AIDS prevention and treatment through regular education.
- Provision of support through Peer Educators and EAP members and support group.
- Provision of Anti-Retro-Viral drugs (ARVs).
- Provision of condoms at all times.
- Commemoration of special events like TB Day; STI/ Condom Week; 'Candle-light' & World Aids Day.
- Monitoring and evaluation of the programme on an annual basis.

In line with the municipality's efforts in reducing the HIV prevalence rate, the project should ideally develop a comprehensive Health and Safety Plan that includes an HIV prevention plan. The HIV prevention plan should link up with the local municipality's initiatives and should extend to local communities.

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.

8.6.4 Potential Impacts during Operation

The categories of expected change processes and resultant impacts during the operation and maintenance period are as follows:

- Geographical processes refer to the processes that affect the land uses of the local area, and will include a permanent change in land use in the form of the sterilisation of agricultural land, permanent loss of land, and change in access to resources that sustain livelihoods.
- Demographical processes refer to the movement and structure of the local community, of which most impacts would be due to the arrival of operational staff.
- Economic processes refer to the livelihood of people in the area, and could entail a number of impacts, of which the major impacts include the following:
  i. Impact on rural and agricultural property values;
  ii. Forfeit of development opportunities;
  iii. Loss or removal of capital goods and services;
  iv. Economic injections;
  v. Impact on output and employment in the agricultural sector;
  vi. Employment opportunities; and
  vii. National economic security.
- **Institution and Legal** processes refer to the processes that affect service delivery to the local area, which is mostly restricted to the implementation of

a Corporate Social Investment Plan during the operation and maintenance phase.

- **Socio-cultural** processes refer to the processes that affect the local culture of an affected area, i.e. the way in which the local community live (however, sometimes different cultural groups occupy the same geographical area and these groups are seldom homogenous). During the operation and maintenance phase changes would mostly be limited to sense of place.

- **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;
- Permanent loss of land; and
- Change in access to resources that sustain livelihoods.
- Construction of roads and connection routes to the site.

- Sterilisation of Agricultural Land

As was mentioned previously, and as reflected in figure 5.4 below, parts of the north-western quadrant of the proposed site consist of irrigated agricultural land as indicated by the presence of a number of centre pivots. While this area is relatively small in the context of the proposed site, it still represents agricultural land in a region which is arid and often difficult to tend agriculturally. The possible sterilisation of such land represents the possible destruction of rare fertile land, possible intrusion into the livelihood of local people, and may potentially send a damaging message to local people regarding the priorities of the proverbial 'powers that be' (as large institutional, governmental, and private sector bodies are often perceived). Such a message (e.g. industrial development is more important than agriculture) may appear insignificant but in small and medium settlements can spread quickly and affect the sentiments of persons currently involved or potentially involved (in the future) in agriculture.

This is an important and often overlooked area, as Mr. Schoonraad from Grootfontein Agricultural Development Institute puts it: "we must admit that agriculture is a very important part of the economy of our country. But to our shame, we must also admit that through our words and actions as well as the legacy from the past, we often create a negative image of agriculture. Some external factors such as an extreme climate, volatile product prices and less glamorous jobs all contributes to a negative perception of agriculture amongst specifically the black youth. This is very dangerous, for if we lose one generation that is not interested in agriculture, who is going to produce the food and fibre and other essentials that we need to live from? This false perception about agriculture as a career needs to be addressed as a matter of urgency."

In addition, the Northern Cape Department of Agriculture holds assisting farmers as a priority point through their Comprehensive Agricultural Support Programme (CASP) and support of the 'Landcare Programme'. In both instances the support of local agriculture and preservation of land are held as being heavily important to their agenda and should therefore be considered in this instance.

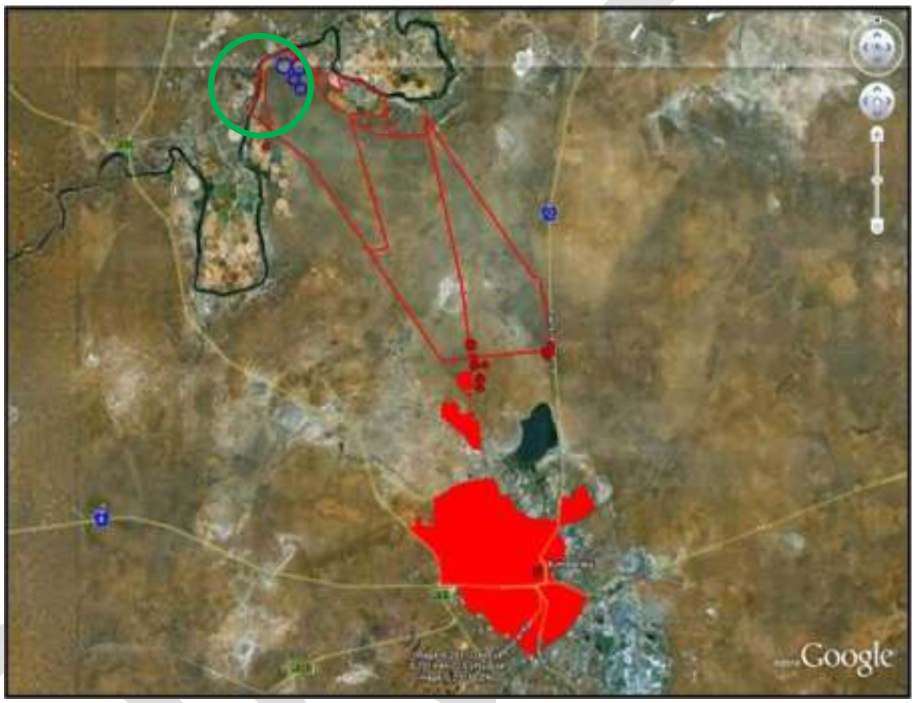

Figure 78: Agricultural land within the site

- Permanent Loss of Land

Regarding proposed development, the IDP (2007/2008 to 2011/2012) has proposed several developments as part of the Spatial Development Framework for Sol Plaatje. It appears that none of those proposed developments affect the Droogfontein site specifically and therefore the potential impact as a result of a loss of land has been ruled out.

- Change in access to resources that sustain livelihoods

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.

- Construction of roads and connection routes to the site

Representatives from Transnet have expressed concern at the possibility of requiring construction and/or alteration of roads in order to access the site (particularly National route crossings). Currently there is a drive underway to either eradicate or increase the safety of road crossings, especially those on national routes as they have been implicated in several severe road accidents. The construction of these would not significantly benefit the local community as they would likely only lead in and out of the site itself and, in addition, may increase road accident hazards.

In other words, the construction and maintenance process may necessitate the further construction of connecting roads leading to the site and crossings on National routes. Such processes have been implicated in increases in road traffic accidents which, in turn, mean that, from a social perspective, injuries and fatalities on local roads may increase. The N12 is the major route of reference here as it is near to the proposed site and will be host to the greatest (and fastest moving) volumes of road traffic in the area. This may be particularly dangerous when considering the relatively remote stretch of highway on which fewer motorists will be vigilant to, or expect, cross traffic. Statistics South Africa's Report entitled 'Transport Accident Deaths in South Africa' (Jhamba; 2007) showed that The Northern Cape had the second highest transport accident death rate in the country (14.4 per 100,000 people) which necessitates even greater attempts to reduce road fatalities. It is suggested that any crossings which are constructed are done so on minor roads with an abundance of safety features in place.

- **Demographic Changes**

As per information received from the project proponent, Mainstream Renewable Power, the operational staff component will consist of approximately 70 people. On a total population size of 243, 015 people, this would represent a population increase of approximately 0.03%, 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 0.03% to 0.13% in addition to the natural average population growth rate of 3.3% per annum. Mainstream have indicated that they intend 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 32 below.

Table 32**:** *Estimated number of people required for Unskilled/Semi-skilled positions*

	Panel Cleaning	**Land Maintenance & Fire Protection**	**Security Services**	**Technical Experts**

		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
	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	

An increase in the population size would mostly lead to other change processes occurring, such as an increase in housing needs as discussed elsewhere in the report.

- **Economic Changes**

Due to limited access to sites, low likelihood of major economic impacts and the lack of finalised feasibility information economic impacts were assessed at a ‘detailed’ scoping level rather than at a full impact assessment level.

- 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	R100 million
National Direct Procurement Expenditure (90%)	R90 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%

Measure	Operations Phase
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 320 people would require housing (if based on families of 4, as previously mentioned). Indications are that sufficient formal housing and services are available in Kimberley, as it is unlikely that the team would require RDP or informal housing (for which there is a backlog). The increase in housing needs/demands would therefore have a negligible impact, if at all, on housing and other services.

Furthermore, it is likely that the individuals will enter the highly accessible local real estate market in their private capacity. Kimberley has a large property market with many houses, townhouses, apartments and communes for sale or for rental. At the time of writing this report one agency alone (Seeff Properties) has 300 dwellings on the market (with a maximum of 80 households requiring accommodation) while it has been noted earlier that many guest houses and hotels are available in the nearby settlements. This indicates an availability of formal accommodation on a permanent or temporary basis. Moreover, it indicates that the influx of contractors, labourers, and workers will not cause major concern regarding availability of formal living space.

- 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 has 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. Several residents posed the question, during the scoping phase, of how skills development may be affected. The youth skills development initiative would mostly entail training in the following fields:

Table 33**:** Youth Skills Development Initiative

TOTAL TRAINEES	**16**
Electrical artisans	4
Boilermakers	4
Welders	2
Electrical Technicians	2
Recruitment priorities	2
Placement priorities	2

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 of 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 already employ a community member to service the existing solar monitoring station on site, he was provided with a bike and fulfills these duties on a daily basis.

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) will also be in the process of establishing a Trust whereby the community will own 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 Sol Plaatje 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:

- 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, which 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.
- 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.
- Mainstream will work closely with suppliers to provide the requisite training to workers, with a special focus on the development of local skills.
- 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.
- 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.
- 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.
- 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 changes during the operation and maintenance phase relate to a change in sense of place, substance abuse, and to the possibility of diseases arriving or increasing in the area, particularly HIV/AIDS.

- 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.

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 PV Plant in a landscape that already bears the marks of development would be less than that of placing it in a relatively unspoilt environment. In discussing the diverse research showing that people overwhelmingly prefer "nature scenes" to urban and built environments, Zadik (1985) explains that *"people seem to respond to environments as natural if the areas are predominantly vegetation and do not contain human artefacts such as roads or buildings."*

As the PV and CSP plants will be placed in a 'greenfields' area, an impact on sense of place is likely as it will change the environment from 'unspoiled' to 'spoiled'. These plants are also highly reflective and therefore it is expected that the impact on sense of place would extend beyond the borders of the site and impact on the visual quality of the area.

According to The Visual Impact assessment Scoping Report for this site, there may well be a negative 'sense of place impact here'. The solar field for a CSP plant will cover an area of approximately $6km^2$ and will hold structures as high as 8m. The PV plant is made up of approximately 160 000 photovoltaic panel arrays and will cover an area of approximately $2km^2$. The size and magnitude of such structures will add to their prominence and "the visual prominence of the facility will be exacerbated when located within a natural setting" (Gibb, 2010). In addition the construction of such plants will require vegetation clearance and as noted above will render a greenfields area 'spoiled'. The actual reflections from the mirrors are not regarded as a visual and/or 'sense of place issue' as they will be focused on a central receiver and stray reflections will be extremely few, if present at all.

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. Furthermore, much of the possible negative impact rests upon the sentiments of the individual perceiver. Some may find the plants to be unwelcome intrusions which degrade the natural beauty of the landscape and reduce the natural qualities to which they are accustomed. Others may find such plants to be a welcome sign of progress and infrastructure development, as well as a conservation effort towards 'green energy'.

- Substance Abuse

It was noted that alcohol abuse in particular is a source of concern in the Roodepan area. It is necessary to differentiate between substance intoxication, abuse, and dependence. The Diagnostic and statistical Manual for Psychiatric Conditions IV-Text Revised (DSM-IV-TR) provides the distinctions between these conditions. The actual diagnostic and treatment related factors are deemed redundant to the purposes of this study, rather the simple differentiations are provided below:

- Intoxication refers to a reversible syndrome brought on by recent ingestion of the substance, with clinically significant maladaptive behavioural or psychological changes.
- Abuse refers to recurrent intoxication resulting in major failures to fulfil role obligations; use of the substance in contexts where it is physically hazardous; intoxication leading to legal problems.
- Dependence refers to tolerance for the substance; withdrawals from the substance; intake of increasingly larger amounts; unsuccessful efforts to control its intake; active time-consuming attempts to obtain the substance; continued abuse despite knowledge of its negative effects (Barlow & Durand; 2005).

If many of the citizens of Roodepan are in fact characterised by rife and pervasive alcohol intake, then it is highly likely that all three of these distinctions are present. Only those who are dependent could be regarded as 'alcoholic', although abusers are also at risk for a variety of psychological and physiological disturbances and pathologies.

Sadly, the affliction of alcoholism is one which could potentially be exacerbated under improved socio-economic conditions. This appears counter-intuitive but unfortunately the spread and increase of the condition of alcoholism is often exacerbated in the presence of improved economic conditions from very little income to slightly more income in a given area. People living under conditions of extreme stress, poverty, malnutrition, social upheaval, and marginalisation are more likely to be substance dependent even after (and sometimes especially after) little more than minor alleviations. This is due to the fact that the individuals in question are dependent on the substance and increased income may lead merely to increased substance abuse as well as knock on effects pertaining to increased prostitution and domestic violence, concerns noted by a member of The Department of Health.

- The effects of HIV/AIDS

The HIV/AIDS prevalence rate may, as discussed earlier, be accelerated or increased as a result of short-term sexual relations between the construction team and local citizens and/or prostitutes. This will affect the critical health of the local populace as well as infringe upon the policy set aside by Provincial government (to turn HIV prevalence around by 2014). The actual toll that this factor may take is difficult to determine since the prevalence of HIV positive workers is not easy to establish and the extent to which the disease may or may not spread is also difficult to determine. Overall, while this problem will take place during the construction phase, it will be a challenge which only comes to full fruition long after the plants have been established. Once again the local municipality, in its IDP, holds the following to be of importance:

- Provision of responsive reaction to TB/STI/HIV/AIDS prevention and treatment through regular education.
- Provision of support through Peer Educators and EAP members and support group.
- Provision of Anti-Retro-Viral drugs (ARVs).
- Provision of condoms at all times.
- Commemoration of special events like TB Day; STI/ Condom Week; 'Candle-light' & World Aids Day.
- Monitoring and evaluation of the programme on an annual basis.

For Mainstream to maintain cognisance and congruence with these measures during their time in the region would be beneficial to the local population.

* The full Socio-economic Impact Assessment Report is included in Appendix 6H.

8.7 Geology

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.

Based on the trialpit results for the PV foundations, loose to medium dense sand is generally present to at least 2.5m depth. No groundwater was encountered within the depth investigated.

Trialpit results for the CSP Power Block Foundations suggests that loose sand is encountered at a shallow depth across the site. The sand extends to at least 2m below ground level.

The general geological succession at the site as revealed by the trialpits is:

- Topsoil – (vegetated layer typically 0.1m thick)
- Loose to medium dense sand
- Weakly cemented sand/Sandstone

* The full Geotechnical Report is included in Appendix 6I.

8.8 Stormwater

Stormwater management has been identified as mitigation and has thus not been rated in the impact assessment section below. The report will be included in the EMPr.

The farm area is divided into two drainage areas by means of a ridge line. The ridge line is located approximately in the centre of the farm, running from the south west boundary towards the north east boundary. The site will therefore be divided into two separate drainage areas namely; the 'northern drainage area' which will drain towards the north (Vaal River) whilst the 'southern drainage area' will drain towards the south west into a natural pan located partially on the farm. The majority of the development will take place within the 'southern drainage area'.
The average slope on the 'southern drainage area' is ±0.77% or a gradient of ±1:128. The 'northern drainage area' has an average slope of ±1.59% or a gradient of ±1:62.

We note that, from the information provided, it is not clear whether the 'southern drainage area' hosts a 1:100 Flood level, however it has been noted in the Geotechnical Report that the drainage line consisted of a salt pan and that ground water was discovered.

Furthermore, we note that the northern drainage area is bordered by the Vaal River. However, as it is proposed to develop the 'southern drainage area' only a 1:100 Flood line study will need to be carried out to determine the extent of the flood inundation area.

8.8.1 Plant Drainage

The Droogfontein 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.

[7] SiVEST EIA – Technical Description

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 and therefore no bulk earthworks will be required. However, the CSP Plant includes *inter alia* that the area be graded free of the natural vegetation with a possibility of a stepped terrace, dependant on the slope of the land.

For the PV Plant no bulk earthworks will be required and therefore we believe that minimal stormwater measures will be required. Furthermore, the Mean Annual Precipitation (MAP) for the Kimberley area is ±399mm/year[8] which further substantiates the minimal need for stormwater management with natural vegetation intact.

However, the CSP Plant includes that the area is graded and can involve bulk excavation in order to construct terraces. This will involve additional stormwater management by means of stormwater channels and chutes as to minimize erosion.

The proposed stormwater measures for both the PV Plant and the CSP Plant includes the draining of each drainage area by means of suitably sized grass lined earth channels positioned within the proposed road reserves. The earth channels will gravitate 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 the terrace are proposed to avoid stormwater running down slopes causing possible erosion. These channels can then be incrementally discharged into the channels located within the road reserve.

8.8.2 Road Drainage

The description of the required roads as indicated in the Technical Description[9] are gravel roads, both for the main access road to the plant and for the internal road network between the PV/CSP panels. It is our recommendations that both the access road and the internal roads be graded and shaped with a 2% 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. Discharging stormwater through culverts must include energy dissipaters at the exits to reduce any possible chances of erosion.

Where these road networks cross defined drainage lines, we suggest the installation of a suitably sized culvert to accommodate the major storms.

[8] Design Rainfall and Flood Estimation in South Africa by JC Smithers & RE Schulze

[9] SiVEST EIA – Technical Description

Stormwater channels that channel stormwater incrementally from the PV panels will occasionally cross internal roads and access roads. Concrete lined, Low level causeways should be constructed to reduce any erosion to the roads in these areas.

* The Stormwater Management Plan is included in Appendix 8B.

8.9 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 be 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 35.

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 34: Description

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 35: 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	
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

IMPACT TABLE FORMAT		
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.	

The 2010 regulations also specify that alternatives must be compared in terms of impact assessment.

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. Potential impacts from these activities are outlined below;

- Impacts on water resources;
- Impact on agricultural potential and soils;
- Disturbance of flora and fauna;
- Impacts on avifauna;
- Increase in traffic volumes in the environs of the construction site;

- Windblown dust;
- Impact on heritage resources;
- Noise pollution;
- Impact on tourism activities;
- Impacts on air quality;
- Impact on visual environment

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 Plan (EMP) would be developed and implemented to regulate and minimise the impacts during the construction phase.

9.2.2 Operation Phase Impacts

These impacts are will be closely scrutinized in the EIA phase as they are long term and continuous in nature. The specialised studies will identify and assess the effects of these impacts and include measures to minimise predicted impacts.

The typical activities during the proposed CSP plant operations phase include operation of the solar energy facility, power generation, and associated maintenance activities that would require vehicular access and heavy equipment operation when components are being replaced or cleaned.

The assessment of potential impacts will help in informing the client (Mainstream) of preferred alternatives which will be submitted to the Department of Environmental Affairs (DEA) for consideration and approval. If thr proposed CSP plant and its associated infrastructure is authorised, the development and implementation of an operation EMP will be required. The operational EMP will be designed to mitigate negative impacts associated with the operational phase of the project as proposed by the specialists.

9.2.3 Biodiversity Impact Assessment

9.2.3.1 Construction Phase

- Loss of habitat for red data / general species

Table 36: Rating of impacts related to loss of habitat for red data / general species

IMPACT TABLE FORMAT	
Environmental Parameter	Biodiversity

IMPACT TABLE FORMAT		
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 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

IMPACT TABLE FORMAT		
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.	

- Edge effect

Table 37: 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	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)

IMPACT TABLE FORMAT		
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)
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).	

9.2.3.2 Operation Phase

- Loss of habitat for red data / general species

Table 38: 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 chance of the impact occurring is extremely low (Less than a 25% 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 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	1	1
Reversibility	2	1
Irreplaceable loss	2	1
Duration	3	1

IMPACT TABLE FORMAT		
Cumulative effect	1	1
Intensity/magnitude	1	1
Significance rating	-10 (low negative)	-6(low negative)
Mitigation measures	▪ Maintain footprint strictly during operation ▪ Constant removal of alien invasive species in and around plant.	

- Edge effect

Table 39: 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 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

IMPACT TABLE FORMAT		
	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)
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).	

- Bird Collisions

Table 40: 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

IMPACT TABLE FORMAT		
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.	
	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	▪ New Bird flappers must be maintained on the power lines. ▪ Bird guards or similar must be maintained.	

- Bird Electrocutions

Table 41: Rating of impacts related to bird electrocutions

IMPACT TABLE FORMAT

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).
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

IMPACT TABLE FORMAT		
Duration	3	1
Cumulative effect	3	1
Intensity/magnitude	2	1
Significance rating	-28 (medium negative)	-7(low negative)
Mitigation measures	▪ New Bird flappers must be maintained on the power lines. ▪ Bird guards or similar must be maintained.	

9.2.3.3 Decommissioning Phase

- Loss of habitat for red data / general species

Table 42: 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 chance of the impact occurring is extremely low (Less than a 25% 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 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	The impact would result in negligible to no 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 postive Low impact i.e. the anticipated impact will

IMPACT TABLE FORMAT		
	have negligible negative effects however mitigation measures must be implemented. **After mitigation measures:** After mitigation measures, the positive low impact persists.	
	Pre-mitigation impact rating	**Post mitigation impact rating**
Extent	1	1
Probability	1	1
Reversibility	2	1
Irreplaceable loss	2	1
Duration	1	1
Cumulative effect	1	1
Intensity/magnitude	1	1
Significance rating	+8 (low positive)	+6(low positive)
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.	

- Edge effect

Table 43: 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 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	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 positive 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 positive low impact will be achieved.	
	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 positive)	+7(low positive)
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	

IMPACT TABLE FORMAT	
	present).

9.2.4 Surface Water Impact Assessment

The tables below represent the identified impacts assessed in the scoping phase. Hence, only the type impact is mentioned, the significance thereof and lastly, the mitigation measures required are stipulated in the context of the development for the construction and operation phases.

Table 44: Impact rating for impacts associated with the construction of excavation trenches for water pipelines through wetlands.

IMPACT TABLE		
Environmental Parameter	*Wetland (Construction Phase)*	
Issue/Impact/Environmental Effect/Nature	Impact of excavation trenches for water pipelines through the wetlands	
Extent	*Site*	
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	-18 (low negative)	-6 (low negative)
Mitigation measures	*Should the construction of a water pipeline need to take place, it is imperative that the routing circumvents any of the wetlands identified. Where and only if absolutely necessary, the construction of the water pipeline will need to be accommodated by a wetland rehabilitation plan that address inter alia the preservation and re-instatement of wetland soils, re-instatement of the wetland structural integrity, and the re-establishment of appropriate vegetation. The rehabilitation plan will need to also cover maintenance and monitoring programme.*	

Table 45: Impact rating for impacts associated with inappropriate construction activities in wetlands.

IMPACT TABLE	
Environmental Parameter	*Wetland (Construction Phase)*
Issue/Impact/Environmental Effect/Nature	Impact of general inappropriate construction activities
Extent	*Site*
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	-18 (low negative)	-6 (low negative)
Mitigation measures	*To prevent any of the above mentioned impacts associated with inappropriate construction activities, it is imperative that all wetland areas that extend into the proposed construction be fenced off with palisade fencing. This fencing will need to begin at the full extent of the buffer zone.*	

Table 46: Impact rating for impacts associated with construction pollution risks to wetlands.

IMPACT TABLE		
Environmental Parameter	*Wetland (Construction Phase)*	
Issue/Impact/Environmental Effect/Nature	Impacts associated with construction pollution risks to wetlands	
Extent	*Site*	
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	-18 (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 47: Impact rating for impacts associated with clearing extensive areas of vegetation resulting in erosion (wind and water) impacts to wetlands.

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 wetlands
Extent	*Site*
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	1	1
Probability	4	4
Reversibility	3	3
Irreplaceable loss	3	3
Duration	4	4
Cumulative effect	4	1
Intensity/magnitude	3	2
Significance rating	-57 (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 48: Impact rating for impacts associated with excessive stormwater run-off impacting on wetlands.

IMPACT TABLE		
Environmental Parameter	*Wetland (Operational Phase)*	
Issue/Impact/Environmental Effect/Nature	Impacts associated with stormwater run-off	
Extent	*Site*	
Probability	*Possible*	
Reversibility	*Completely reversible*	
Irreplaceable loss of resources	*No 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	1	1
Probability	2	2
Reversibility	1	1
Irreplaceable loss	1	1
Duration	3	3
Cumulative effect	3	1
Intensity/magnitude	2	1
Significance rating	-22 (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. Here, the engineer should account for both natural run-off (that which can be released into the natural landscape with no detrimental effect) and excess*	

	artificial run-off generated by the proposed development structures. 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 artificial run-off but releases a certain amount into the landscape. Energy dissipating structures can also be used. Such structures can reduce the amount and rate of excess run-off generated by the proposed development entering wetlands and thereby prevent the onset of erosion.

Table 49: Impact rating for impacts associated with oil pollution risks impacting on wetlands.

IMPACT TABLE		
Environmental Parameter	*Wetland (Operational Phase)*	
Issue/Impact/Environmental Effect/Nature	Impacts associated with oil pollution risks to adjacent nearby wetlands	
Extent	*Site*	
Probability	*Possible*	
Reversibility	*Barely reversible*	
Irreplaceable loss of resources	*Significant loss of resources*	
Duration	*Long 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	3	1
Irreplaceable loss	3	1

Duration	3	3
Cumulative effect	4	1
Intensity/magnitude	3	1
Significance rating	-48 (medium negative)	-8 (low negative)
Mitigation measures	*Transformer 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 wetlands. 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 50: 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.*	

9.2.5 Groundwater Impact Assessment

- Potential Impacts during Construction and Decommissioning

Table 51: Rating Matrix for impacts in the Construction and 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 decommissiong 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, 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 either site (Kimberley) 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	1	1
Probability	2	1

IMPACT TABLE FORMAT		
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.	

Table 52: 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).

IMPACT TABLE FORMAT		
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, 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 either site (Kimberley) 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
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	

IMPACT TABLE FORMAT	
	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.

9.2.6 Noise Impact Assessment

Table 53: 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[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)
Reversibility	The impact is completely reversible.
Irreplaceable loss of resources	The impact will not result in the loss of any resources.

[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		
Duration	Short term	
Cumulative effect	The impact would result in negligible to no cumulative effects	
Intensity/magnitude	A low impact is predicted.	
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)**
Mitigation measures	The following mitigation measures are recommended for the construction and decommissioning phases: • 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.	

Table 54: Noise impacts during operation

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

IMPACT TABLE FORMAT		
	2200m. At this distance (and closer to the plant), and at a residual[11] 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	Long term	
Cumulative effect	The impact would result in negligible to no cumulative effects	
Intensity/magnitude	A low impact is predicted.	
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: • 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	

[11] 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	
	can contribute to mechanical rattling and banging noise on vehicles traversing these roads.

9.2.7 Visual Impact Assessment

9.2.7.1 Potential day-time visual impact of the proposed solar energy facility

- Planning

No visual impacts are expected during planning.

- Construction

Table 55: 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 during construction:** 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), depending on the perception of the viewer.
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).

IMPACT TABLE FORMAT		
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
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 exiting wooded vegetation 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.	

- Operation

Table 56: Rating of day-time visual impacts during operation

IMPACT TABLE FORMAT

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 during operation:** The solar field and associated infrastructure will alter the natural character of the study area and expose sensitive receptors 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 result in marginal loss of this resource as the N12 and Riverton road are not typically valued as scenic routes and the natural thornveld vegetation within Dronfield will limit the visual intrusion of the solar energy facility in scenic views from this reserve.
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 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 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

IMPACT TABLE FORMAT		
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.	

- Decommissioning

Visual impacts during the decommissioning phase are potentially similar to those during the construction phase.

9.2.7.2 Potential night-time visual impact of the solar energy facility

- Planning

No visual impacts are expected during planning.

- Construction

Table 57: 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	**Night-time visual impact during construction:** The night scene is characterised by a relatively dark night scene with several light sources visible in the distance. Most construction activities are likely to take place during day-time 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.

IMPACT TABLE FORMAT		
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.	
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.	

- Operation

Table 58: 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.
Issue/Impact/Environmental Effect/Nature	**Night-time visual impact during operation:** The night scene is characterised by a relatively dark night scene with several light sources visible in the distance. The proposed development will therefore alter the visual quality of the area at night.
Extent	**Local/district:** Will affect the local area or district.
Probability	**Probable:** The impact will likely occur (Between a 50% to 75% chance of occurrence).
Reversibility	**Partly reversible:** The impact is partly reversible with the implementation of mitigation measures.
Irreplaceable loss of resources	**Marginal:** A night scene with minimal light pollution is a visual resource for eco-tourism facilities. The operational and security lighting will result in marginal loss of this resource as there are several existing light sources already visible in the distance and the natural thornveld vegetation within Dronfield will block out most light sources from the reserve.
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	**Low:** The impact would result in insignificant cumulative effects by increasing 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 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

IMPACT TABLE FORMAT		
Extent	2	2
Probability	3	2
Reversibility	2	2
Irreplaceable loss	2	2
Duration	3	3
Cumulative effect	2	1
Intensity/magnitude	2	2
Significance rating	-28 (negative low)	-24 (negative low)
Mitigation measures	▪ Make use of fittings that focus the light and prevent light spill. ▪ Direct perimeter lighting in a downward direction toward the site in a western direction. ▪ Limit the use of flood lighting where possible.	

- Decommissioning

Visual impacts during the decommissioning phase are potentially similar to those during the construction phase.

9.2.8 Heritage Impact Assessment

Table 59: Rating Matrix for impacts in the Construction phase

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*

IMPACT TABLE FORMAT		
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.*	

Table 60: 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*

IMPACT TABLE FORMAT		
Intensity/magnitude	*Magnitude dependent on type of finds made – however in most cases 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 decommissioning will be able to mitigate the impact on the finds through scientific documentation of finds and provide valuable data on any finds made.*	

9.2.9 Tourism Impact Assessment

- Construction Phase - Visual Impact Relative to Tourism

Table 61: Rating of Visual Impacts Relative to Tourism during the Construction Phase

IMPACT TABLE FORMAT	
Environmental Parameter	Tourism: This includes all trips away from one's usual environment, not just holiday/ leisure trips. It also includes business, visiting friends and/or relatives, medical/health trips, and religious journeys, amongst others.
Issue/Impact/Environmental Effect/Nature	**Visual Impact:** Visual impacts relative to tourism are expected along the N12/ diamond route (a major tourist route); Riverton road and within Dronfield Nature Reserve. Because the N12 and Riverton road are frequently accessed by tourists as a way of appreciating the natural beauty of the areas they traverse or to access tourist facilities, they are considered sensitive visual

IMPACT TABLE FORMAT	
	receptors. Furthermore, the natural character or scenic beauty of an area such as Dronfield Nature Reserve plays an important role in attracting tourists to the area and therefore owners of the Nature Reserve as well as visitors to the reserve may perceive the power plants as a visual intrusion that could degrade the areas' natural character and scenic beauty. In addition, this visual intrusion could potentially compromise the practising of tourism activities in the area.
Extent	The impact will only affect the site
Probability	The impact may occur (between a 25% to 50% chance of occurrence).
Reversibility	The visual impact on tourism facilities is reversible with implementation of minor mitigation measures. E.g. vegetation screening or avoiding the areas of the tourism facilities completely
Irreplaceable loss of resources	The visual impact on tourism facilities will not result in the loss of any 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 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	The impact would result in negligible to no 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 and will require little to no mitigation

IMPACT TABLE FORMAT		
	After mitigation measures: After mitigation measures, the negative low impact is persists.	
	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	1	1
Intensity/magnitude	2	1
Significance rating	-14 (low negative)	-6 (low negative)
Mitigation measures	▪ Areas with significant tourism facilities in the study area should be avoided completely ▪ Vegetation screening should be applied in areas of the tourism facilities. After mitigation measures, the negative low impact is persists.	

- Operation Phase - Visual Impact Relative to Tourism

Table 62: Rating of Visual Impacts Relative to Tourism during the Operation Phase

IMPACT TABLE FORMAT	
Environmental Parameter	Tourism: This includes all trips away from one's usual environment, not just holiday/ leisure trips. It also includes business, visiting friends and/or relatives, medical/health trips, and religious journeys, amongst others.
Issue/Impact/Environmental Effect/Nature	**Visual Impact:** Visual impacts relative to tourism are expected along the N12/ diamond route (a major tourist route); Riverton road and within Dronfield Nature Reserve. Because the N12 and Riverton road are frequently accessed by tourists as a way of appreciating the natural beauty of the areas they traverse or to access tourist facilities, they are considered sensitive visual receptors. Furthermore, the natural character or scenic beauty of an area such as Dronfield Nature Reserve plays an important

IMPACT TABLE FORMAT	
	role in attracting tourists to the area and therefore owners of the Nature Reserve as well as visitors to the reserve may perceive the power plants as a visual intrusion that could degrade the areas' natural character and scenic beauty. In addition, this visual intrusion could potentially compromise the practising of tourism activities in the area.
Extent	The impact is only expected within the local area i.e. Sol Plaatje Local Municipality tourism potential could be affected as a result of the proposed development.
Probability	The impact may occur (between a 25% to 50% chance of occurrence).
Reversibility	The visual impact on tourism facilities is reversible with implementation of minor mitigation measures. E.g. vegetation screening or avoiding the areas of the tourism facilities completely
Irreplaceable loss of resources	The visual impact on tourism facilities will not result in the loss of any 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 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	The impact would result in negligible to no 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 and will require little to no mitigation

IMPACT TABLE FORMAT		
	After mitigation measures: After mitigation measures, the negative low impact is persists.	
	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	1	1
Intensity/magnitude	2	1
Significance rating	-16 (low negative)	-6 (low negative)
Mitigation measures	▪ Areas with significant tourism facilities in the study area should be avoided completely ▪ Vegetation screening should be applied in areas of the tourism facilities. After mitigation measures, the negative low impact is persists.	

- Decommissioning Phase

It is anticipated that visual impacts during the decommissioning phase will be similar to those during the construction phase

- Construction Phase - Noise Impact Relative to Tourism

Table 63: Rating of Noise Impacts Relative to Tourism during the Construction Phase

IMPACT TABLE FORMAT	
Environmental Parameter	Tourism: This includes all trips away from one's usual environment, not just holiday/ leisure trips. It also includes business, visiting friends and/or relatives, medical/health trips, and religious journeys, amongst others.
Issue/Impact/Environmental Effect/Nature	**Noise Impact:** Noise will be a factor during the construction phase. This phase will be temporary and it is not likely to be a significant factor impacting the tourism facilities in the area.

IMPACT TABLE FORMAT	
Extent	The impact will only affect the site.
Probability	The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).
Reversibility	The noise impact on tourism facilities is reversible with implementation of minor mitigation measures
Irreplaceable loss of resources	The noise impact on tourism facilities will not result in the loss of any 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 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	The impact would result in negligible to no 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 negligible negative effects and will require little to no mitigation **After mitigation measures:** After mitigation measures, the negative low impact is persists.

	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

IMPACT TABLE FORMAT		
Intensity/magnitude	1	1
Significance rating	-6 (low negative)	-6 (low negative)
Mitigation measures	▪ Areas with significant tourism facilities in the study area should be avoided completely After mitigation measures, the negative low impact is persists.	

- Operation Phase

No Noise impacts are expected during the operation phase.

- Decommissioning Phase

Noise impacts during the decommissioning phase are potentially similar to those during the construction phase

- Construction Phase – Land Use Impact Relative to Tourism

Table 64: Rating of Land use Impacts Relative to Tourism during the Construction Phase

IMPACT TABLE FORMAT	
Environmental Parameter	Tourism: This includes all trips away from one's usual environment, not just holiday/ leisure trips. It also includes business, visiting friends and/or relatives, medical/health trips, and religious journeys, amongst others.
Issue/Impact/Environmental Effect/Nature	**Land use impact:** The study area is characterized by agriculture dominated by cattle grazing. It is traversed by existing 132kV existing transmission lines. Due to the presence of active cattle grazing within the study area, it is degraded and therefore does not exhibit a natural character. As such, from a tourism perspective and in the context of scenic value, introducing CSP and CPV/ PV power plants and associated infrastructure would not be viewed as a change in land use or a change in natural character. It is however acknowledged that the study area is surrounded by important tourism features i.e. the diamond route which is mostly for passing through tourists; the Dronfield Nature Reserve and residential areas scattered to the south where a number of tourist accommodation facilities are concentrated. Therefore, it

IMPACT TABLE FORMAT	
	should not be ruled out that owners of the Dronfield Nature Reserve, managers of various tourist attraction facilities (e.g. the Kimberley Big Hole) as well as owners of various accommodation facilities in Kimberley may raise their concerns.
Extent	The impact will only affect the site
Probability	The impact may occur (Between a 25% to 50% chance of occurrence).
Reversibility	The impact is reversible with implementation of minor mitigation measures
Irreplaceable loss of resources	The land use impact on tourism facilities will result in marginal loss of resources.
Duration	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).
Cumulative effect	The impact would result in insignificant 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 and will require little to no mitigation. **After mitigation measures:** After mitigation measures, the negative low impact is persists.

	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	2	1
Reversibility	1	1

IMPACT TABLE FORMAT		
Irreplaceable loss	2	1
Duration	2	1
Cumulative effect	2	1
Intensity/magnitude	2	1
Significance rating	-20 (low negative)	-6 (low negative)
Mitigation measures	▪ Areas with significant tourism facilities in the study area should be avoided completely After mitigation measures, the negative low impact is persists.	

- Operation Phase – Land Use Impact Relative to Tourism

Table 65: Rating of Land use Impacts Relative to Tourism during the Operation Phase

IMPACT TABLE FORMAT	
Environmental Parameter	Tourism: This includes all trips away from one's usual environment, not just holiday/ leisure trips. It also includes business, visiting friends and/or relatives, medical/health trips, and religious journeys, amongst others.
Issue/Impact/Environmental Effect/Nature	**Land use impact:** The study area is characterized by agriculture dominated by cattle grazing. It is traversed by existing 132kV existing transmission lines. Due to the presence of active cattle grazing within the study area, it is degraded and therefore does not exhibit a natural character. As such, from a tourism perspective and in the context of scenic value, introducing CSP and CPV/ PV power plants and associated infrastructure would not be viewed as a change in land use or a change in natural character. It is however acknowledged that the study area is surrounded by important tourism features i.e. the diamond route which is mostly for passing through tourists; the Dronfield Nature Reserve and residential areas scattered to the south where a number of tourist accommodation facilities are concentrated. Therefore, it should not be ruled out that owners of the Dronfield Nature Reserve, managers of various tourist attraction facilities (e.g. the Kimberley Big Hole) as well as owners of various accommodation facilities in Kimberley may raise their concerns.
Extent	The impact will only affect the site

IMPACT TABLE FORMAT		
Probability	The impact may occur (Between a 25% to 50% chance of occurrence).	
Reversibility	The impact is reversible with implementation of minor mitigation measures	
Irreplaceable loss of resources	The land use impact on tourism facilities 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 insignificant 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 and will require little to no mitigation **After mitigation measures:** After mitigation measures, the negative low impact is persists.	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	2	1
Reversibility	1	1
Irreplaceable loss	2	1
Duration	3	2
Cumulative effect	2	1
Intensity/magnitude	2	1
Significance rating	-22 (low negative)	-7 (low negative)

IMPACT TABLE FORMAT	
	▪ Areas with significant tourism facilities in the study area should be avoided completely
Mitigation measures	After mitigation measures, the negative low impact is persists.

- Decommissioning Phase – Land Use Impact Relative to Tourism

Table 66: Rating of Land use Impacts Relative to Tourism during the Decommissioning Phase

IMPACT TABLE FORMAT	
Environmental Parameter	Tourism: This includes all trips away from one's usual environment, not just holiday/ leisure trips. It also includes business, visiting friends and/or relatives, medical/health trips, and religious journeys, amongst others.
Issue/Impact/Environmental Effect/Nature	**Land use impact:** The study area is characterized by agriculture dominated by cattle grazing. It is traversed by existing 132kV existing transmission lines. Due to the presence of active cattle grazing within the study area, it is degraded and therefore does not exhibit a natural character. As such, from a tourism perspective and in the context of scenic value, introducing CSP and CPV/ PV power plants and associated infrastructure would not be viewed as a change in land use or a change in natural character. It is however acknowledged that the study area is surrounded by important tourism features i.e. the diamond route which is mostly for passing through tourists; the Dronfield Nature Reserve and residential areas scattered to the south where a number of tourist accommodation facilities are concentrated. Therefore, it should not be ruled out that owners of the Dronfield Nature Reserve, managers of various tourist attraction facilities (e.g. the Kimberley Big Hole) as well as owners of various accommodation facilities in Kimberley may raise their concerns.
Extent	The impact will only affect the site
Probability	The impact may occur (Between a 25% to 50% chance of occurrence).

IMPACT TABLE FORMAT		
Reversibility	The impact is reversible with implementation of minor mitigation measures	
Irreplaceable loss of resources	The land use impact on tourism facilities will result in marginal loss of resources.	
Duration	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).	
Cumulative effect	The impact would result in insignificant 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 and will require little to no mitigation **After mitigation measures:** After mitigation measures, the negative low impact is persists.	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	2	1
Reversibility	1	1
Irreplaceable loss	2	1
Duration	2	1
Cumulative effect	2	1
Intensity/magnitude	2	1
Significance rating	-20 (low negative)	-6 (low negative)
Mitigation measures	▪ Areas with significant tourism facilities in the study area should be avoided completely After mitigation measures, the negative low impact is persists.	

- Planning Phase, Construction, Operation and Decommissioning phases – Corporate Demand Relative to Tourism

Table 67: Rating of Corporate Demand Impacts Relative to Tourism during the Planning, Construction, Operation and Decommissioning Phases

IMPACT TABLE FORMAT	
Environmental Parameter	Tourism: This includes all trips away from one's usual environment, not just holiday/ leisure trips. It also includes business, visiting friends and/or relatives, medical/health trips, and religious journeys, amongst others.
Issue/Impact/Environmental Effect/Nature	**Corporate Demand:** The corporate demand for tourism facilities is likely to increase in the area as a result of the proposed development (assuming this proposed development is approved and constructed). Various professional persons such as technical surveyors, engineers, environmental specialists, rehabilitation teams as well as the management / maintenance teams are likely to spend nights at various accommodation facilities in the study area. This is expected during the pre-construction, construction, operation and decommissioning phases of the project. Furthermore the above teams are expected to visit various restaurants (which is a component of leisure tourism) while in the area. In general, the impact of the proposed development on corporate demand for tourism facilities is anticipated to be minimal as the professional team on the project is expected to be small.
Extent	The impact is only expected within the local area i.e. Sol Plaatje Local Municipality tourism potential could be affected as a result of the proposed development.
Probability	The impact may occur (Between a 25% to 50% chance of occurrence).
Reversibility	The impact is reversible with implementation of minor mitigation measures
Irreplaceable loss of resources	The impact will not result in the loss of any resources.

IMPACT TABLE FORMAT		
Duration	Medium term	
Cumulative effect	The impact would result in insignificant cumulative effects	
Intensity/magnitude	Impact has a positive effect on the corporate system. The quality, use, integrity and functionality of the system or component may improve.	
Significance Rating	**Prior to mitigation measures:** There will be a positive low impact **After mitigation measures:** After mitigation measures, a positive medium impact will be achieved	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	2	3
Reversibility	1	2
Irreplaceable loss	1	1
Duration	2	3
Cumulative effect	2	3
Intensity/magnitude	2	3
Significance rating	+20 (low positive)	+42 (Medium positive)
Mitigation measures	▪ Creating demand through appropriate marketing of tourism assets in the area. ▪ Improvement of tourism infrastructure by establishing an up to date tourism information office so as to increase tourism demand. ▪ Identification and Development of new tourist attractions ▪ Creating demand through appropriate marketing of tourism assets in the area. The above recommendations are not be implemented by the proponent but rather by the respective tourism bodies in the study area After mitigation measures, a positive medium impact will be	

IMPACT TABLE FORMAT	
	achieved.

9.2.10 Socio-economic Impact Assessment

- **Construction Phase**

Table 68: Rating of change in demographic profile relative to socio-economics during the construction phase

IMPACT TABLE FORMAT	
Environmental Parameter	Change in the demographic profile of the area.
Issue/Impact/Environmental Effect/Nature	A slight increase in the population of the area may result in certain minor challenges of which the most pressing issues are an increase in housing needs, additional demand on municipal services, and possible conflict with locals over resources. This issue will largely depend on the nature and location of the accommodation taken up during this phase by the construction team. Finally, in-migration of work seekers could serve to further exacerbate this issue. While it is assumed that the issue will not be one which is widespread and of huge significance, the influx of informal workers must be considered as it will serve to increase informal settlements if these people do not find work.
Extent	Will affect the local area only.
Probability	It is unlikely that any major impacts will occur.
Reversibility	The impact is reversible with the implementation of minor mitigation measures.
Irreplaceable loss of resources	The impact will not result in any actual loss of resources. The area will gain resources in the form of revenue.
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 0- 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 and the external endeavours which the

IMPACT TABLE FORMAT		
	construction team engage in (e.g. sexual, social, substance use etc).	
Intensity/magnitude	The impact would affect the quality, use and integrity of the system in a way that is barely perceptible.	
Significance Rating	The anticipated impact will have negligible negative effects and will require little mitigation.	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	1	1
Reversibility	1	1
Irreplaceable loss	1	1
Duration	1	1
Cumulative effect	3	2
Intensity/magnitude	1	1
Significance rating	-9 (Low Negative)	-8 (Low Negative)
Mitigation measures	It is recommended that local and currently available accommodation be used as this is abundantly available and the requisite services and infrastructure are in place. 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 69: Rating of change to municipal infrastructure relative to socio-economics during the construction phase

IMPACT TABLE FORMAT	
Environmental Parameter	The Sol Plaatje Municipality's capability to continue to deliver municipal services without increasing existing backlogs.
Issue/Impact/Environmental Effect/Nature	Current backlogs exist in the spheres of sanitation, water access, road network, electricity, waste removal, and housing. The influx of workers to the area should take place so as not to exacerbate these issues even though the

IMPACT TABLE FORMAT	
	number of workers is relatively small as compared to the backlogs. In addition, it is only likely to occur in the event of the construction of a construction village (highly unlikely) as other modes of accommodation are currently serviced
Extent	Where the impact occurs it will affect mostly the local area, specifically Kimberley, Galashewe and perhaps Roodepan as the closest urban settlements.
Probability	The chance of the impact occurring is low as it is unlikely that the influx of relatively few persons (in the context of the locality) will change the situation significantly. Furthermore, and as noted previously, formal accommodation is currently in place and is being serviced (e.g. hotels, guest houses, homes for sale and/or rent). If a construction village is set up then it is likely that portable services will be used wherever possible and even in the event that certain services will be tapped, this will not occur to a large degree as the number of workers on the team is relatively low.
Reversibility	The impact would be completely reversible.
Irreplaceable loss of resources	The impact would not result in any significant loss of resources.
Duration	The impact and its effects will either disappear over time or will be mitigated through natural process in a span shorter than the construction phase.
Cumulative effect	The impact will result in negligible to no cumulative impacts.
Intensity/magnitude	The impact will affect the use and integrity of the system in a way that is barely perceptible.
Significance Rating	The anticipated impact will have negligible negative effects and will require little to no mitigation.

	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	1	1
Reversibility	1	1
Irreplaceable loss	1	1
Duration	1	1
Cumulative effect	1	1
Intensity/magnitude	1	1

IMPACT TABLE FORMAT		
Significance rating	-7 (Negative low)	-7 (Negative Low)
Mitigation measures	It appears that little to no mitigation measures are required here as the issues are so slight as to be barely perceptible and will rectify themselves in a short space of time.	

Table 70: Rating of change to integration with local communities relative to socio-economics during the construction phase

IMPACT TABLE FORMAT	
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 consists of a sizeable 840 people (worst case scenario, no local employment) who enter 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. Furthermore, it is assumed that the majority of the construction team will be made up of Black Africans and that they will be most likely to integrate with, and associate with, the residents of Galeshewe, an area with a population of 103 228. This would therefore cause a more localised impact in the township of Galeshewe. Over and above this, the spread of HIV/AIDS is a further concern as the construction workers are likely to originate from highly urbanised centres where the disease is more prevalent.
Extent	Where the impact occurs it will affect mostly the local municipal area as any cultural and social upsets tend to spread and endanger immediate locations as well as secondary one.
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.

IMPACT TABLE FORMAT		
Reversibility	Conflict situations are completely reversible, whereas HIV post-facto infection is deemed irreversible. Other health impacts are partly reversible with intense mitigation 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	The anticipated impacts will have significant effects and will require significant mitigation measures to achieve an acceptable level of impact.	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	3	2
Probability	3	2
Reversibility	4	1
Irreplaceable loss	3	2
Duration	4	1
Cumulative effect	4	2
Intensity/magnitude	4	1
Significance rating	-84 (Very high negative)	-10 (Low negative)
Mitigation measures	An aggressive STI and HIV/AIDS awareness campaign should be launched (specifically in Galeshewe), 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, including a HIV prevention plan.	

IMPACT TABLE FORMAT	
	Access at the construction site should be controlled to prevent sex workers from either visiting and/or loitering at the construction village or the construction sites. 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. Finally, a short cultural awareness course/programme could be initiated for the incoming workers so as to increase tolerance and understanding of the local people.

Table 71: Rating of change to net increase in local business revenue opportunities relative to socio-economics during the construction phase

IMPACT TABLE FORMAT		
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	**Post enhancement impact**

IMPACT TABLE FORMAT		
	rating	**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	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 goods 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 72: Rating of change to net increase in local employment opportunities relative to socio-economics during the construction phase

IMPACT TABLE FORMAT	
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.

IMPACT TABLE FORMAT		
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 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.	

- Operational Phase

Table 73: Rating of change to increase in housing needs/demands relative to socio-economics during the operational phase

IMPACT TABLE FORMAT	
Environmental Parameter	An increase in housing needs/demands would place additional strain on the local municipality once the project is up and running since approximately 320 people (assumed

IMPACT TABLE FORMAT		
	maximum) may require housing and services.	
Issue/Impact/Environmental Effect/Nature	The operational staff could consist of 320 people (80 staff members and their families), all who would require housing. Currently, there is sufficient formal housing for those who can afford it i.e. those with formal employment (which would include the permanent staff at the proposed plants)	
Extent	Where the impact occurs it will affect mostly the local area, specifically Kimberley and Galeshewe as the largest nearby urban settlements.	
Probability	Although the increase in housing needs/demands is probable, the probability that this increase will lead to severe social impacts is highly unlikely.	
Reversibility	The impact will be reversible as very few, if any, housing problems will occur.	
Irreplaceable loss of resources	Little strain will be placed on existing resources as these people constitute only a tiny percentage of the population and will likely move into dwellings and area which are currently serviced.	
Duration	As a maximum, the impact and its effects would last over the short term (0-2 years), assuming all personnel retain their positions and few extra labourers arrive as unsuccessful job seekers.	
Cumulative effect	The impact would result in negligible to no cumulative effects.	
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.	
Significance Rating	The anticipated impacts will not have significant effects and will not require significant mitigation measures to achieve an acceptable level of impact.	
	Pre-mitigation impact rating	**Post mitigation impact rating**
Extent	2	1
Probability	1	1
Reversibility	1	1
Irreplaceable loss	1	1

IMPACT TABLE FORMAT		
Duration	1	1
Cumulative effect	1	1
Intensity/magnitude	1	1
Significance rating	**-7 (Low Negative)**	**-6 (Low Negative)**
Mitigation measures	None required where operational staff would be required to secure housing in their private capacity.	

Table 74: Rating of change to corporate social investment relative to socio-economics during the operational phase

IMPACT TABLE FORMAT	
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.
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.
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. This intervention may be directed more intensively at Galeshewe.
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

IMPACT TABLE FORMAT		
	intervention and how it is received by the community.	
	Pre-mitigation impact rating	**Post mitigation impact rating**
Extent	2	2
Probability	2	3
Reversibility	2	3
Irreplaceable loss	1	3
Duration	1	3
Cumulative effect	1	4
Intensity/magnitude	1	3
Significance rating	**+9** **(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 75: Rating of change to sense of place relative to socio-economics during the operational phase

IMPACT TABLE FORMAT	
Environmental Parameter	Change in sense of place.
Issue/Impact/Environmental Effect/Nature	The presence of the PV and CSP plants would render the area ‘spoilt’ and as such can set a precedent for further land use change in future, which could further alter people’s sense of place. On the other hand, some people might experience a positive change in sense of place due to employment opportunities, infrastructure development and knowledge of efforts towards ‘green energy’. 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 Roodepan and surrounding attractions (game reserves, farms, hotels, casinos and so on). The large centre of Kimberley should not be negatively affected as it is likely too far from the actual site and is an area that is already transformed.
Probability	Seeing as the area is currently ‘unspoiled’ with vast open

IMPACT TABLE FORMAT		
	spaces, the negative impact on sense of place is highly probable. Some residents might experience a positive impact on sense of place that can rapidly decrease if they do not receive tangible benefits from the project. Also, an educational drive outlining the probable social and environmental benefits could be undertaken as a mitigation measure towards perceptual change. The construction of the project will remove the raw sewage from the current environment.	
Reversibility	Once the CPS and PV plants have been constructed, the impact would be irreversible as little can be done to shield the visual impact. The education of the local people regarding the positive social and environmental ('green energy') benefits may mitigate some sense of place concerns.	
Irreplaceable loss of resources	The impact can result in marginal to significant loss of resources.	
Duration	The impact will continue indefinitely – some people might get used to the presence of the PV plant, whereas others might not. In either event, the impacts cannot be considered transient.	
Cumulative effect	The presence of the PV plant can set an unintended precedent for land use change, which in future can lead to cumulative impacts.	
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 significant effects and will require significant mitigation measures.	
	Pre-mitigation impact rating	**Post mitigation impact rating**
Extent	2	1
Probability	3	2
Reversibility	4	3
Irreplaceable loss	3	2
Duration	3	2
Cumulative effect	4	4
Intensity/magnitude	2	1
Significance rating	**-38 (Medium Negative)**	**-14 (Low Negative)**

IMPACT TABLE FORMAT	
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 76: Rating of change to net increase in local business revenue opportunities relative to socio-economics during the operational phase

IMPACT TABLE FORMAT		
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 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

IMPACT TABLE FORMAT		
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 goods and services which can be locally supplied, such as security, cleaning and catering. Set achievable targets for local procurement and determine a local procurement growth path.	

Table 77: Rating of change to net increase in local employment opportunities relative to socio-economics during the operational phase

IMPACT TABLE FORMAT	
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.

IMPACT TABLE FORMAT		
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
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 Kimberley 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.	

- Confidence in Impact Assessment

Most of the impacts identified and assessed in this report have been rated as either possible (between a 25% to 50% chance of occurrence) or as probable (between a 50% and 75% chance of occurrence). Very few impacts within the social realm can be regarded as definite (greater than 75% of occurrence) as this would discount people's ability to adapt to new environments or new infrastructure within their environment. Most people are able to adapt and continue with their lives even if it is in a modified way. The assessment was therefore based on the specialist's past experience with similar installations where certain social impacts occurred due to project interventions. Most social impacts are based on a 'worst case scenario' as it is deemed more important to overestimate an impact rather than underestimate. Public consultation would not necessarily increase the confidence in the social impact assessment, as individuals can never represent the views of an entire community, and to consult with and consider the views of every individual in a community would be near impossible.

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. 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 to 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. Residual Impacts If rehabilitation of the site is done efficiently and according to the Environmental Management Programme, no residual impacts on biodiversity are anticipated.
Surface Water Impact Assessment	• *Should the construction of a water pipeline need to take place, it is imperative that the routing circumvents any of the wetlands identified. Where and only if absolutely necessary, the construction of the water pipeline will need to be accommodated by a wetland rehabilitation plan that address inter alia the preservation and re-instatement of wetland soils, re-instatement of the wetland structural integrity, and*

	the re-establishment of appropriate vegetation. The rehabilitation plan will need to also cover a maintenance and monitoring programme. • *To prevent any of the above mentioned impacts associated with inappropriate construction activities, it is imperative that all wetland areas that extend into the proposed construction be fenced off with palisade fencing. This fencing will need to begin at the full extent of the buffer zone.* • *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.* • *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.* • *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. Here, the engineer should account for both natural run-off (that which can be released into the natural landscape with no*

	detrimental effect) and excess artificial run-off generated by the proposed development structures. 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 artificial run-off but releases a certain amount into the landscape. Energy dissipating structures can also be used. Such structures can reduce the amount and rate of excess run-off generated by the proposed development entering wetlands and thereby prevent the onset of erosion. • *Transformer 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 wetlands. 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. • *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.*
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.
Noise Impact Assessment	None foreseen
Visual Impact Assessment	None foreseen
Heritage Impact Assessment	None foreseen
Tourism Impact Assessment	None foreseen
Socio-economic Impact Assessment	▪ Construction Phase i. 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 750. ii. An additional demand on municipal services could result in minor cumulative impacts if services become strained, which in turn would impact mildly on permanent residents. iii. HIV infection adds to the current HIV infection rate in the province and the country, thereby taxing health

	resources further in combating the disease. iv. If conflict situation arise during the integration with the local community members these may potentially flare into further negative cumulative effects although this is unlikely as relatively few people will arrive during this phase. ▪ Operation Phase i. A breakdown in municipal services would affect the whole of the locality, although this is highly unlikely. ii. 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. iii. The presence of the PV plant can set an unintended precedent for land use change, which in future can lead to cumulative impacts. iv. The potential sense of place impact may be significant, especially for immediately located settlements and businesses.

10.2 Mitigation/ Management Measures

10.2.1 Biodiversity

Ideally it is preferable to place the infrastructure away from the sensitive areas identified and away from habitat that may house Red Data species.

Mitigation measures in this report are adopted for floral and faunal protection.

10.2.1.1 Construction site specific mitigation measures

The following mitigation measures are recommended for the study area:

- An on-site ecologist should be present when excavation takes place to ensure that any uncovered species are protected from destruction (It is important to remember that even though these species have not been encountered, they could be in a dormant stage and suddenly arise during construction due to more favourable conditions.

- Demarcation of sensitive areas prior to construction activities starting.
- Care taken during escavation given the presence of Giant Bullfrogs. Should frogs be discovered, a herpetologist should be contacted to suitably relocate the specimen.
- Use of appropriate construction methods in the sensitive area.
- 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. A poster of sensitive species (compiled by a qualified specialist) should be kept on the construction site for easy reference.
- Rehabilitation to be undertaken as soon as possible after construction in sensitive area has been completed
- 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.
- A buffer zone should be established in areas where construction will not take place to ensure that construction activities do not extend into these areas.
- 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.

10.2.1.2 Operation Site Specific Mitigation Measures

The following mitigation measures are recommended for the study area

- 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.
- More recent information should be consulted to ensure that no Red Data species have colonised the areas which were previously rehabilitated.
- Regular maintenance of protection of evaporation ponds to ensure birds do not gather in this area.
- Netting covering or escape measures for birds to be built into evaporation ponds.
- 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.

10.2.1.3 Decommissioning Mitigation and Management measures

All mitigation measures applied during construction will apply to the decommissioning phase of the project.

10.2.1.4 Achievability of Mitigation Measures

Mitigation measures included within this report are feasible and will be easy to achieve. Several of the mitigation measures included here are generic in nature and have been implemented successfully on several different construction sites. The unique mitigation measures stated in this report are also achievable and it is essential that these are taken into account when the proposed development is constructed.

10.2.1.5 Management and Monitoring

It is recommended that a formal monitoring and reporting strategy/protocol be developed for monitoring the impact on the vegetation and biodiversity in general in the area during construction. This will ensure that the mitigation measures stipulated for the construction are well enforced and the identified impacts minimised as much as possible.

Specific areas of concern that require strict monitoring include:

- Containment of construction to the demarcated area
- Erosion control
- Emergence of alien species
- Rehabilitation of the site
- Containment of construction near sensitive areas

If Red Data species are located during construction, the relevant permits must be applied for from the relevant authorities. No listed plants may be removed without these permits. It will be the responsibility of the ECO to ensure that these permits are in place where necessary.

The precautionary principle should be applied during the construction and care taken to implement the recommended mitigation measures.

10.2.1.6 Rehabilitation

Once the proposed development has been constructed, rehabilitation needs to take place. This needs to take place timeously to ensure that alien plant emergence and erosion do not occur.

10.2.2 Surface Water

- Should the construction of a water pipeline need to take place, it is imperative that the routing circumvents any of the wetlands identified. Where and only if absolutely necessary, the construction of the water pipeline will need to be accommodated by a wetland rehabilitation plan that address inter alia the preservation and re-instatement of wetland soils, re-instatement of the wetland structural integrity, and the re-establishment of appropriate vegetation. The rehabilitation plan will need to also cover a maintenance and monitoring programme.

- To prevent any of the above mentioned impacts associated with inappropriate construction activities, it is imperative that all wetland areas that extend into the proposed construction be fenced off with palisade fencing. This fencing will need to begin at the full extent of the buffer zone.

- 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.

- 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.

- The development and implementation of an adequate storm water management plan to be designed by an appropriate engineer. Here, the engineer should account for both natural run-off (that which can be released into the natural landscape with no detrimental effect) and excess artificial run-off generated by the proposed development structures. 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 artificial run-off but releases a certain amount into the landscape. Energy dissipating structures can also be used. Such structures can reduce the amount and rate of excess run-off generated by the proposed development entering wetlands and thereby prevent the onset of erosion.

- Transformer 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 wetlands. 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.

- 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.

10.2.3 Groundwater

Mitigation measures for all phases of the plant should include the following (see impact tables above for more details):

- 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.
- 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

- During construction care should be taken to ensure that noise from construction vehicles and plant equipment does not intrude on the Alberlaine agricultural plots or SANDF base. The lay down area and contractors site offices should not be located closer than 2000m to noise receptors. 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. It is recommended that construction access to the site be taken off the road to Riverton near the intersection of this road with the N12 road.

- Construction work should take place during daylight hours and preferably not on Sundays. If essential construction work should be required at night or on Sundays, neighbours in Alberlaine, the SANDF base and Roodepan should be consulted.

- 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 preferable CSP plant location is at alternative 2 which is approximately 4km from the nearest receptor (Riverton) and about 7km from Alberlaine.

- 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, tracker units (with motors and associated electrical equipment) or the electrical substation be positioned adjacent to the southern boundary of the site should the CSP alternative 1 be selected. The design of the PV plant and positioning of the power block 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, and preferably 2000m away from the nearest dwellings.

10.2.5 Visual

- Carefully plan to reduce the construction period as far as possible.
- Locate laydown and storage areas in zones of low visibility i.e. behind exiting wooded vegetation 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.
- Limit construction activities to day-time hours in order to minimise night lighting during construction.
- Make use of fittings that focus the light and prevent light spill.
- Direct perimeter lighting in a downward direction toward the site in a western direction.
- Limit the use of flood lighting where possible.

10.2.6 Heritage

- Management Guidelines

1. The National Heritage Resources Act (Act 25 of 1999) states that, any person who intends to undertake a development categorised as-
    - the construction of a road, wall, transmission line, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length;
    - the construction of a bridge or similar structure exceeding 50m in length;
    - any development or other activity which will change the character of a site-
        1. exceeding 5 000 m^2 in extent; or
        2. involving three or more existing erven or subdivisions thereof; or
        3. involving three or more erven or divisions thereof which have been consolidated within the past five years; or
        4. the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority;
    - the re-zoning of a site exceeding 10 000 m^2 in extent; or
    - any other category of development provided for in regulations by SAHRA or a provincial heritage resources authority, must at the very earliest stages of initiating such a development, notify the responsible heritage resources authority and furnish it with details regarding the location, nature and extent of the proposed development.

In the event that an area previously not included in an archaeological or cultural resources survey is to be disturbed, the South African Heritage Resources Agency (SAHRA) needs to be contacted. An enquiry must be lodged with them into the necessity for a Heritage Impact Assessment.

2. In the event that a further heritage assessment is required it is advisable to utilise a qualified heritage practitioner preferably registered with the Cultural Resources Management Section (CRM) of the Association of Southern African Professional Archaeologists (ASAPA).

This survey and evaluation must include:

- The identification and mapping of all heritage resources in the area affected;
- An assessment of the significance of such resources in terms of the heritage assessment criteria set out in section 6 (2) or prescribed under section 7 of the National Cultural Resources Act;
- An assessment of the impact of the development on such heritage resources;
- An evaluation of the impact of the development on heritage resources relative to the sustainable social and economic benefits to be derived from the development;
- The results of consultation with communities affected by the proposed development and other interested parties regarding the impact of the development on heritage resources;
- If heritage resources will be adversely affected by the proposed development, the consideration of alternatives; and
- Plans for mitigation of any adverse effects during and after the completion of the proposed development.

3. It is advisable that an information section on cultural resources be included in the SHEQ training given to contractors involved in surface earthmoving activities. These sections must include basic information on:

- Heritage;
- Graves;
- Archaeological finds; and
- Historical Structures.

This module must be tailor made to include all possible finds that could be expected in that area of construction.

4. In the event that a possible find is discovered during construction, all activities must be halted in the area of the discovery and a qualified archaeologist contacted.
5. The archaeologist needs to evaluate the finds on site and make recommendations towards possible mitigation measures.
6. If mitigation is necessary, an application for a rescue permit must be lodged with SAHRA.

7. After mitigation an application must be lodged with SAHRA for a destruction permit. This application must be supported by the mitigation report generated during the rescue excavation. Only after the permit is issued may such a site be destroyed.
8. If during the initial survey sites of cultural significance is discovered, it will be necessary to develop a management plan for the preservation, documentation or destruction of such a site. Such a program must include an archaeological/palaeontological monitoring programme, timeframe and agreed upon schedule of actions between the company and the archaeologist.
9. In the event that human remains are uncovered or previously unknown graves are discovered a qualified archaeologist needs to be contacted and an evaluation of the finds made.
10. If the remains are to be exhumed and relocated, the relocation procedures as accepted by SAHRA needs to be followed. This includes an extensive social consultation process.

The definition of an archaeological/palaeontological monitoring programme is a formal program of observation and investigation conducted during any operation carried out for non-archaeological reasons. This will be within a specified area or site on land, inter-tidal zone or underwater, where there is a possibility that archaeological deposits may be disturbed or destroyed. The programme will result in the preparation of a report and ordered archive.

The purpose of an archaeological/ palaeontological monitoring programme is:

- To allow, within the resources available, the preservation by record of archaeological/palaeontological deposits, the presence and nature of which could not be established (or established with sufficient accuracy) in advance of development or other potentially disruptive works
- To provide an opportunity, if needed, for the watching archaeologist to signal to all interested parties, before the destruction of the material in question, that an archaeological/palaeontological find has been made for which the resources allocated to the watching brief itself are not sufficient to support treatment to a satisfactory and proper standard.
- A monitoring is not intended to reduce the requirement for excavation or preservation of known or inferred deposits, and it is intended to guide, not replace, any requirement for contingent excavation or preservation of possible deposits.
- The objective of the monitoring is to establish and make available information about the archaeological resource existing on a site.

PGS can be contacted on the way forward in this regard.

Table 79: Roles and responsibilities of archaeological and heritage management

ROLE	RESPONSIBILITY	IMPLEMENTATION

A responsible specialist needs to be allocated and should sit in at all relevant meetings, especially when changes in design are discussed, and liaise with SAHRA.	The client	Archaeologist and a competent archaeology supportive team
If chance finds and/or graves or burial grounds are identified during construction or operational phases, a specialist must be contacted in due course for evaluation.	The client	Archaeologist and a competent archaeology supportive team
Comply with defined national and local cultural heritage regulations on management plans for identified sites.	The client	Environmental Consultancy and the Archaeologist
Consult the managers, local communities and other key stakeholders on mitigation of archaeological sites.	The client	Environmental Consultancy and the Archaeologist
Implement additional programs, as appropriate, to promote the safeguarding of our cultural heritage. (i.e. integrate the archaeological components into employee induction course).	The client	Environmental Consultancy and the Archaeologist,
If required, conservation or relocation of burial grounds and/or graves according to the applicable regulations and legislation.	The client	Archaeologist, and/or competent authority for relocation services
Ensure that recommendations made in the Heritage Report are adhered to.	The client	The client
Provision of services and activities related to the management and monitoring of significant archaeological sites.	The client	Environmental Consultancy and the Archaeologist
After the specialist/archaeologist has been appointed, comprehensive feedback reports should be submitted to relevant authorities during each phase of development.	Client and Archaeologist	Archaeologist

- All phases of the project
  - Archaeology

Based on the findings of the HIA, all stakeholders and key personnel should undergo an archaeological induction course during this phase. Induction courses generally form part of the employees' overall training and the archaeological component can easily be integrated into these training sessions. Two courses should be organised – one aimed more at managers and supervisors, highlighting the value of this exercise and the appropriate communication channels that should be followed after chance finds, and the second targeting the actual workers and getting them to recognize artefacts, features and significant sites. This needs to be supervised by a qualified archaeologist. This course should be reinforced by posters reminding operators of the possibility of finding archaeological/palaeontological sites.

The project will encompass a range of activities during the construction phase, including ground clearance, establishment of construction camps area and small scale infrastructure development associated with the project.

It is possible that cultural material will be exposed during operations and may be recoverable, but this is the high-cost front of the operation, and so any delays should be minimised. Development surrounding infrastructure and construction of facilities results in significant disturbance, but construction trenches do offer a window into the past and it thus may be possible to rescue some of the data and materials. It is also possible that substantial alterations will be implemented during this phase of the project and these must be catered for. Temporary infrastructure is often changed or added to the subsequent history of the project. In general these are low impact developments as they are superficial, resulting in little alteration of the land surface, but still need to be catered for.

During the construction phase, it is important to recognize any significant material being unearthed, making and to make the correct judgment on which actions should be taken. A responsible archaeologist/palaeontologist must be appointed for this commission. This person does not have to be a permanent employee, but needs to sit in at relevant meetings, for example when changes in design are discussed, and notify SAHRA of these changes. The archaeologist would inspect the site and any development recurrently, with more frequent visits to the actual workface and operational areas.

In addition, feedback reports can be submitted by the archaeologist to the client and SAHRA to ensure effective monitoring. This archaeological monitoring and feedback strategy should be incorporated into the Environmental Management Plan (EMP) of the project. Should an archaeological/palaeontological site or cultural material be discovered during construction (or operation), such as burials or grave sites, the project needs to be able to call on a qualified expert to make a decision on what is required and if it is necessary to carry out emergency recovery. SAHRA would need to be informed and may give advice on procedure. The developers therefore should have some sort of contingency plan so that operations could move elsewhere temporarily while the material and data are recovered. The project thus needs to have an archaeologist/palaeontologist available to do such work. This provision can be made in an archaeological/palaeontological monitoring programme.

- Graves

In the case where a grave is identified during construction the following measures must be taken.

Mitigation of graves will require a fence around the cemetery with a buffer of at least 20 meters.

If graves are accidentally discovered during construction, activities must cease in the area and a qualified archaeologist be contacted to evaluate the find. To remove the remains a rescue permit must be applied for with SAHRA and the local South African Police Services must be notified of the find.

Where it is then recommended that the graves be relocated a full grave relocation process that includes comprehensive social consultation must be followed.

The grave relocation process must include:

i. A detailed social consultation process, that will trace the next-of-kin and obtain their consent for the relocation of the graves, that will be at least 60 days in length;
ii. Site notices indicating the intent of the relocation
iii. Newspaper Notice indicating the intent of the relocation
iv. A permit from the local authority;
v. A permit from the Provincial Department of health;
vi. A permit from the South African Heritage Resources Agency if the graves are older than 60 years or unidentified and thus presumed older than 60 years;
vii. An exhumation process that keeps the dignity of the remains intact;
viii. An exhumation process that will safeguard the legal implications towards the developing company;
ix. The whole process must be done by a reputable company that are well versed in relocations;
x. The process must be conducted in such a manner as to safeguard the legal rights of the families as well as that of the developing company.

- Paleontology

The Palaeontological desktop study found that, the impact of the proposed development on local fossil heritage considered to be *low* and specialist palaeontological mitigation is not considered necessary.

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 Tourism

- Visual Impact
  i. Areas with significant tourism facilities in the study area should be avoided completely
  ii. Vegetation screening should be applied in areas of the tourism facilities
- Noise Impact
  iii. Areas with significant tourism facilities in the study area should be avoided completely
- Land Use
  iv. Areas with significant tourism facilities in the study area should be avoided completely
- Corporate Demand
  v. Creating demand through appropriate marketing of tourism assets in the area.
  vi. Improvement of tourism infrastructure by establishing an up to date tourism information office so as to increase tourism demand.
  vii. Identification and Development of new tourist attractions
  viii. Creating demand through appropriate marketing of tourism assets in the area.

10.2.8 Socio-economic

- **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.

i. Influx of People

  - It is recommended that the construction workers be housed in existing dwellings as they are numerous and are currently serviced.
  - 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.

ii. Change to Municipal Infrastructure

  - 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.
  - Inform residents in advance, if any blasting is going to take place. The contractor must repair any damages to houses as a direct result of blasting as soon as possible and at the contractor's cost.
  - MRP and its appointed contractor(s) must deliver on their undertakings with local communities in terms of employment allocation and any other commitments made. Any problems that occur as a direct result of any of the construction activities should be addressed effectively and without delay, and in consultation with the affected parties, if so required.
  - 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.

iii. Integration with Local Communities

- 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, including a HIV prevention plan.
- Access at the construction site should be controlled to prevent sex workers from either visiting and/or loitering at the construction village or the construction sites.
- 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.
- Every viable step must be taken to reduce substance abuse on the part of the crew as this will diminish local confidence in them and increase the likelihood of risk behaviour.
- Measures should be introduced (educational or institutional interventions) to reduce and curb the prevalence of substance abuse in the nearby Roodepan area.

- **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.

i. Increase in Housing Needs/Demands

- None would be required where operational staff is required to secure housing in their private capacity.

ii. Corporate Social Investment

- 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.

iii. Sense of Place

- 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.
- Educational drives within the community highlighting the employment creation, industrial development, and technological energy usage brought about by these plants may assist in this regard.

- **Achievability of Mitigation Measures**

Most mitigation measures suggested in this report are relatively achievable as they either make use of existing structures or processes without enormous cost to the project proponent.

11 DESCRIPTION AND COMPARATIVE ASSESSMENT OF ALL ALTERNATIVES IDENTIFIED

11.1.1 Technology Alternatives assessed

The following technological alternatives were investigated and eliminated at Scoping level:

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 80: 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.

There are several alternatives for the proposed development.

Table 81 below highlights the issues associated with each alternative thereby identifying the preferred alternative.

Table 81: Alternatives Assessment

	Biodiversity	**Surface Water**	**Groundwater**	**Visual**	**Heritage**	**Tourism**	**Socio-economic**	**Fatal Flaws**
PV Alternative 1	Located within the boundaries of the pan = not ideal and not preferable	Encroaches on pan = not preferable	No preference	Moderate distance from N12 highway, Riverton road, and of the self drive game routes within Dronfield = Not Preferred	Close to the pan = not preferable	Close to tourist route and therefore has High sensitivity and not preferred.	No preference	The existence of the pan is a fatal flaw
PV Alternative 2	Located outside of the pan = preferable	Away from pan = preferable	No preference	Alternative 2 is the preferred site	Avoids the pan = preferable	Slightly close to major tourist routes and have a moderate sensitivity. Preferred.	No preference	
CSP Alternative 1	High biodiversity = presence of several protected trees, nesting habitat for white backed vultures.	No preference	No preference	Medium visual impact – No Preference	Avoid the pan = No Preference	Close to tourist route and therefore has moderately sensitivity and not preferred.	No preference	The presence of several protected trees, nesting habitat for white backed vultures.

	Biodiversity	Surface Water	Groundwater	Visual	Heritage	Tourism	Socio-economic	Fatal Flaws
	Power line will be required to substation = no preferable							
CSP Alternative 2	Located on impacted grassland, not protected trees. Away from pans = preferable	Out of pans = preferable	No preference	Medium visual impact – No Preference	Avoid the pan = No Preference	Distant from major tourist routes with low sensitivity and therefore preferred.	No preference	
No Go Alternative	No vegetation clearance and habitat loss would occur.				Heritage sites would remain undisturbed and undocumente d.		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	

	Biodiversity	Surface Water	Groundwater	Visual	Heritage	Tourism	Socio-economic	Fatal Flaws
							job creation. The improvement in waste water treatment would not occur.	
Preferred Alternative	**PV Alternative 2 CSP Alternative 2**	**PV Alternative 2 CSP Alternative 2**	**PV Alternative 2 CSP Alternative 2**	**PV Alternative 2 CSP Alternative 2**	**PV Alternative 2 CSP Alternative 2**	**PV Alternative 2 CSP Alternative 2**	**PV Alternative 2 CSP Alternative 2**	

Key

	ELIMINATED
	PREFERRED

The property under investigation was chosen due to the access to the waste water for the CSP operation hence the selection of this farm. The property in question was also selected as the lease agreement will benefit local government hence providing an additional revenue stream.

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.

From the Table 81 above, PV Alternative 2 and CSP Alternative 2 are the preferred alternatives for the construction this proposed development. However, the main constraints limiting Mainstream from utilising site alternative PV Alternative 1 is the presence of the pan. Mainstream have indicated that PV Alternative 2 may expand into the area of PV Alternative 1 that does not fall into the pan. Hence PV Alternative 2 will include all of PV Alternative 1 except the area of the pan and the recommended buffer zones.

11.2 No Go Alternative

The No-Go Alternative is the option of not establishing the CSP and CPV/PV Plants in Kimberley. 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 Kimberley in the form of short term employment, 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.

The No-Go Option does not fall in line the goals of sustainable development and therefore based on the mitigation measures and recommendations provided by specialists, the No-Go option is being ruled out.

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.
- Visual impacts

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 protected and sensitive areas
- Vegetation maintenance around project work sites, workshops and camps
- Works safety elements, including a log of accidents
- HIV/AIDS programme implementation and levels at local health centres

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. Monitoring includes:

- Visual observations
- Selection of environmental parameters at specific locations;
- Sampling and regular testing of these parameters.

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 82 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 82 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 82: 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 8.8
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.
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 EMPr
3. Hazardous material		Refer the EMPr
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	Refer to Appendix 9

	as part of the development planning for the project.	
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 EMPr
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 83 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 83: Summary and Recommendations

Environmental Parameter	Summary of major findings	Recommendations
Biodiversity Impact Assessment	No fatal flaws are present on the site however some potentially sensitive areas are present namely the pans and	Strict mitigation measures must be in place and must be implemented. Monitoring is required.

	thornveld areas. These areas exhibit sensitivities in terms of species present (Bullfrogs present, White backed vultures present) and ecological functionality. Actual footprint is not an issue Birds are the faunal grouping which could be affected the worst by the proposed development however suitable mitigation measures can reduce these impacts.	
Surface Water Impact Assessment	Pan is to be regarded as areas of ***high sensitivity*** and should be avoided.	In consideration of the potential impacts that may affect the functional aspects of the surface water resources, a buffer zone of 50 metres has been applied to the pan. 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 established that the proposed development will have a high visual impact on motorists travelling along the	Mitigation measures suggested in the visual study must be implemented to reduce potential visual

	Riverton road and a medium visual impact on motorists travelling along the N12 highway and visitors using the self drive game routes within the Dronfield Nature Reserve. 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	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. Several Palaeontology features have been identified on the site	Strict implementation of mitigation and management measures. Consultation with SAHRA through a heritage specialist for the duration of construction.
Tourism Impact Assessment	Concentrated on sensitive tourism areas (N12/ the diamond route, Riverton road, and Dronfield Nature Reserve) close to the proposed site. CSP Alternative 2 exhibits no major visually sensitive tourist receptors and is distant from a major tourist route (N12) and a major tourist destination (Dronfield Nature Reserve). It is anticipated that tourists travelling along N12 and those within the Nature Reserve will not view the proposed power plant in this area. Therefore the sensitivity of this alternative to the CSP plants is considered low and therefore	Mitigation measures suggested in the tourism study must be implemented to reduce potential impact on tourism.

	preferred. PV Alternative 2 is slightly close to a major tourist route (N12) and a major tourist destination (Dronfield Nature Reserve). Although the site is slightly close to these tourist areas, tourists travelling along N12 and those within the Nature Reserve are not expected to view the proposed power plant in this area. The site is considered moderately sensitive to the CSP plants and hence preferred.	
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 Kimberley.	▪ 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.

Mainstream have indicated that they plan to expand PV Alternative 2 into the area of PV Alternative 1 that does not fall into the pan. Hence PV Alternative 2 will include all of PV Alternative 1 except the area of the pan and the recommended buffer zones.

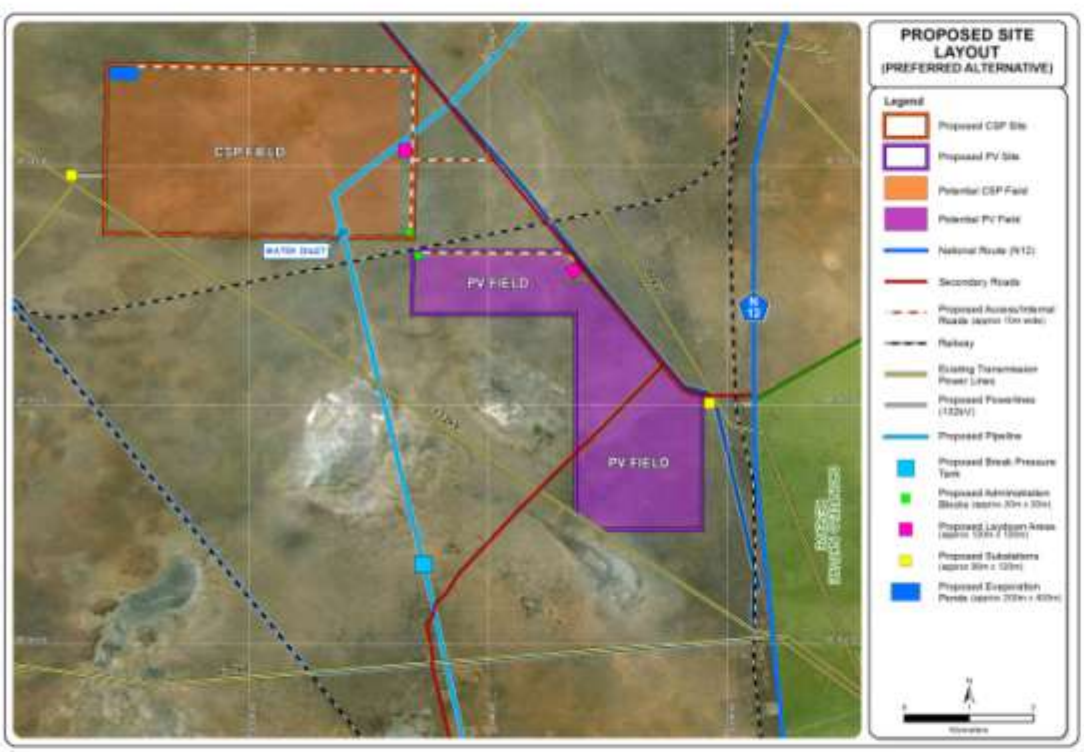

Figure 79: Preferred Site Layout

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 study area is characterized by large areas of natural vegetation, covered by shrublands. The site is classified as “natural” having relatively little human infrastructure on it and is used as grazing land for cattle and sheep herds. Open grazing land is interspersed with two ephemeral pans in the south-eastern part of the study area. The pans are sensitive habitats for birds and may be prone to seasonal inundation.

The proposed development is likely to improve socio-economic conditions in the long term whilst negative social impacts are anticipated for the construction phase. Mainstream will utilise water from the Homevale Sewage Treatment Works, this will assist the Local municipality in dealing with this excess water and generate revenue for the Local Municipality.

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

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.

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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