MAINSTREAM RENEWABLE POWER SOUTH AFRICA

Proposed Construction of a 40MW Solar Photovoltaic (PV) Plant on Mierdam Farm near Prieska, Northern Cape Province of South Africa

Draft Environmental Impact Report

DEA Ref. No.:12/12/20/2320/2
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Revision Number:	1
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Signature:	
For:	SiVEST Environmental Division

KEY PROJECT INFORMATION

FARM DESCRIPTION	21 DIGIT SURVEYOR GENERAL CODE
Portion 1 of the Farm Kaffirs Kolk No. 118	C06000000000011800001
Portion 4 of the Farm Klipgats Pan 117	C06000000000011700004
Portion 7 f the Farm Klipgats Pan 117	C06000000000011700007

TITLE DEEDS: Attached as Appendix 1

PHOTOGRAPHS OF SITE:

General Characteristics of the study area

General Characteristics of the study area

SENSITIVE VISUAL RECEPTORS: Fifteen (15) sensitive receptor locations were identified within a 5km radius of the development.

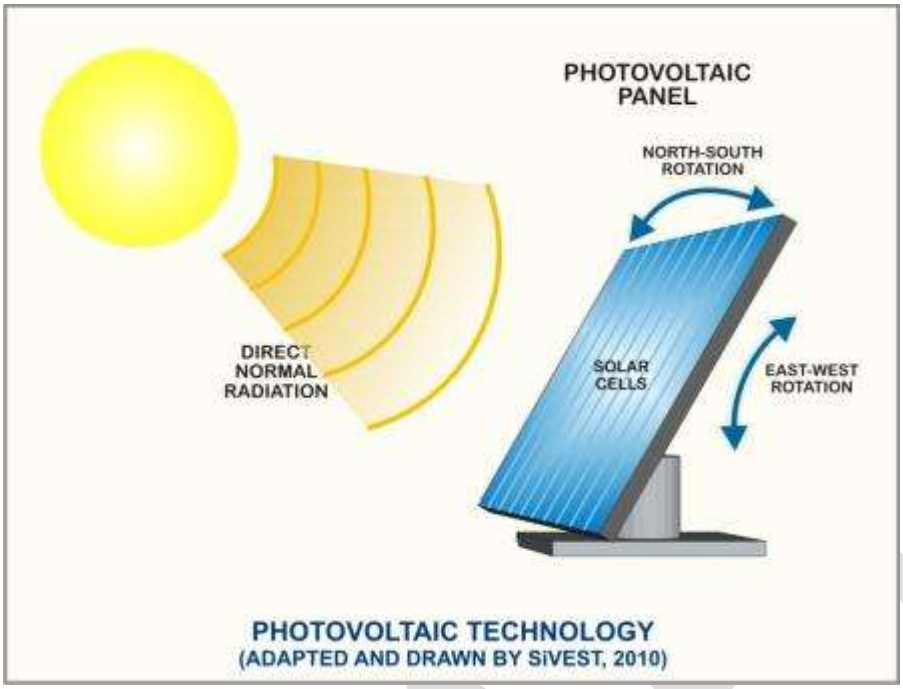
TYPE OF TECHNOLOGY: Photovoltaic (PV) panels

STRUCTURE HEIGHT: 5-10m.

SURFACE AREA TO BE COVERED: 449.34 hectares for the entire buildable area

STRUCTURE ORIENTATION: Structure will be orientated in a north –east / north- west direction.

PV DESIGN: The final design is not available but average specifications are presented below:



FOUNDATION DIMENSIONS: The hard standing area is approximately 200 m².

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

GENERATION CAPACITY: 40MW

A3 Maps of all smaller maps included in the report are attached in Appendix 7.

MAINSTREAM RENEWABLE POWER

PROPOSED CONSTRUCTION OF A 40MW SOLAR PHOTOVOLTAIC (PV) PLANT ON MIERDAM FARM NEAR PRIESKA, NORTHERN CAPE PROVINCE OF SOUTH AFRICA

DRAFT ENVIRONMENTAL IMPACT REPORT

Executive Summary

SiVEST Environmental Division has been appointed as independent consultants to undertake an Environmental Impact Assessment for the proposed establishment of a Concentrated Photovoltaic Plant / Photovoltaic Plant (CPV/PV) plant near Prieska in the Northern Cape Province. The objective of the project is to generate electricity to feed into the national grid by installing a solar plant of 40 MW capacity.

The proposed development requires environmental authorisation from the National Department of Environmental Affairs (DEA),however provincial authorities have also be consulted with i.e. the Northern Cape Department of Tourism, Environment and Conservation (NCDTEC). The development will be carried out under the Environmental Regulations which were promulgated in June 2010 under the National Environmental Management Act (No.107 of 1998) (NEMA)as amended. All relevant legislation (including Equator Principles) has been consulted during the EIA process and will be complied with at all times.

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

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

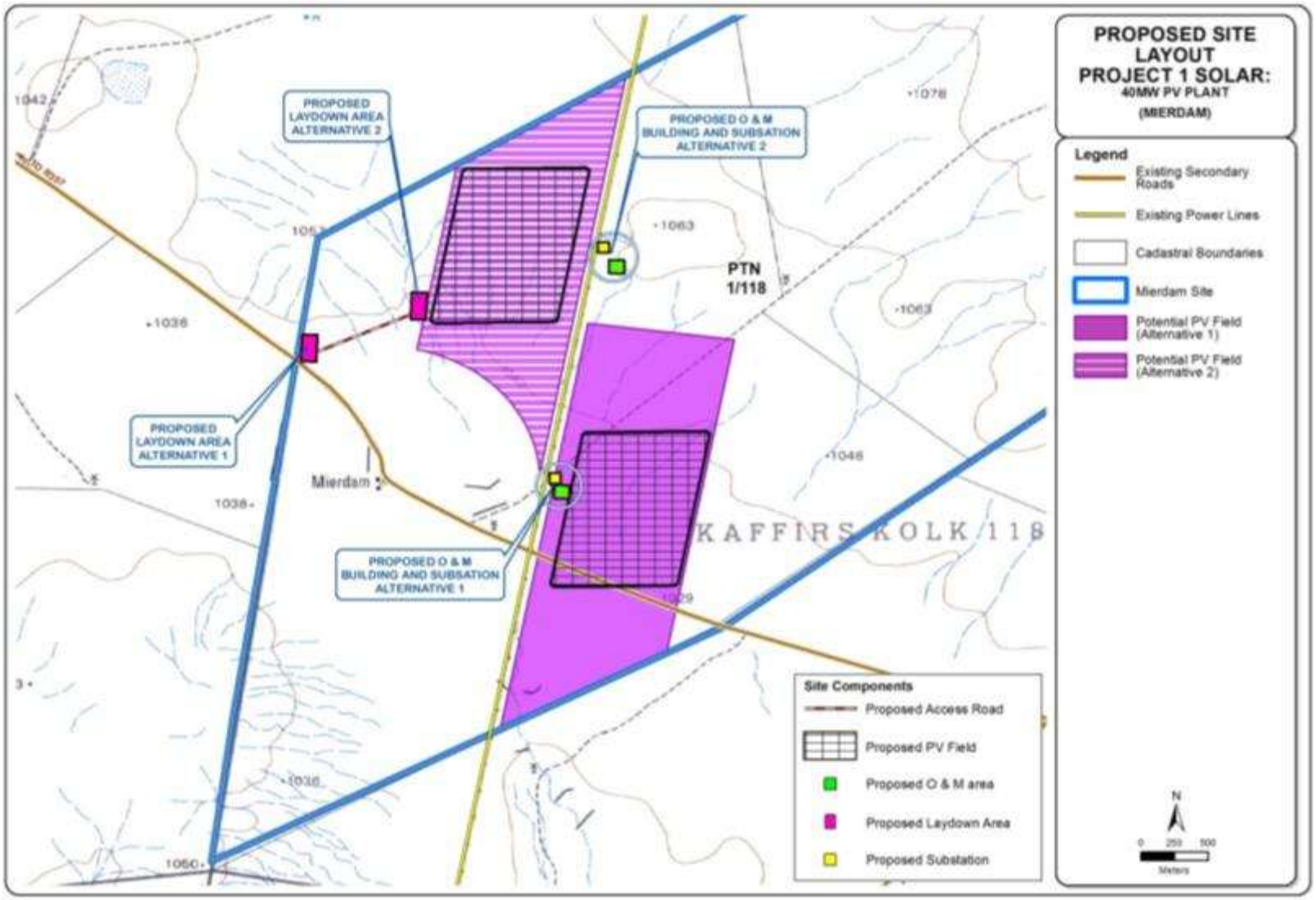


Figure i: Site layout alternatives

The site is characterised by Karoo vegetation and extensive sheep grazing dominates the land use and agricultural practices.

Specialist studies were conducted for the following environmental parameters, as part of the EIR Phase as stipulated in the Plan of Study for EIA:

- Biodiversity (including fauna, flora and avifauna)
- Surface Water
- Agricultural Potential and Soils
- Visual
- Geotechnical
- Heritage
- Socio-economic

Table i: Summary of findings

Environmental Parameter	Summary of major findings	Recommendations
Biodiversity	It is not likely that the proposed development will be to the detriment of the biodiversity of the region due to the pristine nature of the area. A number of particularly sensitive bird habitats and priority bird species were identified. In spite of the relatively low density and total number of species on the site in the context of the area's aridity, a number of birds that are important in a national and southern African context would occur on the site.	▪ A walk down of the more sensitive areas to avoid any trees if possible and potential rare mammal breeding sites is recommended. ▪ A formal monitoring and reporting strategy/protocol should be developed for monitoring the impact on the vegetation and biodiversity in general in the area during construction. ▪ If Red Data species are located during construction, the relevant permits must be applied for from the relevant authorities. ▪ The precautionary principle should be applied during the construction and care taken to implement the recommended mitigation measures.
Surface Water	Surface water features are not a significant part of the natural biophysical features on the site due to the very arid nature of the area, however they should be considered as sensitive features. The PV plant would have a physical footprint over most of the layout area, which is likely to physically alter any surface water features within its footprint. Roads and underground cabling can also have significant impacts on surface water features and therefore the mitigation measures (provided) will need to be adhered to.	▪ The PV layouts should be altered slightly to either avoid the drainage lines completely, or to ensure that these drainage lines are not physically affected by the proposed PV arrays. ▪ No power line towers should be located within any surface water feature.

Agricultural Potential and Soils	The site is not classified as high potential nor is it a unique dry land agricultural resource. Thestudy area has been classified as having an extremely low potential for crop production due to an arid climate and highly restrictive soil characteristics but are considered to have a moderately low value as grazing land, its current use. Normal grazing (the dominant agricultural activity) may be permitted within the PV fields. The proposed site is dominated by grazing land and this activity is considered of low sensitivity when assessed within the context of the proposed development. The impact of the proposed development on the study area's agricultural potential will be extremely low, with the loss of agricultural land being attributed to the creation of the service roads within the PV Fields. There are no centre pivots, irrigation schemes or active agricultural fields which will be influenced by the proposed development. Therefore, from an agricultural perspective, there are no problematic or fatal flaw areas for the site.	▪ Clearing activities should be kept to a minimum (road and PV site footprint). ▪ In the unlikely event that heavy rains are expected activities should be put on hold to reduce the risk of erosion. ▪ If additional earthworks are required, any steep or large embankments that are expected to be exposed during the 'rainy' months should either be armoured with fascine like structures. ▪ If earth works are required then storm water control and wind screening should be undertaken to prevent soil loss from the site. ▪ It is recommended that to the option of allowing seasonal grazing within the PV Fields be considered further by Mainstream in consultation with the landowner to further mitigate the loss of grazing land.
Visual	The likely visual impact of the proposed solar power plant from most of the key receptor locations has been determined to be insignificant. This is mainly due to the extensive distance between the PV layouts and the key observation locations. The thick vegetation that surrounds most receptor locations is also very effective in shielding the actual receptor location (household) from views of the proposed project. Farmsteads located within, or on the	▪ None.

	boundaries of the development site would potentially be subject to a greater degree of visual impact. However due to these farmsteads belonging to, and being inhabited by the owners of the properties on which the development is proposed, these locations are not thought to be sensitive, as they will benefit from the project financially	
Geotechnical	The site is underlain by a variety of bedrock parent materials including quartzite, sandstone and Tillite (consisting of consolidated masses of unweathered blocks and unsorted glacial till). The general succession of soil / rock at the site from a geotechnical engineering perspective is: ▪ Topsoil – generally loose sand/silt ▪ Bedrock – Weakly cemented Calcite / Sandstone / Siltstone becoming harder with depth	▪ Detailed geotechnical investigation will be required once the PV layout is confirmed, the substation site is selected and the plant layout has been finalised.
Heritage	Only three heritage sites (incl. features and objects)were identified on the proposed development site, which include two stone age sites a farmstead. All of which can be classed as having high significance on a regional level.	▪ Sensitive heritage resource areas are to be excluded as no-go areas and a sufficient buffer zones must be implemented. ▪ All suggested mitigation measures must be implemented and included in the EMPr for the proposed development.
Socio-economic	Apart from the possibility of temporary employment, overall the construction phase is characterised by negative low social impacts. In certain instances the implementation of mitigation measures can bring about positive changes. One such case	▪ Address all social issues identified during the EIA phase 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.

	would be the implementation of an effective HIV/AIDS prevention programme that extends to the local communities where construction workers will spend their free time, as this can also serve to inform and empower local people to make better and more informed decisions regarding their future (sexual) behaviour. Where Mainstream has the opportunity to bring about positive change to local communities they should pursue such opportunities where possible. Majority of impacts that would occur during the construction phase would affect people's sense of wellbeing and security within their social environment. A number of changes to the socio-economic environment would lead to economic impacts, but for the most part these impacts would be restricted to individuals or individual households and would not extend to the community at large. The presence of the solar facility during the operation and maintenance phase overall will have a low positive impact, although certain elements will yield medium positive impacts whereas other elements are expected to have a more negative connotation. Most positive impacts are of an economic nature, most significantly Mainstream's corporate social investment in the area, which in turn could lead to an array of other positive social upliftment projects (outside the scope of this study). Negative impacts are expected to be on the low side and would in all probability be over-	▪ Inform neighbouring landowners beforehand of any construction activity that is going to take place in close proximity to their property. Inform them of the number of people that will be on site and on the activities they will engage in. ▪ Ensure that 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.

	shadowed by the more positive contributions that Mainstream will make to the area through their CSI.	

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 project.

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

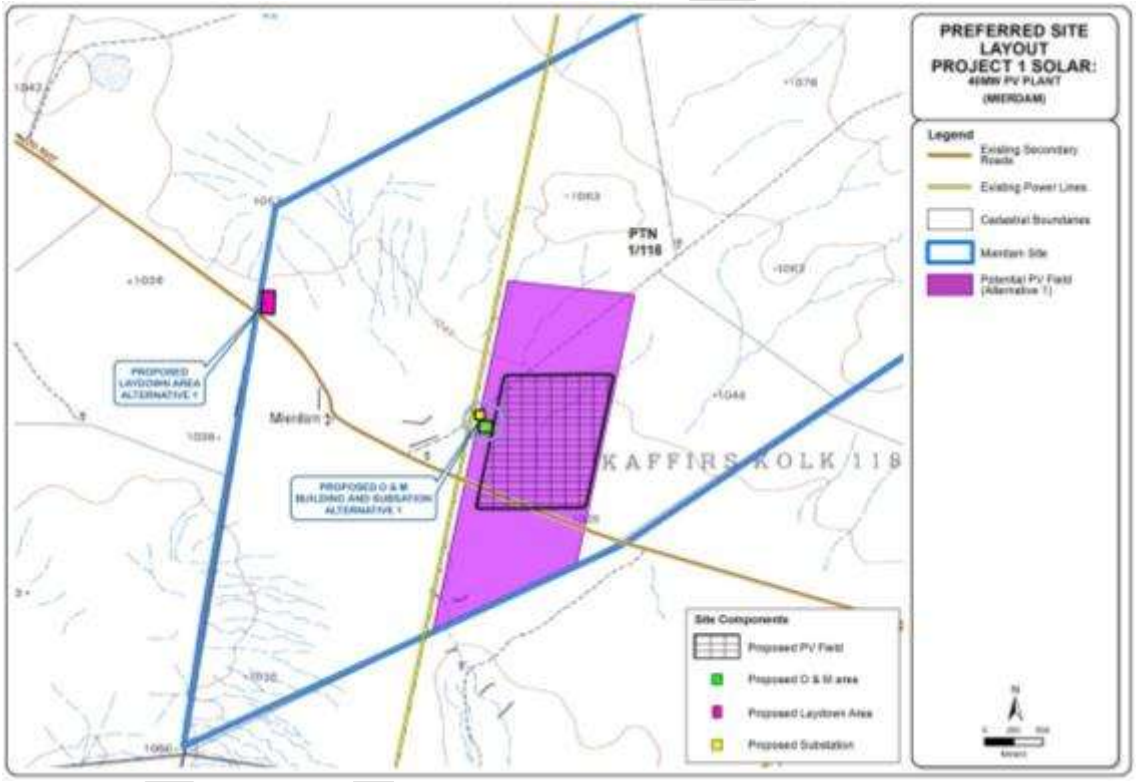


Figure ii: Preferred site layout

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

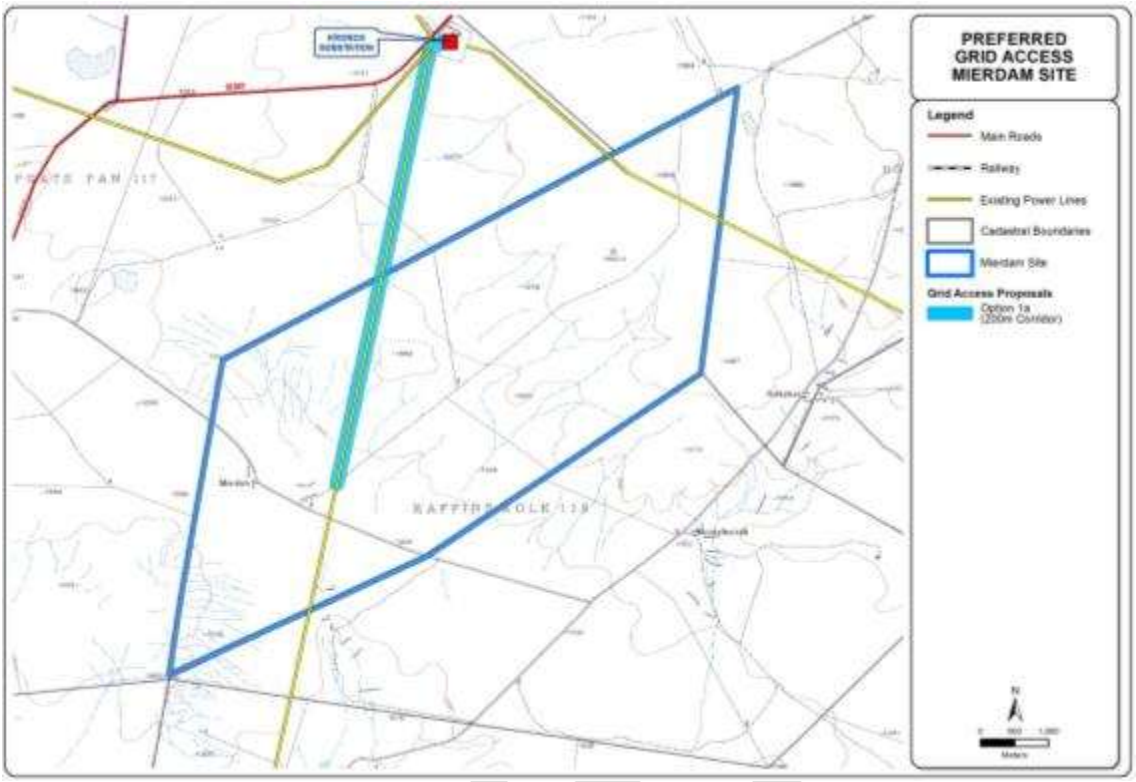


Figure iii: Preferred grid access

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

MAINSTREAM RENEWABLE POWER

PROPOSED CONSTRUCTION OF A 40MW SOLAR PHOTOVOLTAIC (PV) PLANT ON MIERDAM FARM NEAR PRIESKA, NORTHERN CAPE PROVINCE OF SOUTH AFRICA

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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.

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.

Greenhouse gas: Gases (primarily carbon dioxide, methane, and nitrous oxide) in the earth's lower atmosphere that trap heat, thus causing an increase in the earth's temperature and lead towards the phenomenon of global warming.

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

Heritage Significance Grades:
a) Grade I: Heritage resources with qualities so exceptional that they are of special national significance;
(b) Grade II: Heritage resources which, although forming part of the national estate, can be considered to have special qualities which make them significant within the context of a province or a region; and
(c) Grade III: Other heritage resources worthy of conservation,

Hydromorphic / 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).

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.

Renewable Energy: Energy which harnesses naturally occurring non-depletable sources of energy, such as solar, wind, hydro, tidal wave, ocean current and geothermal, or a combination of these energy types, to produce electricity.

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

Social change processes: Processes that are set in motion by project activities and policies. They take place independently of a social context and can lead to several other processes. Depending on the characteristics of the local social setting and mitigation process that are put in place, social change process can lead to social impacts (Vanclay and Slootweg, 2003).

Social impacts: Theconsequences to human populations of any public or private actions that alter the ways in which people live, work, play, relate to one another, organise to meet their needs and generally live and cope as members of society. These impacts are felt at various levels, including individual level, family or household level, community, organisation or society level. Some social impacts are felt by the body as physical reality, while other social impacts are perceptual or emotional (Vanclay, 2002).

Stone Age: The first and longest part of human history is the Stone Age, which began with the appearance of early humans between 3-2 million years ago. Stone Age people were hunters, gatherers and scavengers who did not live in permanently settled communities. Their stone tools preserve well and are found in most places in South Africa and elsewhere.
Early Stone Age 2 000 000 - 150 000 Before Present
Middle Stone Age 150 000 - 30 000 BP
Late Stone Age 30 000 - until c. AD 200

Sustainable Development: Integration of social, economic and environmental factors into planning, implementation and decision-making so as to providing for the needs of the present without impairing the ability of future generations to meet their own needs.

List of Abbreviations

AIA	Archaeological Impact Assessment
C&RR	Comments and Response Report
CPV	Concentrating Photovoltaic
BID	Background Information Document
DEA	Department of Environmental Affairs
DEAT	Department of Environmental Affairs and Tourism (currently known as DEA)
DSR	Draft Scoping Report
DWA	Department of Water Affairs
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EIR	Environmental Impact Report
EMPr	Environmental Management Programme
ENPAT	Environmental Potential Atlas
EP	Equator Principles
EPFI	Equator Principles Financial Institutions
EWT	Endangered Wildlife Trust
FGM	Focus Group Meeting
FSR	Final Scoping Report
GHG	Greenhouse gas
GIS	Geographic Information System
HIA	Heritage Impact Assessment
I&APs	Interested and Affected Parties
IDP	Integrated Development Plan
IFC	International Finance Corporation
IPP	Independent Power Producer
IUCN	International Union for the Conservation of Nature and Natural Resources
IRP	Integrated Resource Plan
IUCN	International Union for the Conservation of Nature and Natural Resources
KSW	Key Stakeholder Workshop
kV	Kilo Volt
LSA	Late Stone Age
LM	Local Municipality
MAP	Mean Annual Precipitation
MW	Megawatt
MWp	Megawatt peak
NCDTEC	Northern Cape Department of Tourism, Environment and Conservation
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998)
NEMBA	National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)
NERSA	National Energy Regulator of South Africa

NGO	Non-Government Organisations
NHRA	National Heritage Resources Act, 1999 (Act No. 25 of 1999)
NWA	National Water Act, 1998 (Act No. 36 of 1998)
PM	Public Meeting
PPA	Power Purchase Agreement
PPP	Public Participation Process
PSRs	Potentially Sensitive Receptors
PV	Photovoltaic
REFIT	Renewable Energy Feed-In Tariff
SAHRA	South African Heritage Resources Agency
SANBI	South African National Biodiversity Institute
SAWS	South African Weather Service
SIA	Social Impact Assessment
SKA	Square Kilometre Array
WESSA	Wildlife and Environment Society of South Africa

MAINSTREAM RENEWABLE POWER

PROPOSED CONSTRUCTION OF A 40MW SOLAR PHOTOVOLTAIC (PV) PLANT ON MIERDAM FARM NEAR PRIESKA, NORTHERN CAPE PROVINCE OF SOUTH AFRICA

DRAFT ENVIRONMENTAL IMPACT REPORT

1 INTRODUCTION

South Africa Mainstream Renewable Power Mierdam (Pty) Ltd (hereafter referred to as Mainstream) has appointed SiVEST as independent consultants to conduct an Environmental Impact Assessment for the proposed establishment of a Concentrated Photovoltaic / Photovoltaic (CPV/PV) plant nearPrieska in theNorthern Cape Province, South Africa. 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 utilised.

This proposed PV facility forms one component of the overall wind and solar energy facilities that Mainstream are proposing to develop on both Mierdam Farm and Platsjambok Farm (Figure 1). In the scoping phase the project the environmental issues for both renewable energy facilities on the two farm portions were assessed in one report. However, during the EIA phase the solar facility and PV plant have been split-up into their various phases. This has been done in order to ensure that the impacts of each proposed facility are comprehensively assessed. The Department of Energy also require that each phase of a renewable energy facility be allocated an individual reference number. As such, the original application forms for each proposed project were amended and separate DEA reference numbers have been allocated for each project as follows:

Wind

- **Mierdam 40MW:**
  DEA Ref. No: 12/12/20/2320/1 & NEAS Ref. No: DEA/EIA/0000380/2011
- **Platsjambok 100MW:**
  DEA Ref. No: 12/12/20/2320/3 & NEAS Ref. No: DEA/EIA/0001076/2012

PV Solar

- **Mierdam 40MW:**
  DEA Ref. No: 12/12/20/2320/2 & NEAS Ref. No: DEA/EIA/0000582/2011
- **Platsjambok West 75MW:**
  DEA Ref. No:12/12/20/2320/5 & NEAS Ref. No: DEA/EIA/0001078/2012
- **Platsjambok East 75MW:**
  DEA Ref. No: 12/12/20/2320/4 & NEAS Ref. No: DEA/EIA/0001077/2012

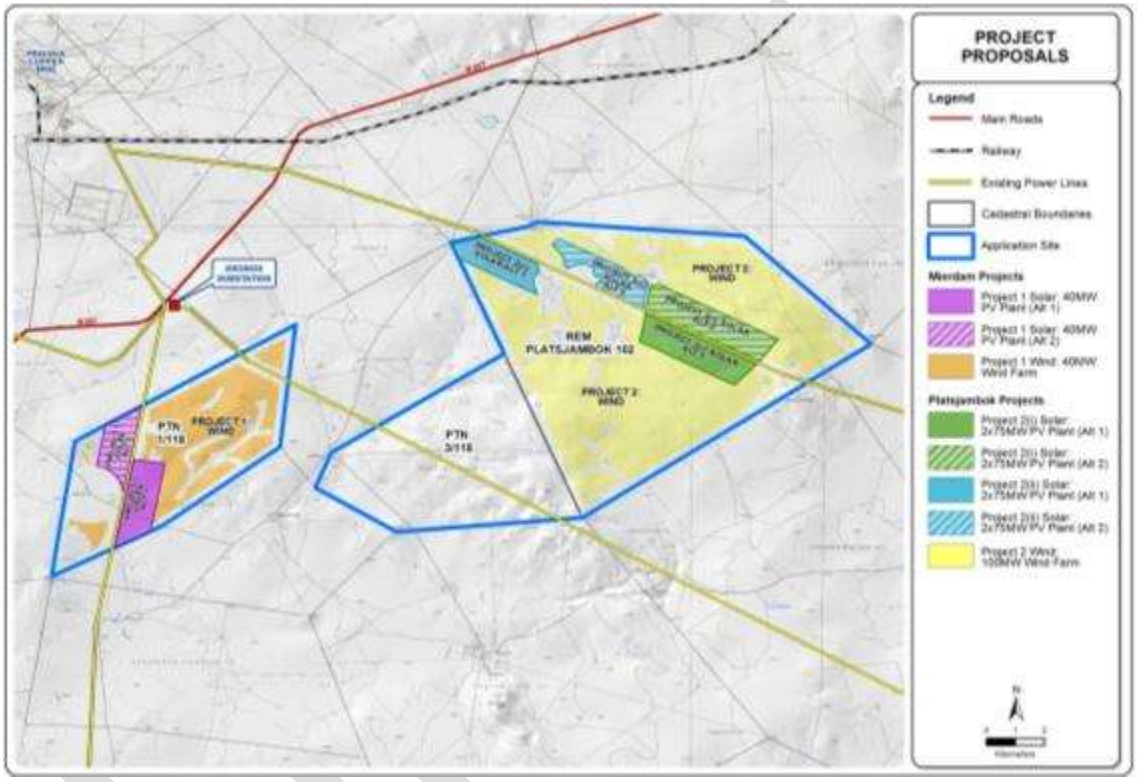

Figure 1: Proposed wind and solar project on Mierdam and Platsjambok Farm

It is important to note that in effect Mainstream intend to develop solar facilitys on both Mierdam Farm and Platsjambok Farm, howeverthe PV facilities have been proposed as an alternative means of generating renewable power, should it be determined that the solar facility is not a feasible option.

In terms of the Environmental Impact Assessment Regulations (2010) published under the National Environmental Management Act (No 107 of 1998) (NEMA) 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 now in the EIA phase.

This report has been 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).

This 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 5gives detailed technical descriptions of the CPV/PV power plant as well as the alternatives involved.
- Chapter 6 provides a 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 CPV/ PV power plant.
- 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) 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 BankStandards and Equator Principles.
- Chapter 14summarises the findings and recommendations per specialist study and provides the overall conclusion.
- Chapter 15lists 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 report are detailed in Table 1 below.

Table 1: Project Team

Name and Organisation	Role
Kelly Tucker – SiVEST	Project Leader
Andrea Gibb – SiVEST	Report compilation, Public participation
Liesl Koch – SiVEST	Biodiversity (Flora and Fauna)
Paul da Cruz – SiVEST	Surface water, Visual, Avifauna
Kurt Barichievy – SiVEST	Soils and Agricultural Potential
Johnny Van Schalkwyk	Heritage
Nonka Byker – MasterQ	Social
Sean Smith – MasterQ	
An Kritzinger – MasterQ	Economic
Bernard Casey – Mainstream	Geotechnical
Kerry Schwartz – SiVEST	GIS and Mapping
Nicolene Venter – SiVEST	Public participation

Please refer to Appendix 2 for CV's of each team member. Declarations of independence are included in Appendix 8.

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 since been amended on several occasions from this date. This Act replaces parts of the Environment Conservation Act (Act No 73 of 1989) with exception to certain parts pertaining to 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.

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

1.3.2 NEMA EIA Requirements

Sections 24 and 44 of NEMA make provision for the promulgation of regulations that identify activities which may not commence without an environmental authorisation, the result being that NEMA now governs the EIA process with the said promulgation of the EIA Regulations in April 2006 (Government Gazette No. 28753 of 21 April 2006). These regulations have subsequently been replaced by the NEMA EIA 2010 Regulations listed in Government Gazette No. 33306 of 18 June 2010 (GN543, 544, 545 and 546 of 18 June 2010, as amended). The NEMA EIA 2010 Regulations are contained in four Government Notices and came into effect on 2 August 2010, as amended.

Apart from other matters regulating the EIA process and related matters, Government Notice (GN) No. R.543 sets out two distinct authorisation processes. Depending on the nature of listed activity that is proposed to be undertaken, either a so-called “basic assessment” process or a so-called “scoping and EIA” process is required to apply for an environmental authorisation in terms of NEMA. GN No. R.544 lists activities that require a Basic Assessment (BA), GN No. R.545 lists activities that require scoping and an Environmental Impact Assessment (EIA) and GN No. R.546

lists activities that only require an environmental authorisation, through a basic assessment process, if the activity is undertaken in a specific geographical area indicated in the listing notice.

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 2: Listed activities in terms of the NEMA Regulations

Number and date of the relevant notice:	**Activity No (s)**	**Description of listed activity**
Government Notice R544 (18 June 2010)	Activity 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*
	Activity 11	The construction of: (xi) infrastructure or structures covering 50 square metres or more where such construction occurs within a watercourse or within 32 metres of a watercourse, measured from the edge of a watercourse, excluding where such construction will occur behind the development setback line.
	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; -*
	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 land 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	Physical alteration of undeveloped, vacant or derelict land for

	15	residential, retail, commercial, recreational, industrial or institutional use where the total area to be transformed is 20 hectares or more.
Government Notice R546 (18 June 2010)	Activity 4	The construction of a road wider than 4 metres with a reserve less than 13,5 metres - a) In Eastern Cape, Free State, KwaZulu-Natal, Limpopo, Mpumalanga and Northern Cape provinces: *ii) Outside urban areas, in:* *a) A protected area identified in terms of NEMPAA, excluding conservancies;* *b) National Protected Area Expansion Strategy Focus areas;* *c) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority;* *d) Sites or areas identified in terms of an International Convention;* *e) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;* *f) Core areas in biosphere reserves;* *g) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core areas of a biosphere reserve;*
	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;*
	Activity 13	The clearance of an area of 1 hectare or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation, except where such removal of vegetation is required for: 1) the undertaking of a process or activity included in the list

		of waste management activities published in terms of section 19 of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008), in which case the activity is regarded to be excluded from this list;

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

The protection and management of South Africa's heritage resources is primarily regulated by the National Heritage Resources Act, 1999 (Act 25 of 1999) (NHRA). The law ensures community participation in the protection of national heritage resources and involves all three levels of government (national, provincial and local) in the management of the country's national heritage. The South African Heritage Resources Agency (SAHRA) is the enforcing authority for the NHRA.

In terms of the Act, various forms of heritage resources (such as graves, certain trees, archaeological artefacts, fossil beds etc.), are afforded protection and a permit may be required to destroy, damage, excavate, alter, etc. protected heritage resources).

Furthermore, in terms of section 38 of the NHRA, the responsible heritage resources authority can call for a Heritage Impact Assessment (HIA) where certain categories of development are proposed. The provisions of section 38 do not apply to a development if an evaluation of the impact of such development on heritage resources is required in terms of (among other legislation), NEMA. This is subject to the proviso that the consenting authority must ensure that the evaluation fulfils the requirements of the relevant heritage resources authority in terms of section 38(3) and that any comments and recommendations of the relevant heritage resources authority with regard to such development have been taken into account prior to the granting of the consent.

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

1.3.4 National Water Act (Act No 36 of 1998)

The National Water Act 1998 (Act 36 of 1998 (NWA) provides a framework to protect the water resources of South Africa.

In the context of the proposed project and any potential impact on water resources, there are two aspects of the NWA which are of key importance.The first is the mechanism for authorising various water uses (as detailed in section 21 of the NWA). If any water uses are to be undertaken as part of the project they will need to be authorised in accordance with one of the mechanisms

created under the NWA, which include Schedule 1 water uses, generally authorised water uses and licensing of water uses.

In terms of section 19 of the NWA; "*An owner of land, a person in control of land or a person who occupies or uses the land on which any activity or process is or was performed or undertaken; or any other situation exists, which causes, has caused 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;
- Compliance with any prescribed waste standard or management practice;
- Containment or prevention of the movement of pollutants;
- Remediation of the effects of the pollution; and
- Remediation of 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 Northern Cape Nature Conservation Act, 2009 (Act No. 9 of 2009)

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 in terms of this legislation. The Northern Cape Nature Conservation Act, 2009 (Act No. 9 of 2009) and the Nature and Environmental Conservation Ordinance 19 of 1974 are of relevance to the Northern Cape Province.

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

1.3.6 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.

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

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

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

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

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

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

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

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

- Promote the sustainable management and development of forests for the benefit of all;
- Provide special measures for the promotion of certain forests and trees;

- Promote the sustainable use of forests for environmental, economic, educational, recreational, cultural, health and spiritual purposes;
- Promote greater participation in all aspects of forests and the forest products industry by persons disadvantaged by unfair discrimination.

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 34595 Notice Number 734 of the 16 September 2011. 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 protected tree species may be damaged, disturbed, cured, destroyed or removed. As mentioned by Jacoline Mans from the Department of Forestry and Fisheries (DAFF), protected *Boscia albitrunca* is known to occur near Prieska and if affected by the proposed development, a Forest Act License would be required to cut and destroy the protected trees.

1.3.9 Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) (CARA)

The Conservation of Agricultural Resources Act (CARA) and the Regulations promulgated under that Act are designed to protect natural agricultural resourcesand to promote inter alia water sources and vegetation in South Africa.

The primary objective of the Act is to conserve natural agricultural resources by:

- maintaining the production potential of land;
- combating and preventing erosion and weakening or destruction of the water resources;
- protecting vegetation; and
- combating weeds and invaders plants.

The ambit of the CARA is however limited, as land situated within the ambit of an "urban area[1]" **does not** fall within the ambit of the CARA, except in so far as the Act relates to weeds and invader plants.

[1] "**Urban area**" is defined to include any land which is under the control of a local authority (subject to certain exclusions) and land which is subdivided into erven or lots.

The CARA is relevant to the proposed project as the construction of a solar plant may impact on agricultural resources and vegetation on the site. The CARA prohibits the spreading of weeds and prescribes control measures that need to be complied with in order to achieve this. As such, measures will need to be taken to protect agricultural resources and prevent weeds and exotic plants from invading the site as a result of the proposed development.

An agricultural potential assessment has been conducted to explore how the proposed development may impact on the agricultural production potential of the proposed site.

1.3.10 Subdivision of Agricultural Land Act No. 70 of 1970, as amended

The Subdivision of Agricultural Land Act No. 70 of 1970 controls the subdivision of all agricultural land in South Africa; prohibiting certain actions pertaining to agricultural land. Under the Act the owner of agricultural land is required to obtain consent from the Minister of Agriculture in order to subdivide agricultural land.

The purpose of the Act is to prevent uneconomic farming units from being created and degradation of prime agricultural land. To achieve this purpose the act also regulates leasing and selling of agricultural land as well as registration of servitudes.

The Act is of relevance to the proposed development as any land within the study area that is zoned for agricultural purposes will be regulated by this Act.

Although the whole of this Act has been repealed by section 1 of the Subdivision of Agricultural Land Act Repeal Act 64 of 1998, this Repeal Act has not been implemented and no date of coming into operation has been proclaimed.

It is important to note that the implementation of this Act is problematic as the Act defines 'Agricultural Land' as being any land, except land situated in the area of jurisdiction of a municipality or town council, and subsequent to the promulgation of this Act uninterrupted Municipalities have been established throughout South Africa.

1.3.11 National Road Traffic Act No. 93 of 1996, as amended

The National Road Traffic Act (NRTA) No. 93 of 1996 provides for all road traffic matters and is applied uniformly throughout South Africa. The Act enforces the necessity of registering and licensing motor vehicles. It also stipulates requirements regarding fitness of drivers and vehicles as well as making provision for the transportation of dangerous goods.

All the requirements stipulated in the NRTA will need to be complied with during the construction and operational phases of the proposed photovoltaic plant.

1.3.12 Astronomy Geographic Advantage Act No. 21 of 2007

The Astronomy Geographic Advantage Act No. 21 of 2007 provides for:

- The preservation and protection of areas that are uniquely suited for optical and radio astronomy;
- Intergovernmental cooperation and public consultation on matters concerning nationally significant astronomy advantage areas and matters connected therewith.

In terms of section 7(1) and 7(2) of this Act, the Minister declared core astronomy advantage areas on 20 August 2010 under Regulation No. 723 of Government Notice No. 33462. As such, all land within a 3 Kilometer radius of the center of the Southern African large Telescope (SALT) dome located in the Northern Cape Province, falls under the Sutherland Core Astronomy Advantage Area. The declaration also applies to the core astronomy advantage area containing the MeerKAT radio telescope and the core of the planned Square Kilometre Array (SKA) radio telescope.

Under Section 22(1) of the Act the Minister has the authority to protect the radio frequency spectrum for astronomy observations within a core or central astronomy advantage area. As such, the Minister may still under section 23(1) of the Act, declare that no person may undertake certain activities within a core or central astronomy advantage area. These activities include the construction, expansion or operation; of any fixed radio frequency interference source, facilities for the generation, transmission or distribution of electricity, or any activity capable of causing radio frequency interference or which may detrimentally influence the astronomy and scientific endeavours.

The South African SKA was notified of the proposed project, provided with the opportunity to comment on the project and a meeting was held with SiVEST, the project proponent and the South African SKA on Friday 14 October 2011.

During the scoping phase (17 November 2011) comments were received from the Southern African SKA, noting that a high-level impact assessment of the proposed construction of a photovoltaic (PV) facility on SKA stations located nearest the proposed site was undertaken. The results of the assessment showed the PV plant will pose a medium to high risk of detrimental impact on the SKA and mitigation measures will be required.

In response to these comments, the PV plants were positioned closer to the existing electromagnetic disturbance created by the power lines that traverse the proposed development site.

1.3.13 Additional Relevant Legislation

- Occupational Health and Safety Act (Act 85 of 1993)
- National Environmental Management: Air Quality Act, 2004
- National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008)
- Development Facilitation Act No. 67 of 1995
- Northern Cape Planning and Development Act, 1998 (Act No. 7 of 1998)

1.4 Equator Principles (EPs)

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

Principle 1: Review and Categorisation
When a project is proposed for financing, the Equator Principles Funding Institution ("EPFI") will categorise the project based on the magnitude of its potential impacts and risks.

Principle 2: Social and Environmental Assessment
For each project assessed as being either Category A or Category B, the client / borrower must conduct a Social and Environmental Assessment ("Assessment") process to address the relevant impacts and risks of the proposed project. The Assessment should also propose mitigation and management measures relevant and appropriate to the nature and scale of the proposed project.

Principle 3: Applicable Social and Environmental Standards
The Assessment will refer to the applicable IFC Performance Standards and applicable Industry Specific EHS Guidelines.

Principle 4: Action Plan and Management System
The client / borrower must prepare an Action Plan ("AP") or management system that addresses the relevant findings, and draws on the conclusions of the Assessment. The AP will describe and prioritise the actions needed to implement mitigation measures, corrective actions and monitoring

measures necessary to manage the impacts and risks identified in the Assessment. The management measures are required to comply with the applicable host country, social and environmental laws and regulations, and requirements of the applicable Performance Standards and EHS Guidelines, as defined in the AP.

Principle 5: Consultation and Disclosure

The client / borrower or third party expert must consult with project affected communities in a structured and culturally appropriate manner. For projects with significant adverse impacts on affected communities, the process will ensure their free, prior and informed consultation and facilitate their informed participation as a means to establish, to the satisfaction of the EPFI, whether a project has adequately incorporated affected communities' concerns.In order to accomplish this, the non-technical summaries must be made available to the public by the borrower for a reasonable minimum period in the relevant local language and in a culturally appropriate manner.

Principle 6: Grievance Mechanism

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

Principle 7: Independent Review

For all Category A projects and, as appropriate, for Category B projects, an independent social or environmental expert not directly associated with the borrower must review the Assessment, AP and consultation process documentations in order to assist the EPFIs due diligence, and assess Equator Principles compliance.

Principle 8: Covenants

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

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

with relevant local, state and host country social and environmental laws, regulations and permits

- To decommission the facilities, where applicable and appropriate, in accordance with an agreed decommissioning plan

Principle 9: Independent Monitoring and Reporting

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

Principle 10: EPFI Reporting

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

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

- The "Equator Principles" 2006
- International Finance Corporations Performance Standards on Social and Environment, IFC, April, 2006 namely:
    - Performance Standard 1: Social and Environmental Assessment and Management Systems
    - Performance Standard 2: Labor and Working Conditions
    - Performance Standard 3: Pollution Prevention and Abatement
    - Performance Standard 4: Community Health, Safety and Security
    - Performance Standard 5: Land Acquisition and Involuntary Resettlement
    - Performance Standard 6: Biodiversity Conservation and Sustainable Natural Resource Management
    - Performance Standard 7: Indigenous Peoples
    - Performance Standard 8: Cultural Heritage

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

The Environmental, Health, and Safety (EHS) Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP). These EHS Guidelines are applied as required by the World Bank's respective policies and standards.

These General EHS Guidelines are designed to be used together with the relevant Industry SectorEHS Guidelines which provide guidance to users on EHS issues in specific industry sectors.

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

1.5 Key Development Strategies and Guidelines

1.5.1 Integrated Development Plans

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

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

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

Each municipality is required to produce an IDP which would address pertinent issues relevant to their municipality. However, common concerns include municipal transformation and development, and service delivery and infrastructural development.

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

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

The site falls within the Northern Cape District Management Area 07 (NCDMA) of the Pixley ka Seme District Municipality. According to the DistrictIDP for 2010/11 (IDP, 2010), there is a lack of access to electricity in the district municipality, which is largely due to poor maintenance, slow implementation and very few new household connections. The core needs of the district municipality in terms of electricity are to:

- Implement free basic electricity;
- Provide access to electricity or alternative sources of energy to all;
- Undertake a desktop survey on alternative sources of electricity;

- Upgrade and maintain the electricity network; and
- Provide area lighting.

One of the service delivery priorities of the municipality is to provide all households with access to electricity by 2014, by fast tracking the process of delivering free basic electricity (Pixley ka Seme District Municipality, IDP Process Plan and District Framework for 2010/11).

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

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

The Integrated Energy Plan (IEP), developed by the former DME (now DMR), 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 the environment is considered with regard to energy supply, transformation and end use. This project is thus in line with the goals of the IEP and will assist with implementing the plan.

1.5.4 Independent Power Producer Process

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

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

- Country Process

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

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

In August 2009, the Department of Energy (DoE) gazetted the Electricity Regulations on New Generation Capacity under the ERA. The New Generation Regulations establish rules and

guidelines that are applicable to the undertaking of an IPP Bid Programme and the procurement of an IPP for new generation capacity. They also facilitate the fair treatment and non-discrimination between IPPs and the buyer of the energy.

- Formal Programmes

In terms of the New Generation Regulations, the Integrated Resource Plan (IRP) will be developed by the DoE and will set out the new generation capacity requirement per technology, taking energy efficiency and the demand-side management projects into account. This required, new generation capacity to 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.

The table below highlights the energy plan that has been proposed until 2030.

Table 3: Government Energy Plans up until 2030 in terms of the IRP

New Build Options								
	Coal	**Nuclear**	**Import Hydro**	**Gas - CCGT**	**Peak - OCGT**	**Wind**	**CSP**	**Solar PV**
2010	0	0	0	0	0	0	0	0
2011	0	0	0	0	0	0	0	0
2012	0	0	0	0	0	0	0	300
2013	0	0	0	0	0	0	0	300
2014	500	0	0	0	0	400	0	300
2015	500	0	0	0	0	400	0	300
2016	0	0	0	0	0	400	100	300
2017	0	0	0	0	0	400	100	300
2018	0	0	0	0	0	400	100	300
2019	250	0	0	237	0	400	100	300
2020	250	0	0	237	0	400	100	300
2021	250	0	0	237	0	400	100	300
2022	250	0	1143	0	805	400	100	300
2023	250	1600	1183	0	805	400	100	300
2024	250	1600	283	0	0	800	100	300
2025	250	1600	0	0	805	1600	100	1000
2026	1000	1600	0	0	0	400	0	500
2027	250	0	0	0	0	1600	0	500
2028	1000	1600	0	474	690	0	0	500
2029	250	1600	0	237	805	0	0	1000
2030	1000	0	0	948	0	0	0	1000
	6250	**9600**	**2609**	**2370**	**3910**	**8400**	**1000**	**8400**

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

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

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

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

To start renewable energy procurement in order to achieve targets as in the IRP the DoE has launched a call for renewable energy projects issued on the 3rd of August 2011. The request for qualification and proposals for new generation capacity under the IPP procurement programme will have a continuous roll out and milestones until the end of 2013. Once the Regulator has approved the bidder's associated PPA, the bidder may be licensed as a generator and grid connection may be possible.

2 APPROACH TO UNDERTAKING THE STUDY

The Environmental Impact Assessment was undertaken in accordance with the EIA 2010 Regulationslisted in Government Gazette No. 33306 of 18 June 2010 (GN 543, 544, 545 and 546 of 18 June 2010, as amended),in terms of Section 24 and 44 of the National Environmental Management Act, (No 107 of 1998) (NEMA) 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 as well as the studies which were required to be undertaken as part of the EIA-phase of the project. The Draft Scoping Report (DSR) was made available for public review from Monday 10 October 2011 to Monday21 November 2011. Comments received on the Draft Scoping Report were included in the Final Scoping Report (FSR) which was submitted to the DEA. The DEA accepted the FSR on the 27 March 2012.

The following studies were taken through into the EIA Phase:

- Biodiversity Assessment (including fauna, flora and avifauna)
- Surface Water Assessment
- Agricultural Potential and Soils Assessment
- Visual Impact Assessment
- Geotechnical Assessment
- Heritage Impact Assessment
- Socio-economic Assessment

2.2 Authority Consultation

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

- An application was submitted to DEA on the 30th of June 2011 and acknowledged on the 13th of July 2011.
- Following amendments to this original application, the project application was acknowledged on the on10October 2011. The following two reference numbers were allocated to the project:
    - Solar facility reference numbers:
      DEA: 12/12/20/2320/1
      NEAS: DEA/EIA/0000380/2011
    - PV Plant reference numbers:
      DEA: 12/12/20/2320/2
      NEAS: DEA/EIA/0000380/2011
- The Final Scoping Report was submitted to the National Department of Environmental Affairs (NDEA) on 02 December 2011.
- Approval of the Final Scoping Report was received on 27 March 2012.
- On 23 February 2012 amended application forms were submitted to the DEA in order to divide the wind and PV projects up into their various phases. The DEA acknowledged having received the amended application forms on 09 March 2012 and noted that they will respond in due course. The new reference number were received on 27 March 2012 and all stakeholders were notified of the changes in the EIA newsletter which was distributed on 28 March 2012. These are as follows:

Wind

- **Mierdam 40MW:**
  DEA Ref. No: 12/12/20/2320/1 & NEAS Ref. No: DEA/EIA/0000380/2011
- **Platsjambok 100MW:**
  DEA Ref. No: 12/12/20/2320/3 & NEAS Ref. No: DEA/EIA/0001076/2012

PV Solar

- **Mierdam 40MW:**
  DEA Ref. No: 12/12/20/2320/2 & NEAS Ref. No: DEA/EIA/0000582/2011
- **Platsjambok West 75MW:**
  DEA Ref. No:12/12/20/2320/5 & NEAS Ref. No: DEA/EIA/0001078/2012
- **Platsjambok East 75MW:**
  DEA Ref. No: 12/12/20/2320/4 & NEAS Ref. No: DEA/EIA/0001077/2012

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

Consultation with other relevant authorities was and is also being undertaken via meetings and telephonic consultation in order to actively engage them and provide them with information and gain their feedback.

Authorities and key stakeholders consulted include the following:

- National Government
- Northern Cape Provincial Government
- Northern Cape Department of Economic Development and Tourism (NCDTEC).
- Pixley ka Seme District Municipality
- Siyathemba Local Municipality
- Department of Water Affairs (DWA)
- Department of Agriculture Forestry and Fisheries (DAFF)
- South African National Roads Agency Limited (SANRAL)
- Northern Cape Department of Roads and Public Works
- South African Heritage Resources Agency (SAHRA)
- Northern Cape Department of Heritage
- Eskom
- Square Kilometre Array (SKA)
- Air Traffic Navigation Services (ATNS)
- Transnet Freight Rail
- Telkom SA
- Endangered Wildlife Trust (EWT)
- Wildlife and Environment Society of South Africa (WESSA)
- Birdlife South Africa

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 been 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

South Africa is the largest emitter of greenhouse gases (GHG) in Africa and the one of the most carbon emission-intensive countries in the world. Despite the worldwide concern regarding GHG emissions and climate change, South Africa continues to rely heavily on coal as its primary source of energy, while most of the countries renewable energy resources remain largely untapped (DME, 2003).

Coupled with this, is the growing demand for electricity in South Africa. According to Eskom, the demand for electricity in South Africa has been growing at approximately 3% per annum. This factor fueled by increasing economic growth and social development within Southern Africa, is placing increasing pressure on South Africa's existing power generation capacity.

As the demand for electricity grows, so too the awareness of environmental impacts, climate change and the need for sustainable development. There is therefore an increasing need to establish a 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.

As one of its strategies to meet future energy consumption requirements, the country is opting for the use of renewable energy technologies, which is fast becoming an important energy option for South Africa. The use of renewable energy technologies is also being investigated as part of Eskom's long-term strategic planning and research process as one of a mix of technologies needed to meet future energy consumption requirements. It is within this context that Mainstream plan to establish a photovoltaic plant near Prieska, Northern Cape Province.

The Government of South African is also committed to growing the renewable energy industry in South Africa. This is supported by the *White Paper on Renewable Energy* which sets out the Government's principals, goals and objectives for promoting and implementing renewable energy in South Africa. In order to achieve the long term goal of achieving a sustainable renewable energy industry, the Government has set a medium term target of contributing 10 000 *GWh* of renewable energy to the final energy consumption by 2013 – approximately 4% of the estimated electricity demand. This target is to be produced mainly through biomass, wind, solar and small scale hydro (DME, 2003).

In addition the *White Paper on Energy Policy of the Republic of South Africa*, which sets out the Governments policy regarding the supply and consumption of energy, prioritizes the need to stimulate the development of renewable energy sources. It is also concerned with meeting the challenge of ensuring that; economically feasible technologies and applications are implemented, national resources are equitably invested in renewable technologies and constraints on the development of renewable industry are addressed (DME, 1998).

According to the solar map (Figure 2) the Northern Cape region of South Africa has the highest concentration of solar energy in the world hence; 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.

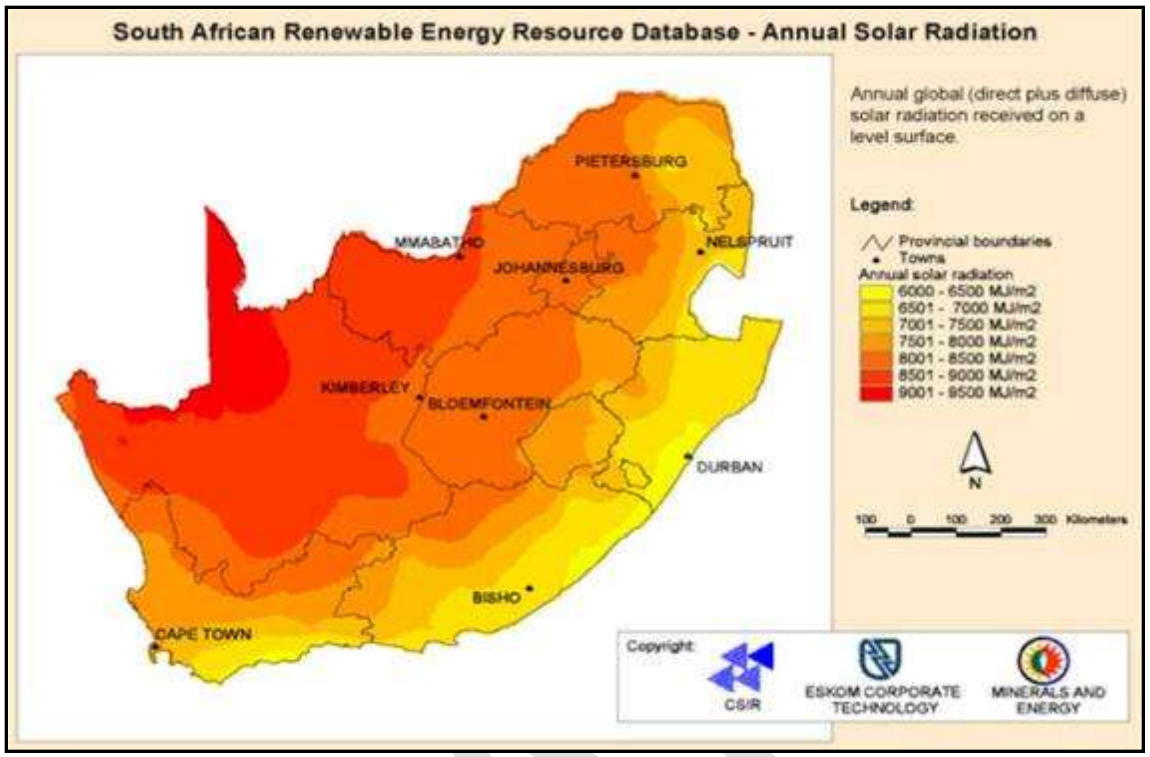

Figure 2: National Solar Resource Map (Source: Solar Vision, 2010)

In addition, CPV/PV plants have been identified as potentially being viable and capable of being employed on a large scale. This project will therefore have the potential to make significant contribution to the electricity stabilization and reduce load shedding.

It is important to note that the current CPV/ PV market in South Africa is relatively small (about 12 MWp 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 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 (HIS 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.

4.2 Sustainable Development

Mainstream's objective is to develop the proposed PV plant under the Clean Development Mechanism (CDM). As such, project information gathered during the EIA process will be submitted to the South African Designated National Authority (DNA) who sits within the Department of Mineral Resources (DMR) to be assessed against the Sustainable Development Criteria for CDM projects as defined by the DMR in South Africa.

The purpose of the Clean Development Mechanism (CDM) is to assist developing countries such as South Africa achieve sustainable development, and to assist industrialized countries achieve compliance with their emission targets under the Kyoto Protocol (KP) through the acquisition of certified emission reductions accruing from project activities. Specifically, the CDM can contribute to South Africa's sustainable development objectives through:

- Transfer of technology and financial resources;
- Sustainable ways of energy production;
- Increasing energy efficiency & conservation;
- Poverty alleviation through income and employment generation.

Currently, the project information is being compiled in a Project Design Document, that will be submitted to the United Nations Framework Convention on Climate Change (UNFCCC) towards the end of this year.

The project will generate electricity from a renewable energy with an associated carbon dioxide emission of close to zero for every kWh that is generated into the grid. For every kWh generated, approximately 0.97 to 1.1 kg carbon dioxide emissions will be reduced from the national grid

managed by Eskom. The estimated reduction of CO_2 over the 20 year period for this project will be presented once the energy analysis is completed.

4.3 Local Employment

The proposed site falls within the Northern Cape District Management Area (NCDMA) which enjoys a high level of employment, with almost three quarters of the population being formally employed. This is not mirrored in the Siyathemba Local Municipality (SLM), in which the town of Prieska is located, where on average there are 1.5 potential dependents for every fully employed person. At present electricity, gas and water supply provide no employment opportunities and less than 2% of the population is employed in the construction industry within the SLM. The proposed project will therefore contribute employment opportunities in these industries.

4.4 Regional and Local Income Profile

Evidence of local and regional income figures demonstrate the disturbingly low income levels in the area surrounding the proposed site. Within the SLM, very few people are high earners with the highest percentage of people earning between R801 and R1600 per month. The local and district municipality are poor areas in which a very low proportion of people earn more than R3201 per month. Although the NCDMA has a greater proportion of earners in the higher income categories, almost a third of the population between 15 and 65 do not have any source of income.

There may, therefore 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, during the operationalphase.

5 TECHNICAL PROJECT DESCRIPTION

At this stage, it is estimated that the proposed project will encompass the installation of a solar field and their associated components, in order to generate electricity that is to be fed into the existing Eskom grid via an existing distribution line that crosses the proposed site or via a new 132kV power line, whichwill lead to Kronos Substation. The total power generation capacity limit will ultimately depend on the size of the developable area which will be determined by the EIA. However, it is currently envisaged the generation capacity will be 40 Megawatts (MW). The voltage of the connection lines from the PV plant substation to the grid will be dependent on the total generation capacity and the actual available connection as determined by Eskom.

The key components of the project follow in the sub-sections below.

5.1 CPV/PV Project Components

Mainstream is proposing the establishment of a photovoltaic (PV) plant on the development site near Prieska.The objective of the solar project is to generate electricity to feed into the national grid. The photovoltaic (PV) plant will have a maximum capacity of 40 MW.

The project will consist of two components:

- PV Power Plant
- Associated infrastructure

The PV Power plant will consist of the following infrastructure

- Solar field
- Buildings

The section below describes the technical components that would be involved in the construction of the proposed infrastructure.

5.1.1 Solar field

Approximately 150 000 photovoltaic (PV) panels arrays will be installed and an area of approximately 1.2km^2 is likely to be required for the PV plant. The area required does not need to be cleared or graded however there is limited tall vegetation 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 tilted at a fixed angle equivalent to the latitude at which the site is located in order to capture the most sun (Figure 3). Arrays usually reach up to between 5m and 10m above ground level.

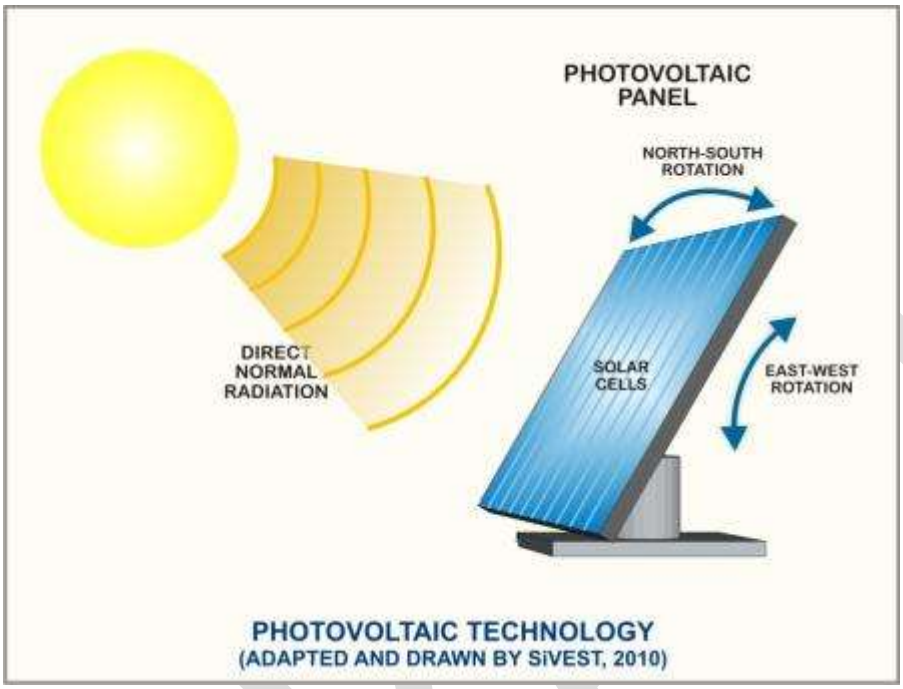

Figure 3: Illustration of how a CPV panel operates

5.1.2 Building infrastructure

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

5.1.3 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 4). The DC to AC inverters may be mounted on the back of the panels

support substructures / frames or alternatively in a central inverter station.The strings are connected to the inverters by low voltage DC cables. Power from the inverters is collected in medium voltage transformers through AC cables. Cables may be buried or pole mounted depending on voltage level and site conditions.

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

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

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

As previously mentioned, the electricity generated by the proposed PV plant may be fed into the existing Eskom grid via a 132kV existing distribution line that crosses the proposed site. Alternatively, a new power line will be constructed to connect the proposed facility to the existing Kronos Substation.The new power line will be assessed as an alternative to connecting directly into the existing 132kV line which traverses site.The electrical connection to the grid will be dependent on the total generation capacity and the actual available connection as determined by Eskom. The transmission lines could therefore have a voltage of 66kV to 132kV.

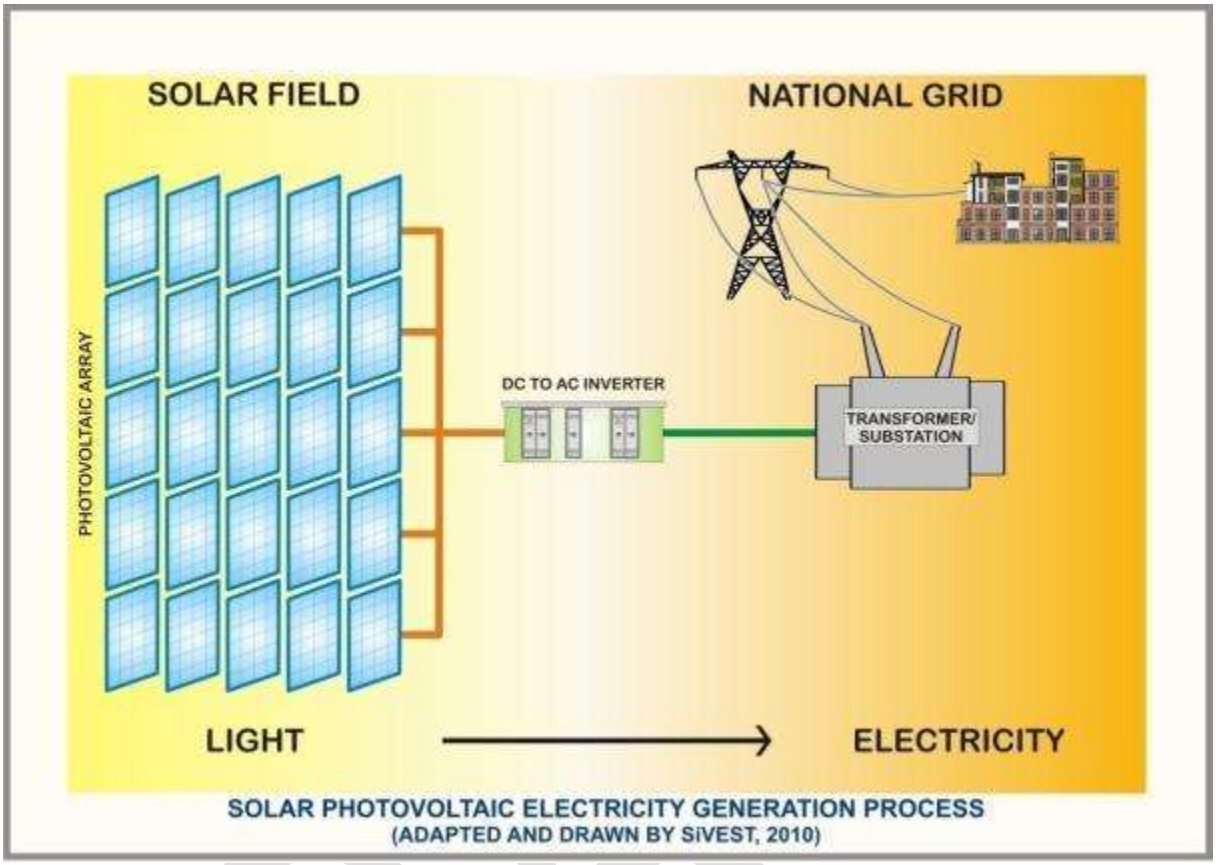

Figure 4: PV process

- Solar Resource Measuring Station

At least three permanent solar resource measuring stations are required to be installed within the solar park. Each station will consist of two pyrometers, temperature and pressure sensors, relative humidity detectors and a 10m high wind measuring meteorological mast. These will measure solar irradiation levels and will be used to derive energy forecasts for the grid operator as part of the SA IPP PPA requirements.

Location of this infrastructure will be finalised based on the EIA assessments but will be within the approved development area.

5.1.4 Alternatives

In terms of the EIA regulations, feasible and reasonable alternatives are required to be considered through the EIA process. Layout Alternatives and the no-go alternative were thus considered in this Draft Environmental Impact Report.

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

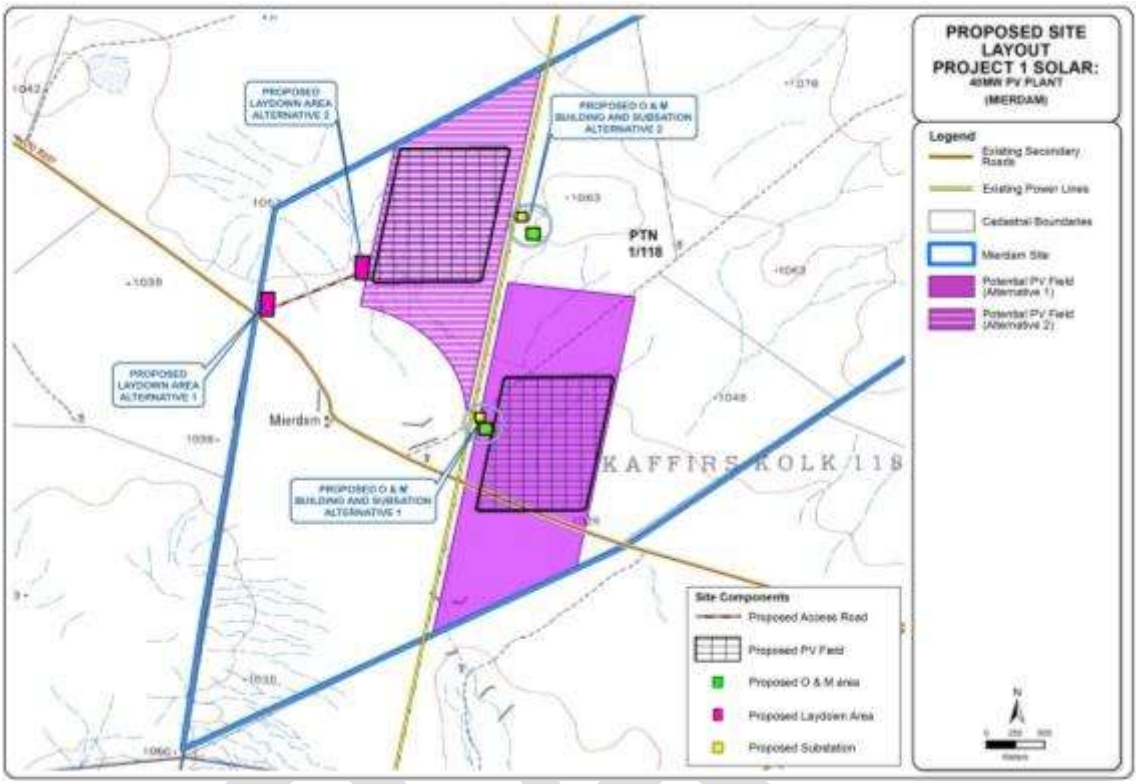

Figure 5: Site Layout Alternatives

Various layout alternatives have been investigated for the proposed project and these are presented in Figure 5. Layout alternatives relate mainly to the associated infrastructure.

Two (2) alternatives for the position of the PV field have been investigated; these are PV field alternative 1 and 2

Two (2) alternatives for the position of the substation have been investigated; these are substation alternative 1 and 2.

Two (2) alternatives for the position of the operation and maintenance area have been investigated; these are area alternative 1 and 2.

Two (2) alternatives for the position of the laydown areas have been investigated; these are laydown alternative1 and 2.

As mentioned above, the option of constructing a new power line will be assessed as an alternative to connecting directly into the existing line which traverses the site. As such, two 200m wide corridors were proposed to provide grid access from Mierdam farm to the Kronos Substation

(option 1a and 1b). Route option 1a links to Kronos Substation by running parallel to the existing power line that traverses Mierdam farm in a north-south alignment. Route option 1b also follows this existing power line until it reaches the northern boundary of Mierdam farm, which it then follows until reaching another existing power line which traverses the north-eastern corner of Mierdam farm. The line then runs parallel to this existing line before connecting with Kronos Substation (Figure 6).

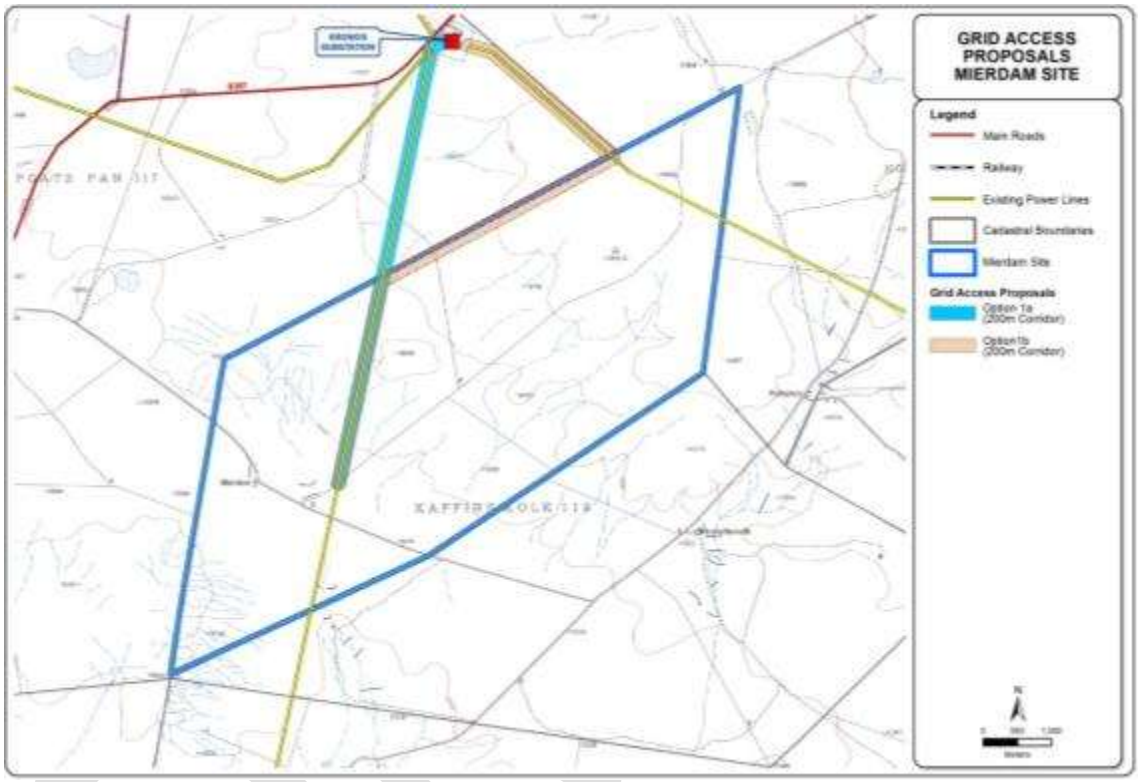

Figure 6: Grid access Proposals

Whether one of the new proposed power line options are used or if access to the grid is provided by connecting directly into an existing power line will be determined by Eskom through ongoing negotiations. This EIR request approval for a new power line from Miredam farm to Kronos Substation, as it may be required in order to connect to Kronos Substation. It is expected that the capacity of the new power line will be 132 kV.

- No-go Alternative

The 'no-go' alternative is the option of not establishing the proposed PV plant. South Africa is currently under immense pressure to provide electricity generating capacity to accommodate for the pressures which have been identified in this regard. With the current global focus on climate change, the government are under severe pressure to explore alternative energy sources in addition to coal fired power stations. Although wind power is not the only solution to solving the

energy crisis in South Africa, not establishing the proposed PV plant would be detrimental to the mandate that the government has set to promote the implementation of renewable energy. It is a suitable sustainable solution to the energy crisis and this project would contribute to this solution. This project will aid in achieving South Africa's goals in terms of sustainability, energy security, mitigating energy cost risks, local economic development and national job creation.

In light of the above, the no-go alternative has also been evaluated in Chapter 11.

Ort

6 DESCRIPTION OF THE RECEIVING ENVIRONMENT

The Northern Cape Province is considered to be one of the most suitable regions for solar energy facilities. Accordingly, land portions located outside of Prieska have been identified as a potential site. A general description of the study area is outlined in the sections below.

6.1 Locality

The proposed PV plant will be established on the following land portion:

- Portion 1 of the Farm Kaffirs Kolk No. 118, Prieska (2 883.96 hectares)

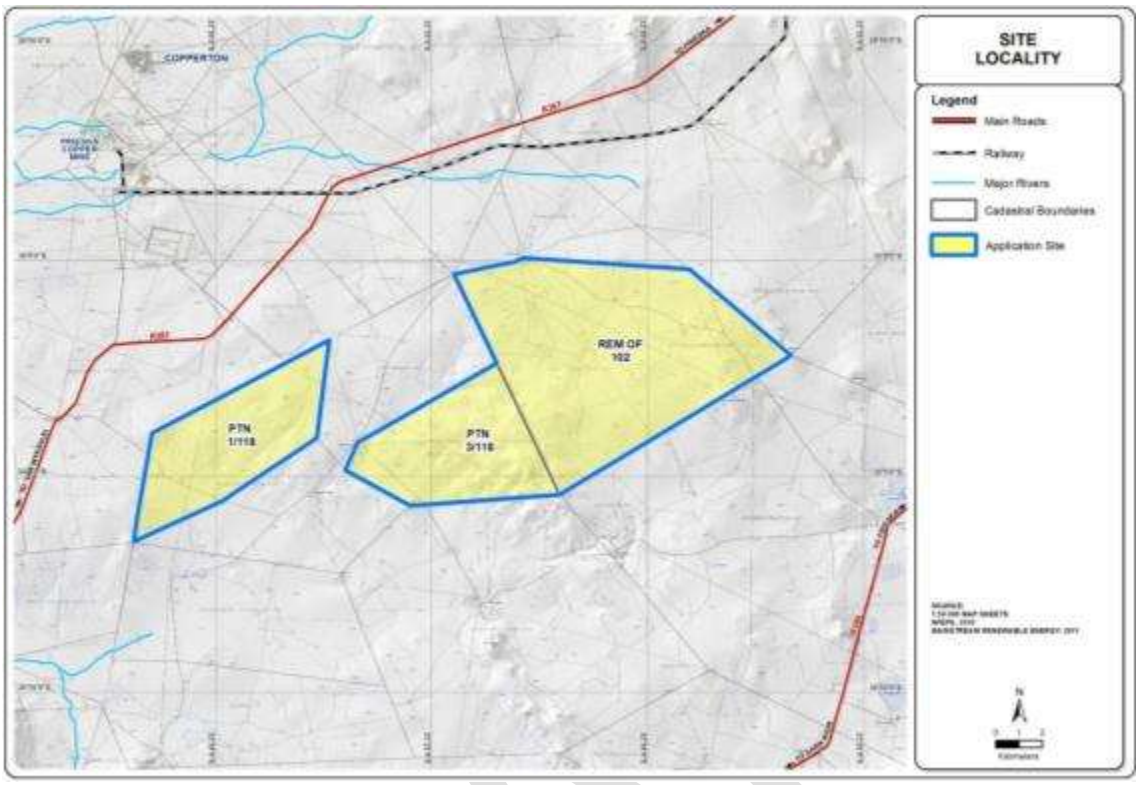

Figure 7: Site locality map

The study area is situated approximately 45km south-west of Prieska andis accessed via the R357 and R386 respectively (Figure 8). The site is located within the Northern Cape District Management Area 07 (NCDMA) of the Pixley ka Seme District Municipality of the Northern Cape Province. The District Management Area surrounds the Siyathemba Local Municipality which has thus been included in the greater study area.

The town of Prieska is situated south of the Orange River at the foot of the Doringberg. It is accessible from the N10 highway (south out of Kimberley).

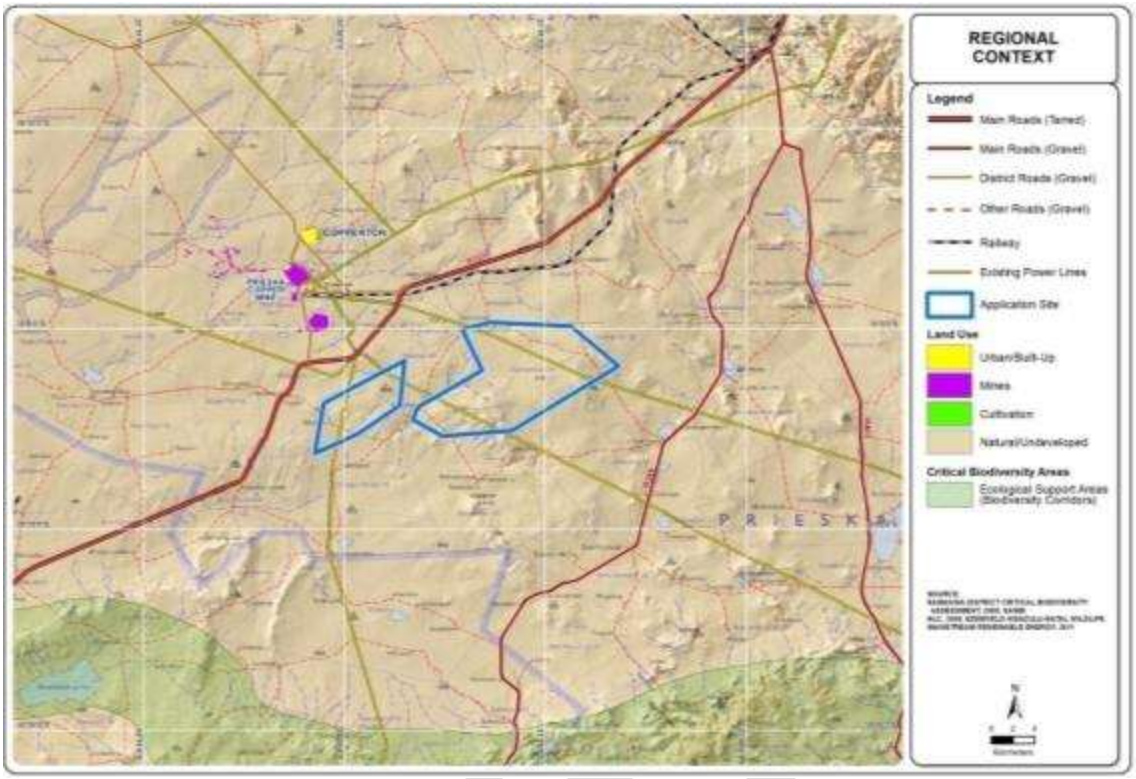

Figure 8: Regional locality map

6.2 Study Area Description

The site proposed for the development is approximately 2855.042 Ha in size of which a smaller area will be required for the establishment of the proposed photovoltaic plant.

The study area is dominated by relatively short natural shrub land,which is used as general grazing land for sheep, with no sign of formal agricultural fields or cultivation. The area within and surrounding the proposed site is largely vacant with a relatively low human footprint in the form of scattered farmsteads. The closest built up area (approximately 15km to the north-west) is the small mining town of Copperton and the defunct Prieska Copper Mine, which was closed in 1996 (Figure 9). Other built form includes transmission and distribution power lines which traverse the study area and a network of gravel access roads both within the boundaries of the site and in the surrounding area.

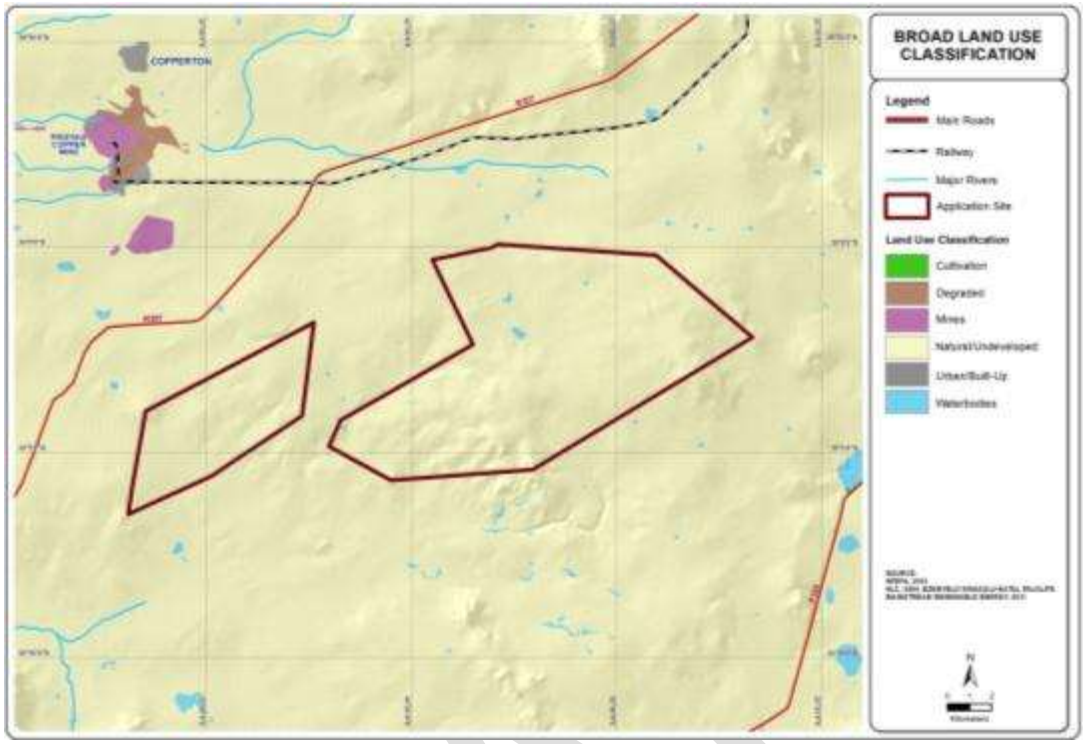

Figure 9: Land use of the study area

The topography within and surrounding the site is characterised by generally flat landwith an average gradient of less than 10%, as well as some slightly more undulating relief in the form of (Figure 10). Although no priority river or stream systems are located on the site, several drainage lines prevail in the western half of the study area and seven wetlands have been identified. The size and number of wetlands relative to the size of the proposed study area is however, small and few respectively.

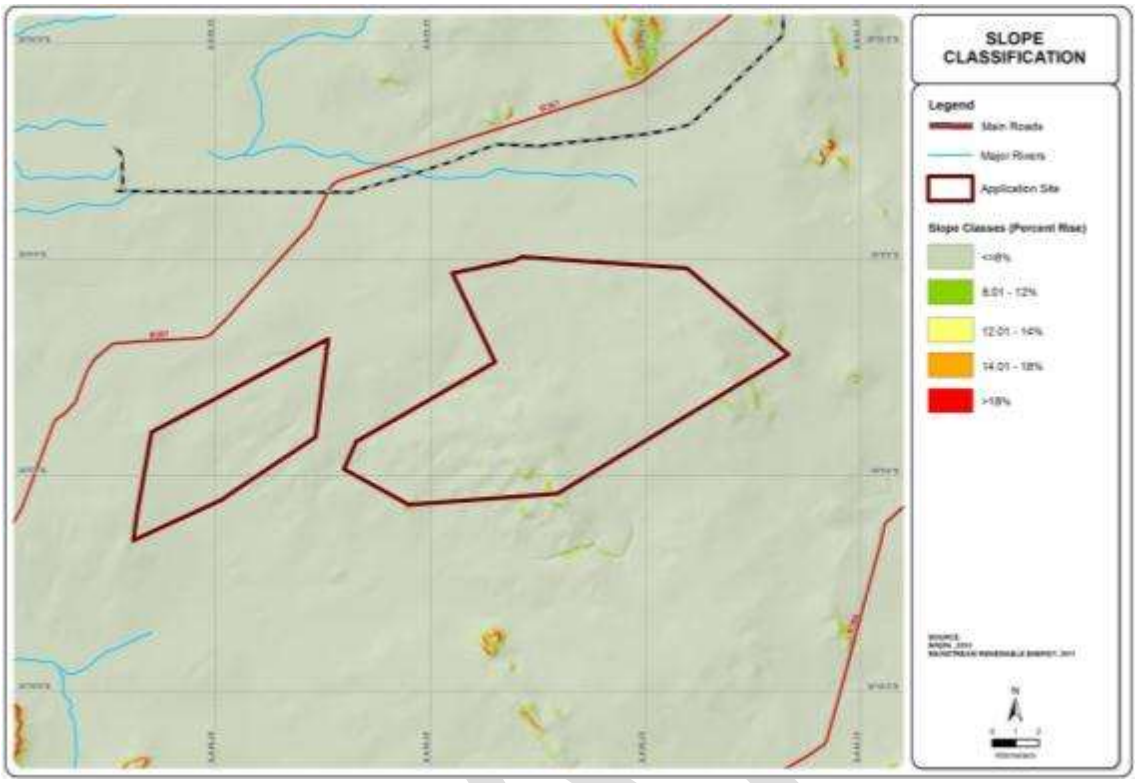

Figure 10: Slope of the study area

6.3 Climate

The study area has an 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 242 mm of rain per year, with most of it occurring during autumn,with the highest amount being received in March and the lowest in July (Figure 11). The Mean Annual Precipitation (MAP) is approximately 205 mm per year. Prieska typically experienceshot days and cold nights with the average summer temperature of approximately 33ºC and the average winter night time temperatures of approximately 1°C (Table 4).

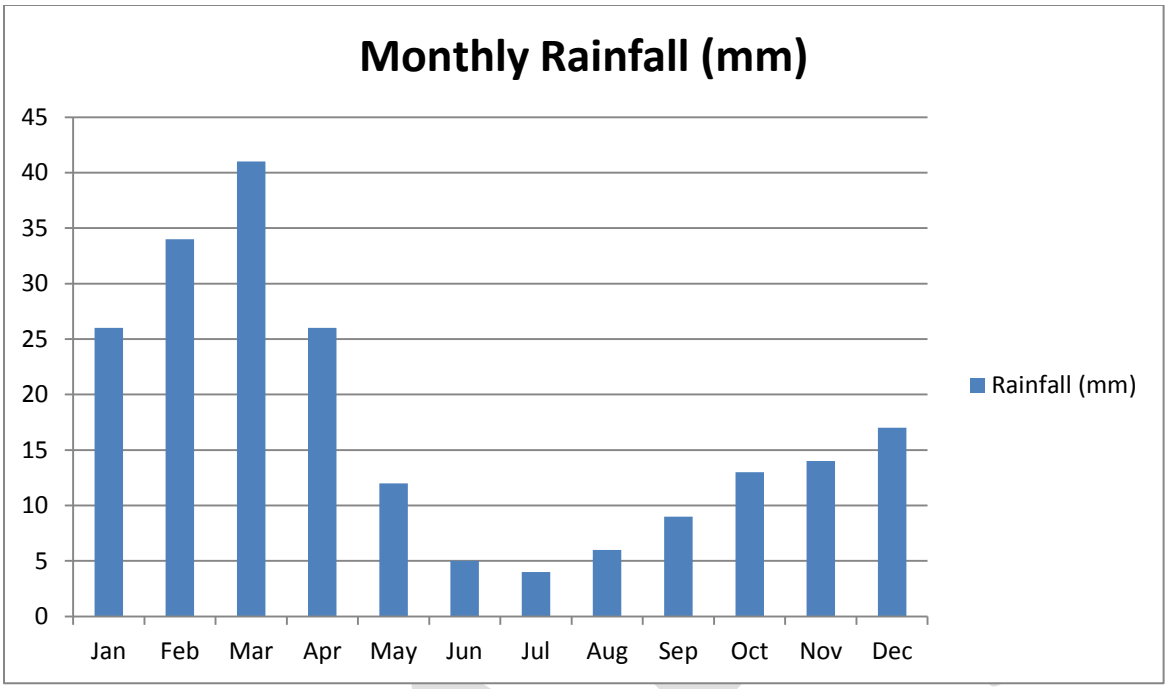

Figure 11: Mean Monthly Rainfall Graph for Prieska (Source: South Africa's Rain Atlas)

Table 4: Mean monthly and annual temperature for Prieska (Source: http://www.saexplorer.co.za)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Avg
Midday Temp (°C)	33	31	29	25	22	18	18	21	24	27	30	32	26
Night Temp (°C)	17	16	13	10	5	2	1	4	7	10	13	15	9

6.4 Geology

The study area is underlain by a variety of parent materialsincluding quartzite, sedimentary and tillite (Figure 12). Tillite is however, the most dominate geologic material and underlies the entire site. Tillite consists of consolidated masses of unweathered blocks and unsorted glacial till. Quartzite, a medium grained metamorphic rock, underlies the eastern portions of the larger adjoining area and is formed from recrystallised sandstone with the fusion of sedimentary quartz grains. Non-descript sedimentary geologic materials are found in the northern portion of the eastern area.

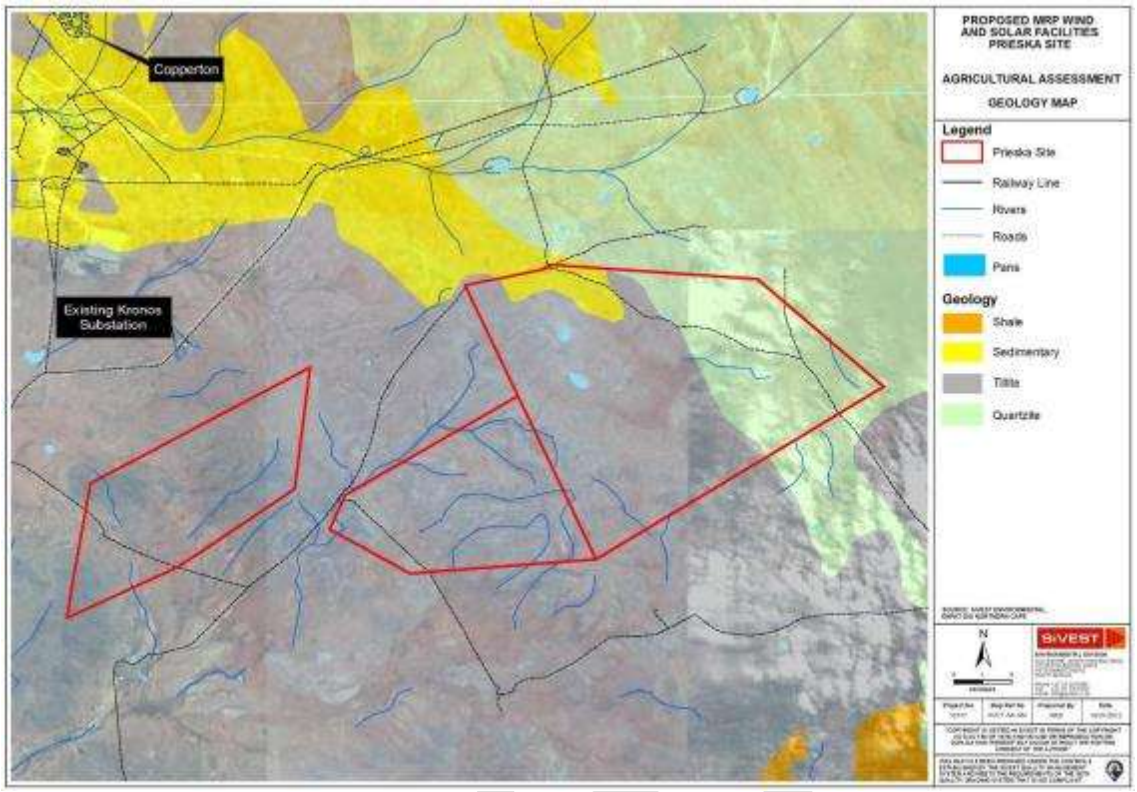

Figure 12: Geological map

6.5 Biodiversity (Flora & Fauna)

The Biodiversity Assessment was conducted by SiVEST (Appendix 6A). The environmental baseline from a biodiversity perspective is presented below.

6.5.1 Habitats

Faunal populations are dependent on the flora that supports them therefore assumptions regarding the presence of fauna can be made based on the flora present. The study area is very uniform in nature with characteristic Nama Karoo shrubland.

- Acacia *mellifera-Stipagrostis* shrubland

The north eastern part of the site is characterised by grassy plans dominated by *Stipagrostis* species. This area contains the Shepherds Tree / Stink Bush (*Boscia foetida subsp foetida*) and the tree layer is dominated by *Acacia mellifera*.

- Asteraceae (daisy) dominated "bossieveld"

The majority of the study area is dominated by this vegetation and is characterised by low bushes mostly of the Asteraceae or daisy family. Grasses are present in these areas but are scarce. Patches of *Rhigozum trichotomum* are present where the sandy soils suit the species.

- Grassy pans

Some local depressions are present which have developed into pans. Although they hold water very seldom they are unique in relation to the surrounding areas. Grass diversity is not exceptional and *Stipagrostis* species dominate.

- Avifauna Habitat Types

The land use and land cover in the study area presents a number of avifaunal habitats that occur. These are described in more detail below.

    - Rocky Karoo scrubland plains

This is the predominant natural habitat type that occurs across most of the study area. Very low Karoo-type scrubveld vegetation characterised by a very low density of vegetation occurs on very flat to gently undulating plains (Figure 13). These plains are often very rocky, with a sparse density of open ground, with very little grass cover, appear to be very important for the game bird species on the site as both Korhaan species and the Ludwig's Bustards recorded on the site were mostly encountered in this habitat type. They are also inhabited by a number of smaller bird species typically encountered in such vegetation all over the Karoo.

Figure 13: Rocky Karoo scrubland plains on the site

- Sandy Bushmanland grassy shrubland

This habitat type appears to be exclusively associated with areas of sandy soils. These sandy soils appear to be of alluvial origin, and provide suitable rooting areas for a few grass species that occur, including a few *Stipagrostis* species and some *Eragrostis* species. Karoo-type scrubs also occur in this habitat type, but are typically larger in size than the scrubs found on the above habitat type. There is typically a much greater vegetation cover in this habitat type. These sandy grassy plains also appear to be well-utilised by both Korhaan species encountered on the site, as well as a similar range of smaller bird species typical of the Karoo.

Figure 14: Example of sandy grassy scrubveld on the site

- Ephemeral Drainage lines

A number of ephemeral drainage lines are present across the site. In places these drainage lines are no more than a poorly defined valley bottom with no discernible vegetation change, but some drainage lines are characterised by taller shrubs that the surrounding Karoo plains, and are thus important. Due to this factor, the drainage lines are likely to support a slightly higher density of bird species, similar in composition to the quartzite ridges.

- Farmsteads

A number of farmsteads occur on the development site and within the wider area. Although artificial, these farmsteads and their associated gardens (which comprise of mostly exotic tall trees and shrub species) are a very important habitat for a number of bird species due to the availability of water, cover, nesting areas and likely improved food availability as compared to the surrounding arid areas. The presence of these "oases" is likely to have allowed the expansion of a number of bird species into the area which did not historically or naturally occur in the area (such as the Hadeda Ibis). These areas are also very well-utilised by a number of small bird species, as well as the most common raptor in the area, the Pale Chanting Goshawk, probably due to the increased occurrence of rodent and reptile prey species around these areas as well as suitable roosting and hunting perches.

- Feedlots

Feedlots where sheep are provided with food and water (as well as being fenced in at night) are another important bird habitat in the area, although artificial and limited in spatial size. The easy availability of water in drinking troughs, and food in numerous forms attracts many bird species to these areas, in particular doves, Lark-like Buntings and a number of canary species. In places these feedlots are characterised by the presence of higher shrub-type vegetation and trees than the surrounding areas (probably due to the increased availability of ground water), thus attracting other bird species such as scrub-robins and tit-babblers.

- Other human infrastructure

Although not a habitat as such, other human-related infrastructure that occurs in the study area is very important for a number of bird species, particularly as roosting, perching and even nesting areas. Two power line routes traverse the site, and these power lines are well-utilised by a number of species for perching and roosting, including Pied Crows, and some raptor species In addition telephone lines occur along most roads in the area. These are important as perching areas for a number of species, including the raptor species present as well as the Spotted Eagle-Owl. Importantly the larger telephone lines that are located along the R357 road have been utilised by Sociable Weavers to construct their massive communal nests(Figure 15). These birds were only observed within a certain proximity of their nests. Due to the non-availability of natural nesting areas (such as on mature camel thorn trees which do not occur in the study area), it is thought to be likely that these birds have extended their range southwards into this area. The disused mining infrastructure to the west of the site may well provide suitable roosting and nesting opportunities for a number of bird species.

Figure 15: A sociable weaver nest on a telephone pole

6.5.2 Transformation

The study area currently operates as a functioning grazing farm and the associated impacts are present. The larger study area can however be considered to be intact due to the low sheep carrying capacity.

6.5.3 Flora in the study area

The vegetation types in question have approximately seven (7) endemic species.

The vegetation types on the site are described as Bushmanland Basin Shrubland and the Bushmanland Arid Grassland. These fall within the Nama Karoo Biome.

The Bushmanland Basin Shrubland vegetation type is characterised by low shrubs species which include: *Aptosimum spinescens*, *Hermannia spinosa*, *Pentzia spinescens, Zygophyllum microphyllum* and *Aptosimum elongatum*. It is considered to be Least Threatened and none of it is conserved in statutory conservation areas (Mucina, *et al,* (2006).

The Bushmanland Arid Grassland vegetation type is characterised by graminoids such as *Aristida adscensionis, A. Congesta* and *Eragrostis nindensis*; small trees such as *Acacia mellifera*, and *Boscia foetida*; tall shrubs namely *Lycium cinereum, rhigozum trichotomum* and *Cadaba aphylla*as well as low shrubs such as *Aptosimum spinescens, Hermannia spinosa* and *pentzia spinescens*.

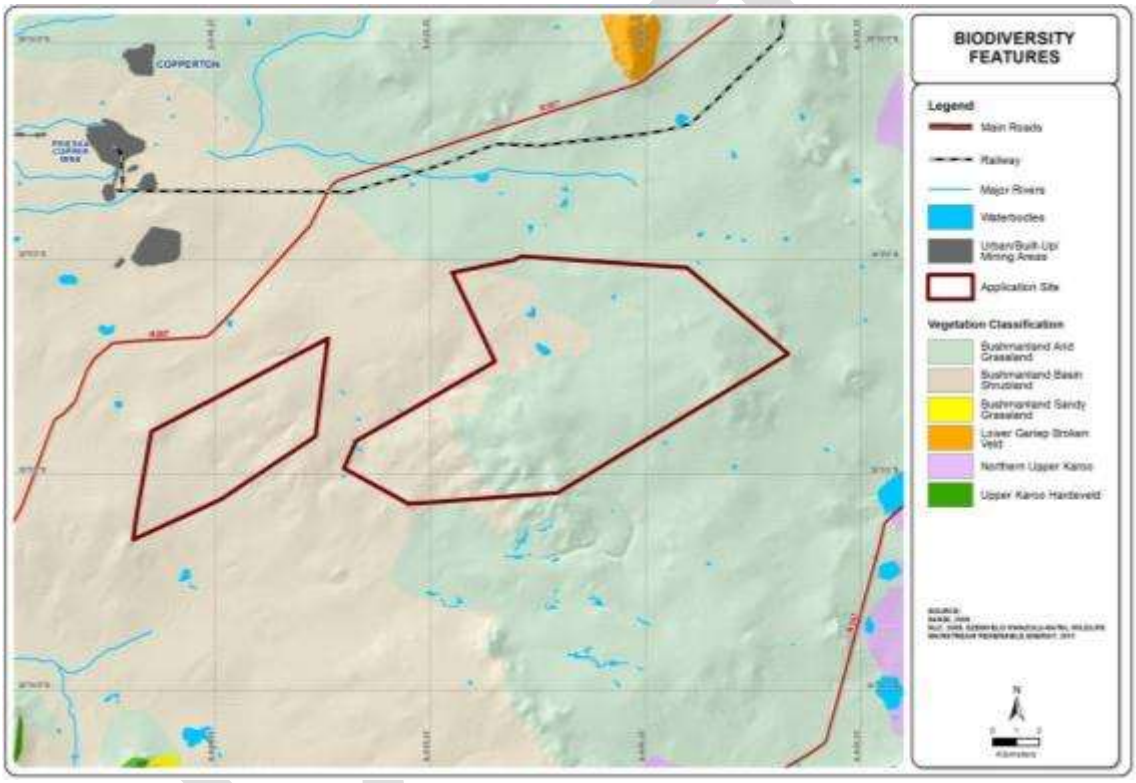

Figure 16: Vegetation of the study area

6.5.4 Fauna in the study area

Friedman and Daly, (2004) list several red data mammal species that could potentially occur in the study area. The Honey Badger (*Mellivora capensis*) and the Littledale's Whistling Rat (*Parotomys littledalei*) both listed as Near Threatenedare likely to occur in the study area. On the other hand, the Black Rhinoceros (*Diceros bicornis bicornis*) which is listed as Critically Endangered, the Lesueur's Wing-gland Bat *Cistugo lesueuri* and Geoffroy's Horseshoe Bat

Rhinolophus clivosus which are Near Threatened, along with several other recorded mammal species are not likely to occur in the study area due to the anthropogenic activities that have taken place.

Amphibians have been recorded for the study area however these are likely to be present near water courses. The study area is extremely dry and the presence of amphibians is unlikely.

Several reptile species are likely to be present and these are listed below.

6.5.5 Mammals

Various mammal species are likely to occur within the study area. Appendix 2 of the biodiversity Assessment Report comprisesof 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. As mentioned above, the Honey Badger (*Mellivora capensis*) and the Littledale's Whistling Rat (*Parotomys littledalei*) which are both listed as Near Threatenedare likely to occur in the study area.

Several other species distribution fall across the site however anthropogenic activities such as farming and road development have led to the decrease or absence of these species.

- Field assessment results

During field assessments, several specimens of the Striped Mouse (*Rhabdomys pumilio*) (**Figure 17**) were captured and released.

Figure 17: Striped Mouse (*Rhabdomys pumilio)*

Yellow mongoose (*Cynictis penicillata*),scrub hares (*lepus saxatilis*) and ground squirrels (*Xerus inauris*) were common on the farms. Evidence of larger burrowing mammals was very evident in the more sandy areas, mostly associated with the ridge area. Species present include the Aardvark (*Orycteropus afer*), Porcupines (*Hysterixafricaeaustralis*) and Bat eared foxes (*Octocyon megalotis*).

Figure 18: Aardvark excavation on the site

According to the landowners, the Black footed cat (*Felis nigripes*) is fairly common on the site. The species is considered to be vulnerable and is listed as such on CITIES. Care must be taken to avoid any breeding sites.

Trapping success of small mammals was low generally perhaps due to the low cover which is typical of the Nama Karoo Biome where although vegetation grows on rich soils, plant growth is limited by climate. Cover is among the most important factors that influence small mammal abundance and richness. This is because unlike open habitats which increase predation risk (Kotler, 1997), habitats with cover provide protection againstpredators (Asher *et al.,* 2004; Keller & Schradin, 2008). According to Silva *et al.,*(2005), open habitats exhibit low mammal diversity due to reduced cover (which provides food and resources) hence leading to lower fecundity (Grant *et al.,* 1982). Therefore, greater species abundance and richness are expected in areas that exhibit dense cover.

Furthermore, sheep grazing observed within the study area influences the existence of small mammals in the area. Although in terms of grazing, the farm where the proposed site is situated is well managed in that rest periods are allowed between camps, it is predicated that grazing has an impact on small mammal richness and abundance to some degree. According to Bergstrom (2004), the presence of livestock has a negative effect on both small mammal species richness and abundance. Moreover small mammals can be seen as indicators of environmental conditions (Linzey & Kesner, 1997). This is because changes in the environment due to heavy grazing leads to changes in the habitats for small mammals therefore affecting their abundance, survival and breeding success (Dooley & Bowers, 1996). In the North American rangelands, trampling and grazing have been shown to reduce the lower vegetation cover for small animals hence increasing their exposure to predators (Grant *et al.,* 1982; Birney et al., 1976; Edge *et al.,* 1995). In addition trampling may affect the burrowing substrate for the rodents (Bergstrom, 2004).

6.5.6 Amphibians

Of all amphibian species previously recorded in the study area, only the Giant Bullfrog (*Pyxicephalus adspersus*) is categorised as Near threatened. Other amphibian species previously recorded in the study area are not threatened (Du Preez and Carruthers, 2009). It is important to note that although the Giant Bullfrog and other amphibians are recorded in the study area, they are not likely to occur. This is because the study area is extremely dry with very little rainfall and amphibian numbers are expected to be very low. The table below indicates the species that have been previously recorded.

Table 5: Amphibian species in the study area

Scientific name	Common name	Category
Amietophrynus gutturalis	Guttural Toad	Not threatened

Vandijkophrynus gariepensis	Karoo Toad	Not threatened
Cacosternum boettgeri	Boettger's Caco	Not threatened
Amietia fuscigula	Cape River Frog	Not threatened
Amietia angolensis	Common River Frog	Not threatened
Pyxicephalus adspersus	Giant Bullfrog	Near threatened
Xenopus laevis	Common Platanna	Not threatened
Tomopterna tandyi	Tandy's Sand Frog	Not threatened

6.5.7 Reptiles

Several reptile species are present in the study area. Table 6highlights these species (Branch 1998). According to the current Red Data information, none of these species are currently Red Listed (McLachlan, 1978). The Red Data book is currently being updated.

Habitat for these species is currently available.

Table 6: Reptiles in the study area

Common name	**Scientific name**
Tent tortoise	*Psammobates tentorius*
Delalande's Beaked Blind Snake	*Rhinotyphlops lalandei*
Schinz's Beaked Blind Snake	*Rhinotyphlops schinzi*
Brown House Snake	*Lamprophis fuliginosis*
Mole snake	*Pseudoaspis cana*
Dwarf Beaked Snake	*Dipsina multimaculata*
Karoo Sand Snake or Whip Snake	*Psammophis notostictus*
Namib Sand Snake	*Psammophis leightoni*
Common or Rhombic Egg Eater	*Dasypeltis scabra*
Beetz's Tiger Snake	*Telescopus beetzii*
Coral Snake	*Aspidelaps lubricus*
Cape Cobra	*Naja nivea*
Puff adder	*Bitisarietansarietans*
Horned adder	*Bitis caudalis*
Cape skink	*Mabuya capensis*
Western Three-stripped Skink	*Mabuya occidentalis*
Western Rock Skink	*Mabuya sulcata*
Variegated skink	*Mabuya variegata*
Spotted Desert Lizard	*Meroles suborbitalis*
Cape Sand Lizard	*Pedioplanis laticeps*
Spotted sand lizard	*Pedioplanis lineoocellata pulchella*

Common name	Scientific name
Namaqua Sand Lizard	*Pedioplanis namaquensis*
Karoo girdled lizard	*Cordylus polyzonus*
Ground Agama	*Agama aculeata*
Southern Rock Agama	*Agama atra*
Giant Ground Gecko	*Chondrodactylus angulifer*
Bibron's Thick-toed Gecko	*Pachydactylus bibronii*
Cape Thick-toed Gecko	*Pachydactylus capensis*
Marico Thick-toed Gecko	*Pachydactylus mariquensis mariquensis*
Unspecified	*Pachydactylus purcelli*
Common Barking Gecko	*Ptenopus garrulus*

6.5.8 Avifauna

- Occurrence of Red Data bird species in the study area

A number of Red Data species could potentially occur within the development site. These are listed below. The table lists the conservation status of the species.

Species	***Scientific Name***	**Conservation Status**	**Recorded on the site?**
Common name	**Scientific name**	**Category**	
African White-backed Vulture	*Gyps africanus*	Vulnerable	
Secretarybird	*Sagittarius serpentarius*	Near Threatened	Y
Tawny Eagle	*Aquila rapax*	Vulnerable	
Martial Eagle	*Polemaetus bellicosus*	Vulnerable	
Lanner Falcon	*Falco biarmicus*	Near Threatened	
Lesser Kestrel	*Falco naumanni*	Vulnerable	
Blue Crane	*Anthropoides paradiseus*	Vulnerable	
Kori Bustard	*Ardeotis kori*	Vulnerable	
Ludwig's Bustard	*Neotis ludwigii*	Vulnerable	Y
Sclater's Lark	*Spizocorys sclateri*	Near Threatened	Y
Red Lark	*Certhilauda burra*	Vulnerable	

- Occurrence of Bird Species as recorded on the site (SABAP2 Data)

Two site visits were undertaken to the project site during which birds were recorded. The following table lists the birds that were recorded on the site and the habitat in which they were recorded. Although not all habitats were covered during both visits, and in spite of the two visits not being sufficient to draw seasonal conclusions relating to the distribution of birds, the table below provides a reasonable indication of the distribution of bird species recorded across the various habitats on the site. These species were recorded as part of the South African Bird Atlassing Project (SABAP2). At the time of writing the submissions made by the author were the only submissions made for the pentads within the study area with one exception, thus the list below should be taken as the birds recorded on the site as part of the SABAP2 project.

Common Name	***Scientific Name***	**Habitat Type in which Species was Recorded**						
		Karoo Plains	**Sandy Scrubveld**	**Grassy Pans**	**Quertzite Ridges**	**Farmsteads**	**Feedlots**	**Human Infrastr.**
Common Ostrich		X						
Hadeda Ibis	*Bostrychia hagedash*					X	X	
Egyptian Goose	*Alopochen aegyptiacus*							
Secretarybird	*Sagittarius serpentarius*	X						
Black-chested Snake-Eagle	*Circaetus pectoralis*	X						X
Southern Pale Chanting Goshawk	*Melierax canorus*	X			X	X	X	X
Greater Kestrel	*Falco rupicoloides*	X	X					X
Pygmy Falcon	*Polihierax semitorquatus*							X
Helmeted Guineafowl	*Numida meleagris*	X				X		
Ludwigs Bustard	*Neotis ludwigii*	X						
Karoo Korhaan	*Eupodotis vigorsii*	X		X				
Northern Black Korhaan	*Afrotis afraoides*	X	X	X				
Blacksmith Lapwing	*Vanellus armatus*					X		
Spotted Thick-knee	*Burhinus capensis*	X						
Double-banded Courser	*Rhinoptilus africanus*		X					
Namaqua Sandgrouse	*Pterocles namaqua*	X						
Speckled Pigeon	*Columba guinea*					X	X	
Cape Turtle-Dove	*Streptopelia*					X		

Common Name	*Scientific Name*	Habitat Type in which Species was Recorded						
		Karoo Plains	Sandy Scrubveld	Grassy Pans	Quertzite Ridges	Farmsteads	Feedlots	Human Infrastr.
	capicola							
Laughing Dove	*Streptopelia senegalensis*					X		
Namaqua Dove	*Oena capensis*	X			X	X	X	
Spotted Eagle-Owl	*Bubo africanus*					X		X
Common Swift	*Apus apus*					X		
White-rumped Swift	*Apus caffer*					X		
Little Swift	*Apus affinis*	X				X		
African Palm-Swift	*Cypsiurus parvus*					X		
White-backed Mousebird	*Urocolius indicus*					X		
Red-faced Mousebird	*Urocolius indicus*					X		
European Roller	*Coracias garrulus*							X
Acacia Pied Barbet	*Tricholaema leucomelas*				X	X		
Eastern Clapper Lark	*Mirafra fasciolata*	X	X					
Fawn-coloured Lark	*Calendulauda africanoides*		X		X			
Sabota Lark	*Calendulauda sabota*	X	X		X			
Karoo Long-billed Lark	*Certhilauda subcoronata*				X			
Spike-heeled Lark	*Chersomanes albofasciata*	X	X		X			
Red-capped Lark	*Calandrella cinerea*	X						
Sclaters Lark	*Spizocorys sclateri*	X					X	
Large-billed Lark	*Galerida magnirostris*	X	X				X	
Grey-backed Sparrowlark	*Eremopterix verticalis*	X		X			X	
Barn Swallow	*Hirundo rustica*	X	X	X	X	X	X	X
Greater Striped Swallow	*Hirundo cucullata*					X	X	X
Rock Martin	*Hirundo fuligula*					X		
Pied Crow	*Corvus albus*	X						X
African Red-eyed Bulbul	*Pycnonotus nigricans*					X		

Common Name	*Scientific Name*	Habitat Type in which Species was Recorded						
		Karoo Plains	Sandy Scrubveld	Grassy Pans	Quertzite Ridges	Farmsteads	Feedlots	Human Infrastr.
Mountain Wheatear	*Oenanthe monticola*				X			
Capped Wheatear	*Oenanthe pileata*	X					X	
Familiar Chat	*Cercomela familiaris*		X			X		
Tractrac Chat	*Cercomela tractrac*	X						
Anteating Chat	*Myrmecocichla formicivora*	X	X		X			
Karoo Scrub-Robin	*Cercotrichas coryphoeus*		X		X	X	X	
Kalahari Scrub-Robin	*Cercotrichas paena*				X	X	X	
Chestnut-vented Tit-Babbler	*Parisoma subcaeruleum*				X		X	
Long-billed Crombec	*Sylvietta rufescens*		X			X		
Desert Cisticola	*Cisticola aridulus*		X	X				
Grey-backed Cisticola	*Cisticola subruficapilla*	X	X				X	
Black-chested Prinia	*Prinia flavicans*	X	X		X	X	X	
Rufous-eared Warbler	*Malcorus pectoralis*	X	X		X			
Chat Flycatcher	*Bradornis infuscatus*	X						X
Fiscal Flycatcher	*Sigelus silens*		X			X		
Pririt Batis	*Batis pririt*				X	X	X	
Cape Wagtail	*Motacilla capensis*					X		
African Pipit	*Anthus cinnamomeus*	X						
Common Fiscal	*Lanius collaris*				X		X	
Bokmakierie	*Telophorus zeylonus*	X	X		X		X	
Dusky Sunbird	*Cinnyris fuscus*						X	
White-browed Sparrow-Weaver	*Plocepasser mahali*				X	X		
Sociable Weaver	*Philetairus socius*	X	X			X		X
Sparrow House	*Passer domesticus*					X		
Cape Sparrow	*Passer melanurus*	X				X	X	
Southern Grey-headed Sparrow	*Passer diffusus*						X	

Common Name	*Scientific Name*	Habitat Type in which Species was Recorded						
		Karoo Plains	Sandy Scrubveld	Grassy Pans	Quertzite Ridges	Farmsteads	Feedlots	Human Infrastr.
Scaly-feathered Finch	*Sporopipes squamifrons*	X					X	
Southern Masked-Weaver	*Ploceus velatus*		X		X	X		
Red-billed Quelea	*Quelea quelea*	X	X			X		
Southern Red Bishop	*Euplectes orix*	X						
African Quailfinch	*Ortygospiza atricollis*			X				
Red-headed Finch	*Amadina erythrocephala*					X	X	
Black-throated Canary	*Crithagra atrogularis*					X		
Yellow Canary	*Crithagra flaviventris*						X	
White-throated Canary	*Crithagra albogularis*	X					X	
Lark-like Bunting	*Emberiza impetuani*	X				X	X	

- Occurrence of Priority Bird Species

A number of priority species were identified during the site visits; these are listed below. Species recorded in the wider area have been included as these could easily move onto the site of the proposed development. These include the following:

- Secretarybird
- Black-chested Snake Eagle
- Southern Pale Chanting Goshawk
- Greater Kestrel
- Pygmy Falcon
- Karoo Korhaan
- Northern Black Korhaan
- Ludwig's Bustard
- Namaqua Sandgrouse
- Eastern Clapper Lark
- Karoo Long-billed Lark
- Fawn-coloured Lark
- Sclater's Lark

Figure 19: Karoo Korhaan recorded near the development site

As described above the two korhaan species encountered on the site as well as the Ludwig's Bustard were encountered almost exclusively in the Karoo scrubveld plains, and to a lesser degree in the sandy scrubveld. The latter species as well as the Karoo Korhaan were only sited on the Karoo scrubveld plains while the Northern Black Korhaan appeared to have a wider habitat tolerance. In the case of the Ludwig's Bustard, this is potentially important in terms of the impact of the proposed development, as most of the site is covered by the habitat in which it occurs and thus would be affected by the proposed development.

Most of the raptors recorded, as well as the owls recorded were observed on man-made infrastructure, especially telephone poles and power lines. Due to the natural absence of trees in the landscape, raptors appear to have adapted and appear to use telephone poles and power lines as important perches for hunting. This suggests that when they occur in the study area, most raptors would inhabit areas where such suitable perches / roosting places are present, such as along roads and power line servitudes. Information provided by local farmers suggests that when vultures do occur (occasionally) in the study area, they are observed to move along the large power line servitude that runs across the development site. The record for the Greater Kestrel on the Platsjambok site was for a pair that was observed around a nest on one of the wooden power line towers. Nests of Pied Crows were observed in similar locations and even on the Mierdam wind monitoring mast. Power line towers are thus important for nesting; the

proposed construction of another power line between the Kronos and Kuprum Substations, if developed, would further enhance nesting opportunities. Thus, power line and telephone line servitudes should be viewed as important areas for raptor occurrence in the study area.

Figure 20: Black-chested Snake-Eagle perched on a roadside telephone pole south-west of the Klippan Farmstead along the R357

The most common resident raptor in the study area is the Pale Chanting Goshawk. These birds were observed all over the study area, with pairs having well-defined territories. Like most of the other raptors these birds were typically observed along telephone lines and to a lesser degree along the power lines in the area. Pairs were often observed in close proximity to farmsteads.

A number of lark species were observed to undertake the aerial displays, including the Eastern Clapper Lark, Karoo Long-billed Lark and Sabota Lark. These species have differing habitat preferences; the Eastern Clapper Lark is by far the most widespread and common lark in the study area and is found all over the site in natural habitats. The Sabota Lark has similar diverse habitat tolerances, but tends to favour areas of thicker and bushier vegetation. Lastly the Karoo Long-billed Lark is very habitat-specific and is only encountered in areas of rocky ground on the site, i.e. the on the low quartzite ridges. All of these species undertake high aerial displays, often rising to significant heights above the ground.

It is important to note that no specific flight paths of birds were noted on the site, although it must be remembered that no detailed pre-construction avifaunal monitoring has been undertaken. There are no large or permanent open water bodies on the site, thus there is no movement of water birds to and from the site from the direction of the Orange River to the north, where most

water birds would be likely to be concentrated. The korhaans and bustards on the site were not observed to fly to and from the site, and these birds were only observed in flight when flushed. The only birds observed on site that are likely to undertake a daily flight to and from the site are Barn Swallows. It is expected that the Barn Swallows in the local area roost in the nearest suitable habitat – i.e. the reedbeds along the Orange River. These birds would leave these roosts at dawn, flying out to their foraging areas, and returning at dusk. This is seemingly supported by the appearance of Barn Swallows on the site approximately 45 minutes to an hour after sunrise on the site during the December field trip when the swallows were present.

6.5.9 Bats

- Species probability of occurrence

Table 7**:** Species that may be roosting on the study area, the possible site specific roosts, and their probability of occurrence.LC = Least Concern; NT = Near Threatened; V = Vulnerable; DD = Data Deficient (Monadjem*et al.*, 2010).

Species	**Common name**	**Probability of occurrence**	**Conservation status**	**Possible roosting habitat to be utilised on study area**
Eidolon helvum	Straw coloured fruit bat	Very Low - None	LC	A non breeding migrant
Rhinolophusclivosus	Geoffroy's horseshoe bat	Low	LC	Roosts gregariously in caves, no known caves close to the study site.
Rhinolophusdarlingi	Darling's horseshoe bat	Medium	LC	Roosts gregariously in caves and rock hollows, and culverts.
Rhinolophusdenti	Dent's horseshoe bat	Medium	DD	Caves, hollows, mines, culverts. Well in distribution, but roosting space may be limited.
Nycteris thebaica	Egyptian slit-faced bat	**High**	LC	Cavities, aardvark burrows, and culverts under roads. Any suitable hollows.

Tadarida aegyptiaca	Egyptian free-tailed bat	**Confirmed**	LC	Crevices, buildings, very adaptable and very common.
Miniopterus natalensis	Natal long-fingered bat	Low	**NT**	Roosts gregariously in caves, no known caves close to the study site.
Eptesicus hottentotus	Long-tailed serotine	Medium	LC	Crevice dweller and in buildings. Rock crevices limited on site.
Neoromiciacapensis	Cape serotine	**High**	LC	Under bark of trees and roofs of buildings, very common and adaptable.

- Bat detection and route scouting

Very few bat calls (2 in total) were recorded during vehicle based monitoring within the site (Figure 21). Physical scouting (Figure 22), as well as searches of Google Earth images of the site revealed that the site is void of any meaningful roosting opportunity for bats. A few sources of open water were detected using Google Earth searches of the site but these are likely not significant enough to attract bats from the closest roosting site which are likely in Copperton and Prieska. The lack of bat activity during monitoring can probably be attributed to the lack of roosting space and open drinking water available on site. The lack of bat activity at this site should not be considered a permanent trend since bat activity can vary greatly on a seasonal basis due to insect availability. Even if bats do not use this site for regular foraging, possible seasonal migrations of bats may cause bats to fly through the site.

Figure 21: Bat species and activity detected during vehicle monitoring on site, showing very low levels of activity. Orange circles indicate where Egyptian free-tailed bats (*Tadaridaaegyptiaca*) where detected.

Figure 22: Typical topography of site showing lack of roosting opportunities for bats.

6.6 Surface Water

The environmental baseline from a surface water perspective is presented below.

As described elsewhere in this report, the study area falls within a part of South Africa's Nama Karoo Region that is highly arid. Average Rainfall is extremely low – at an average of around 135mm MAP for the two vegetation types found on the site (Mucina and Rutherford, 2006). Coupled with the very high average temperatures during the day time over most of the year and the Mean Annual Soil Moisture Stress (i.e. the % of days when evaporative demand is more than the soil moisture supply) of 86%, there are thus naturally very few surface water features on the site, as surface water is not a significant factor in terms of the geomorphology of the landscape.

The terrain of the site is typically very flat with wide, very gently undulating plains occurring across much of the site. This terrain is derived from the underlying geology, which comprises of sedimentary geology (Ecca Shales) and tillite in the areas in which the plains are encountered. The nature of the terrain over most of the site has implications for surface water drainage on the site. Most of the site is very poorly drained, and parts of the site are endorehic (inward draining). Over the rest of the site where drainage lines typically occur they are very shallow and poorly defined in cross-sectional profile, rather than being incised. The nature of rainfall entails that they are ephemeral and episodic in nature, i.e. only flowing on very rare occasions when sufficient rainfall occurs to generate sufficient surface runoff. In a few places, these watercourses have been dammed in an attempt to trap any surface overflow, but these are not common in the context of the site.

Due to the low amount of rainfall and ability of soils on the site to remain saturated for any amount of time, there are no hydric soils that are found on the site. Hydric soils are soils found in wetlands, display a number of morphological characteristics that are derived from periods of saturation, during which the soils become denuded of oxygen, thus initiating certain chemical and morphological characteristics that define these soils. The soils found the pans were found to not be hydric in nature.

In terms of vegetation, the pans on the site are characterised by grassy vegetation (mainly *Stipagrostis sp* – Bushmans grass), with the vegetation cover being very good. As the pans are not characterised by saturated soils, there is no hydromorphic vegetation within them. The extensive vegetation cover within the pans and the presence of grass species rather than dwarf shrubs is indicative of a slightly higher soil moisture content as compared to the surrounding soils.

Figure 23: Photograph showing grassy vegetation in part of the pan

Vegetation in the drainage lines typically differed little from the surrounding scrubveld, with little divergence in terms of species composition and even vegetation size, with very little larger vegetation. Unlike many drainage lines in the Karoo, the drainage lines are typically un-impacted by the invasive *prosopis sp.*

6.7 Agricultural Potential and Soils

The Agricultural Potential Assessment was conducted by SiVEST (Appendix 6C).The environmental baseline from anagricultural potential and soil perspective is presented below.

6.7.1 Agricultural Potential

Agricultural potential is described as an area's suitability and capacity to sustainably accommodate an agricultural land use with this potential being benchmarked against crop production. 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 extremely low for crop production while moderately low for grazing. This poor agricultural potential rating is

primarily due to restrictive climatic characteristics and soil depth limitations. The site is not classified as high potential nor is it a unique dry land agricultural resource.

- Current Situation

The farms which constitute the assessment area for this project are currently used as extensive grazing land for free range sheep production (Figure 24). Stocking rates are estimated at around 1 SSM (small stock unit) per 8 hectares. Water is the major limiting factor to local agricultural enterprises and the proposed development area does not contain nor border a perennial river / freshwater impoundment which could be used as a source of irrigation water.The site does not currently accommodate any centre pivots, irrigation schemes or active agricultural fields. Seasonal pans tend to have the highest grazing potential due to the increased plant available water. Drinking water for the animals is sourced from groundwater resources.

Figure 24: A typical flock of sheep grazing on the Prieska Site

6.7.2 Soil Characteristics

According to the ENPAT database the Prieska site is dominated by apedal soil types (Figure 25). Apedal soils lack well formed peds other than porous micro-aggregates and are weakly structured. Apedal soils tend to freely drained and due to overriding climate conditions these soils will tend to be Eutrophic (high base status). The study area is classified as having an effective soil depth, depth to which roots can penetrate the soil, of less than 0.45 m deep which is a limiting in terms of sustainable crop production (Figure 26).

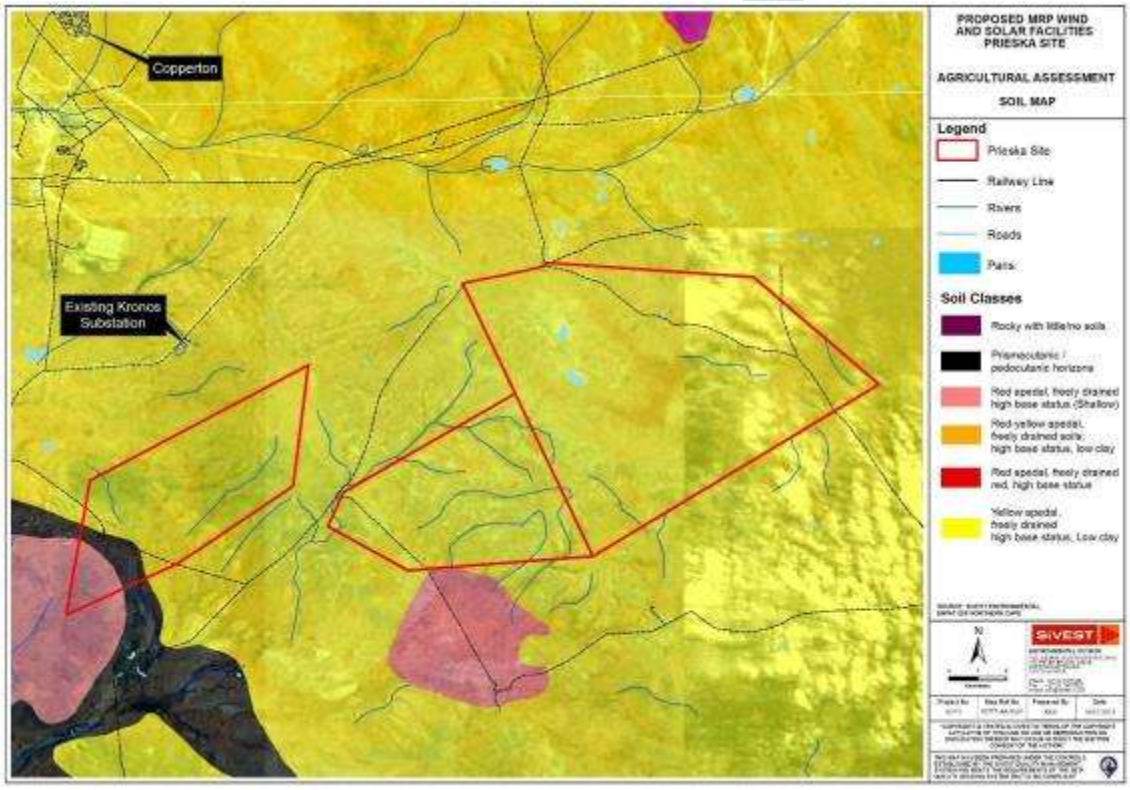

Figure 25: Broad soil type map

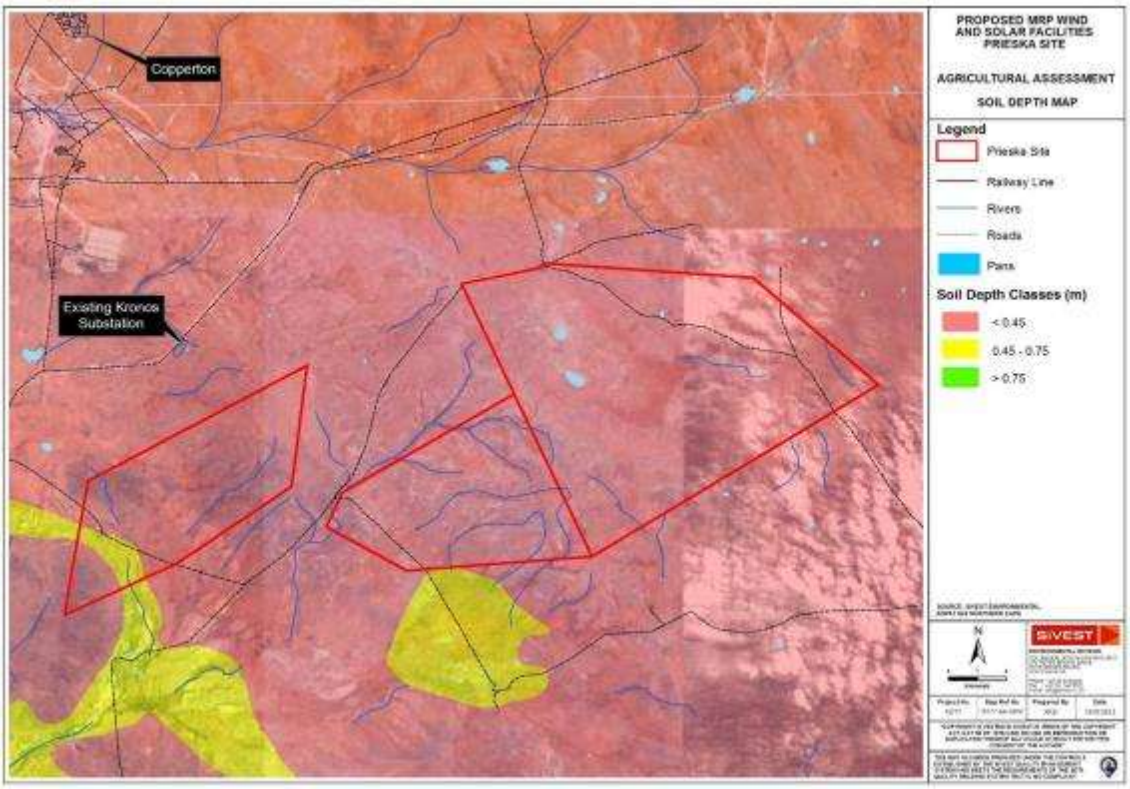

Figure 26: Soil depth map

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 the strong summer rainfall regime, moisture stress and low winter temperatures will further reduce the agricultural potential of the area under assessment.The study area is dominated by soils which are not suited for arable agriculture (Figure 29) mainly due to the shallow effective rooting depth.

- Soil Survey and Field Characteristics

Due to the size of the site (12 853ha) local agricultural activities (unimproved grazing land) and the nature of the proposed activities, an exploratory soil survey was performed.The soils identified on the development site are predominantly calcic, rocky and shallow with a low agricultural potential. Rocky and shallow calcic soils (Glenrosa Form) cover most of the surveyed area (Figure 27). Virtually all the soils encountered on site contained at least one layer that was limiting to plant growth and these layers included Lithocutanic, hard rock and hard pan carbonate. The soils' properties identified during the field verification reflect the arid climate in which they were formed.

The location and description of the sample points were used to create a verified soil map showing homogeneous soil bodies (Figure 27). Combining the effective depth information (i.e. depth to

root limiting layer) and Inverse Distance Weighting one is able to obtain a generalised soil depth for the PDA (Figure 28). Soils with an effective depth of greater than 50 cm were rarely observed during the soil survey with most soils exhibiting an effective soil depth of less than 30 cm.

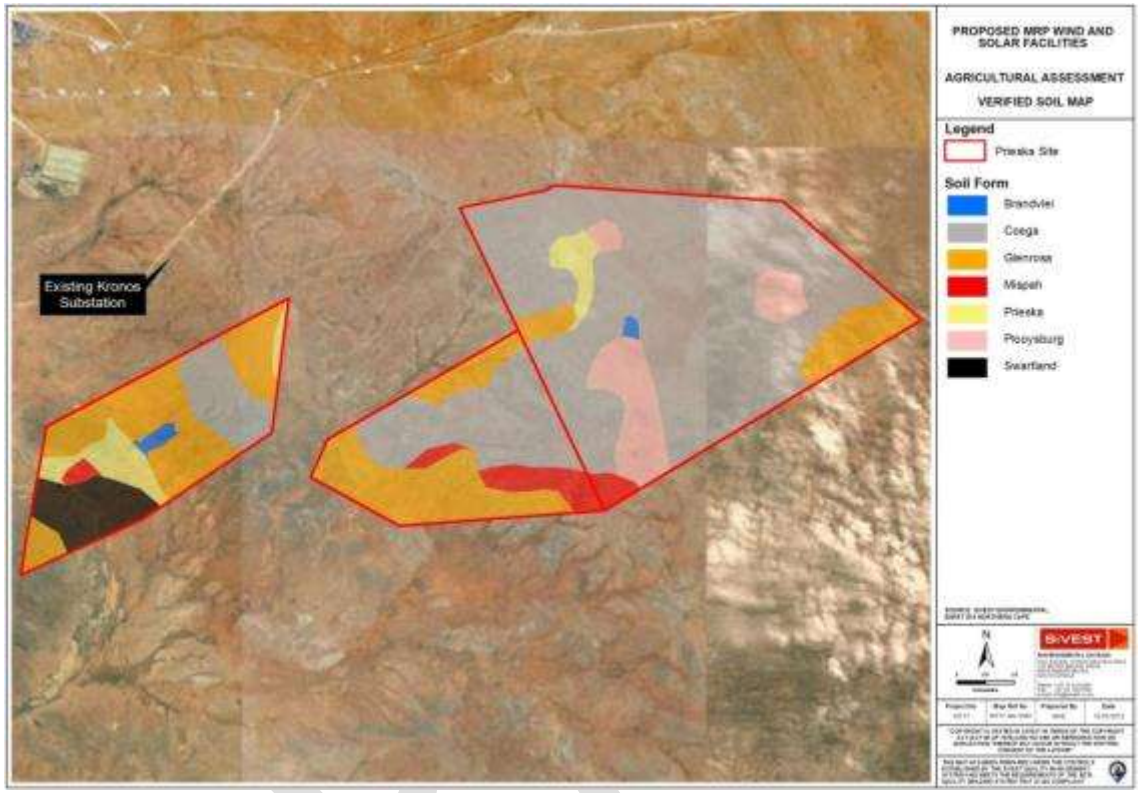

Figure 27: Verified Soil Map for the Prieska Sites

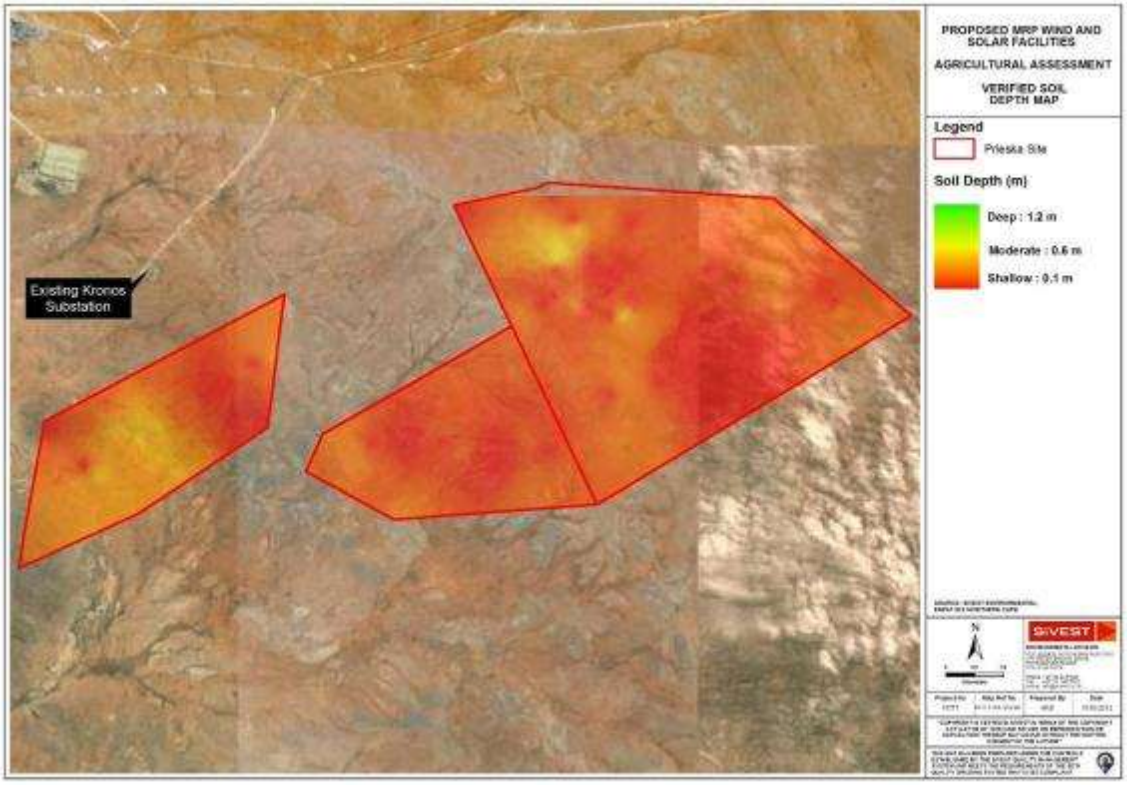

Figure 28: Verified Soil Depth Map

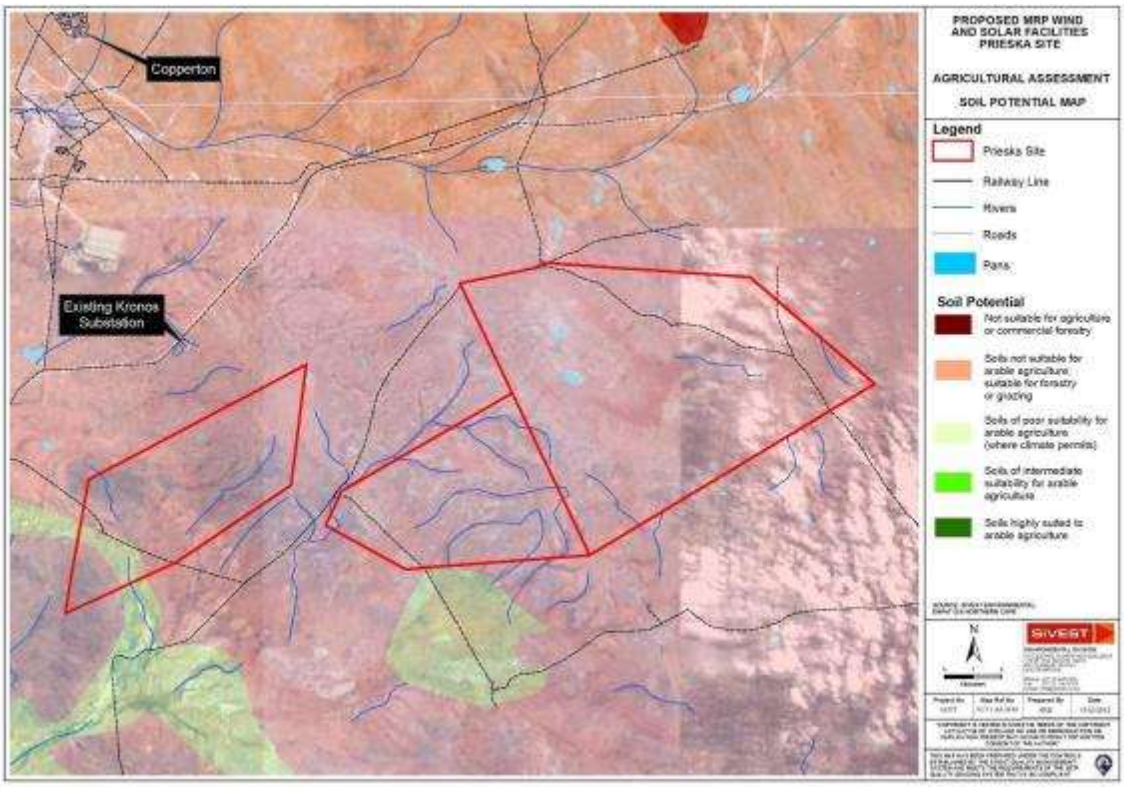

Figure 29: Soil Potential Map

6.7.3 Verified Agricultural Potential

Overall agricultural potential is based on assessing a number of inter-related factors including climate, topography, soil type, soil limitations and current land use. In this area climate is the overriding and foremost limiting factor to sustainable agricultural production. The combination of low rainfall and an extreme moisture deficit means that sustainable arable agriculture cannot take place without some form of irrigation. The site does not contain nor is it bounded by a reliable surface water irrigation resource and the use of groundwater for this purpose does not seem agriculturally and economically feasible. This is due to the high cost of borehole installation and the sheer volume of water required for irrigation purposes.

As mentioned above, shallow lithic and calcic soils (Glenrosa Form) cover most of the total survey area. Virtually all the soils encountered had a layer that was limiting to plant growth and are very susceptible to erosion. Effective soil depth rarely exceeded 50 cm. A map indicating agricultural potential in terms of crop production for site is provided in Figure 30. The majority of the site has been classified as having low potential for crop production due to an arid climate and highly restrictive soil characteristics. The site isnot classified in terms of registering a high agricultural potential and they are not a unique dry land agricultural resource. The site is considered to have a moderately low value when utilised as grazing land, its current use.

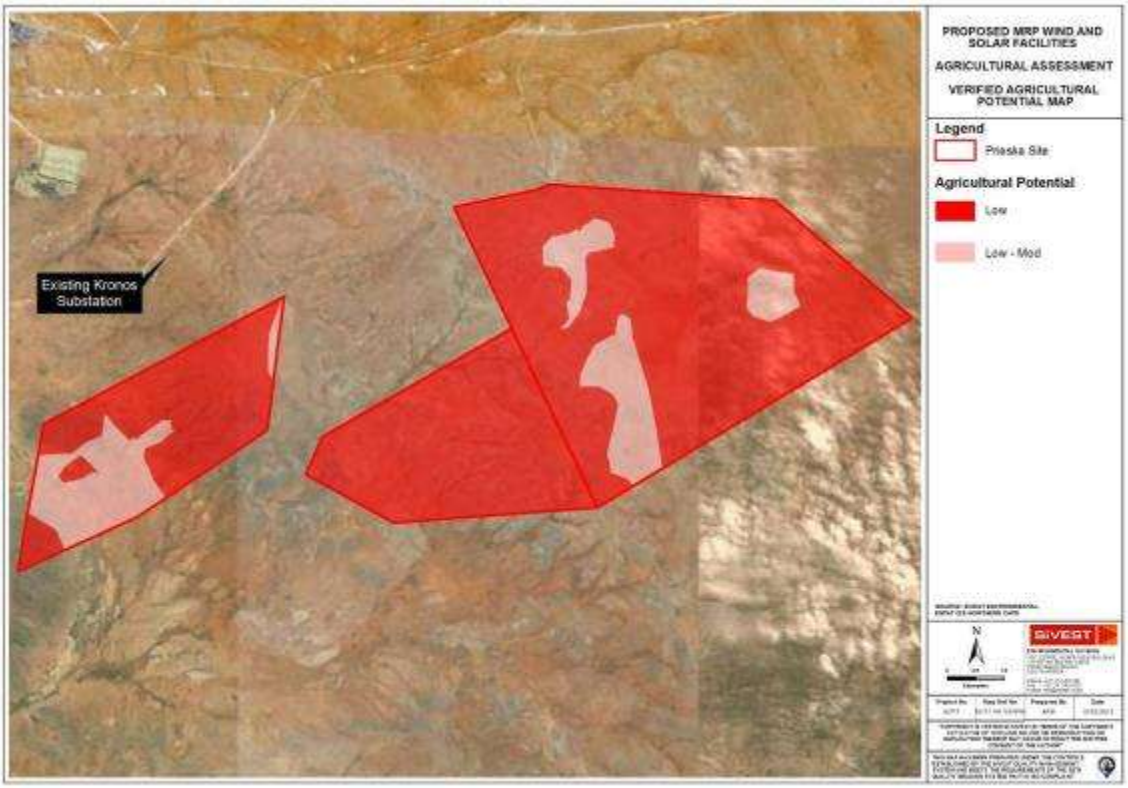

Figure 30: Agricultural Potential Map

6.8 Visual

The Visual Assessment was conducted by SiVEST and is included in Appendix 6D.The environmental baseline from a visual perspective is presented below.

6.8.1 Physical Landscape and Land Use related Characteristics of the Study Area

Descriptions of the physical landscape characteristics of the study area, namely, topography, vegetation cover and land use, are included below as part of its visual characterisation.

The topography in the wider study area around the site is characterised by a mix of very flat plains (typical of much of the Karoo), as well as areas of slightly more undulating relief. This generally flat relief engenders wide vistas, especially from higher-lying ground.

The natural vegetation comprises of very low scrub vegetation due to the natural aridity of the area. Vegetation on the plains typically comprises of very low shrubs, being very small in size in areas of stony ground and being slightly higher (to around 500mm) in areas of sandier soils. Only in very limited areas on the study site, including along some ephemeral drainage lines, and along some of the low ridges and koppies in the area does the slightly larger vegetation occur. In these areas, black thorn shrubs (*Acacia mellifera*) of up to 2-3m in height occur sparsely, especially on rocky ground. In certain areas, man has had an impact on the natural vegetation, especially around farmsteads, where over many years tall trees and other typical garden vegetation have been established. Around certain farmsteads, little 'plantations' of prickly pear cacti have been established. In areas where this artificial vegetation has been established, the vegetation can be effective in blocking views.

Due to the highly arid nature of the area's climate, livestock rearing (of sheep) is the predominant rural land use in the wider area. As such, the natural vegetation has been retained across the vast majority of the study area, and the landscapes have retained a very mostly natural character, as described in more detail below.

The nature of the climate and corresponding land use which entails that stocking densities are low has resulted in relatively large farm properties across the area, thus the area has a very low density of rural settlement, with only a handful of scattered farmsteads occurring across the area. Built form in the parts of the study area where livestock rearing occurs is thus limited to isolated farmsteads, gravel access roads, ancillary farm buildings, telephone lines, fences and the remnants of old workers' dwellings.

In some parts of the study area, a greater human influence is visible, in the form of mining infrastructure and electricity transmission infrastructure. Close to Copperton (to the west of the development site), the infrastructure associated with a now-defunct mine still exists, with the headgear, as well as an old slimes dams being prominent landmarks. Current mining is present to the east of the development site along the R386 road where salt is being mined from a large salt pan. As indicated in the overall study area orientation map above, there are a number of large power lines that bisect the site, and two large substations (Kronos and Cuprum) occur with a density of high steel structures.

- Visual Implications

Due to the topographical and vegetative characteristics of the area, a viewer in the study area will have a general impression of a natural, rural where there are wide-ranging vistas over the flat to very gently undulating terrain that are constrained very little by the vegetation. The generally low degree of human habitation and obvious impact on the landscape level thus engenders the area with a largely natural, rural feel. The flat terrain entails that the horizon is usually very flat and

visible across an entire 360^{o}arc of the viewer. The limited effect of vegetation in screening the horizon and sky to the viewer adds to this natural feel.

In areas where the topography is gently undulating, vistas can be restricted if the viewer is located within one of the very gentle valleys. Low ridges can be somewhat effective in enclosing and restricting the viewshed of a viewer especially if the viewer is close to the foot of the ridge. Conversely if the viewer is located on higher ground, then the vista 'opens up', with views extending to distant relief. This is illustrated well if one considers the vistas that are visible to the people driving south along the R386 to the south of the site. In the vicinity of the Vrede farmstead, the road runs alongside the base of a low ridge that is effective in blocking views to the east of the road. Only where the road rises up onto higher ground to the south–west do is the motorist presented with views of the surrounding areas.

The generally wide ranging vistas have implications for the visibility of the power-generation infrastructure that is proposed to be located on the development site – large structures such as the solar fields would be highly visible from most parts of the study area.

6.8.2 Visual Character and the importance of the Karoo Cultural Landscape

As has been explained above, the physical and land use-related characteristics of the study area contribute to its visual character. Visual character is also influenced by the presence of built infrastructure such as buildings, roads and other objects such as electrical infrastructure. Visual character can be defined based on the level of change or transformation from a completely natural setting, which would represent a visual baseline in which there is little evidence of human transformation of the landscape. This is not to say that landscapes transformed by man are necessarily visually degraded, as many landscapes and visual settings around the world are a product of hundreds or even thousands of years of human influence, and thus represent a perceived 'natural visual baseline'. Varying degrees of human transformation of a landscape would engender differing visual characteristics to that landscape, with a highly modified urban or industrial landscape being very different to a largely natural undisturbed landscape.

Built infrastructure within most of the study area is limited to a low density of gravel access roads, boundary fences, very few farm buildings and other farming infrastructure such as windmills, as well as much larger-scale infrastructure such as mining infrastructure as well as power lines and substations. As explained above, the low density of human settlement and associated low level of change to the natural environment engenders the area with a largely natural visual character which can best be described as a rural or pastoral visual character, however with an element of human (industrial) influence.

The only spatial divergence from this mostly rural character is in the immediate area within and surrounding the small settlement of Copperton, where a cluster of houses occurs. The settlement and has an urban visual character, which means that it is characterised more by anthropogenic objects (such as buildings and roads) than natural features. However, it should be noted that the very small extent of the settlement and the immediate transition into scrublands on its boundary entails that it does not really stand out as an area with a different visual character.

The greater study area can thus be considered to be typical of a Karoo or "platteland" landscape that would typically be encountered across the high-lying dry western and central interior of South Africa. Much of South Africa's dry Karoo interior consists of wide open, uninhabited spaces sparsely punctuated by widely scattered farmsteads and small towns. Traditionally the Karoo has been seen by many as a dull, lifeless part of the country that was to be crossed as quickly as possible en route between the major inland centres and the Cape coast, or between the Cape and Namibia. However in the last couple of decades this has been changing, with the launching of tourism routes within the Karoo, and the promotion of tourism in this hitherto little visited, but large part of South Africa. In a context of increasing urbanisation in South Africa's major centres, the Karoo is being marketed as an undisturbed getaway, especially as a stop on a longer journey from the northern parts of South Africa to the Western and Eastern Cape coasts. Examples of this may be found in the relatively recently published "Getaway Guide to Karoo, Namaqualand and Kalahari" (Moseley and Naude-Moseley, 2008). The exposure of the Karoo in the national press during 2011 as part of the debate around the potential for fracking (hydraulic fracturing) mining activities has brought the natural resources, land use and lifestyle of the Karoo into sharp focus.Many potential objectors stress the need to preserve environment of the Karoo, as well as preserving the 'Karoo Way of Life', i.e. the stock farming practices which are highly dependent on the use of abstracted ground water (e.g. refer to the Treasure Karoo Action Group website http://treasurethekaroo.co.za/).

These examples of how the Karoo is valued provide a good example of how the typical Karoo landscape can be considered a valuable 'cultural landscape' in a South African context. Cultural landscapes are becoming increasingly important concepts in terms of the preservation and management of rural and urban settings across the world; the concept of 'cultural landscape' is a way of looking at place that focuses on the relationship between human activity and the biophysical environment (Breedlove, 2002). The cultural landscape concept is a relatively new one in the heritage conservation movement across the world. In 1992 the World Heritage Committee adopted a definition for cultural landscapes:

Cultural landscapes represent the combined worlds of nature and of man illustrative of the evolution of human society and settlement over time, under the influence of the physical constraints and/or opportunities presented by their natural environment and of successive social, economic and cultural forces, both external and internal

Cultural Landscapes can fall into three categories (according to the Committee's Operational Guidelines):

i) "a landscape designed and created intentionally by man";
ii) an "organically evolved landscape" which may be a "relict (or fossil) landscape" or a "continuing landscape";
iii) an "associative cultural landscape" which may be valued because of the "religious, artistic or cultural associations of the natural element"

The typical Karoo landscape of wide open plains, and isolated relief, interspersed with isolated farmsteads as well as windmills and stock holding pens, is an important part of the cultural matrix of the South African environment. The presence of the Karoo farmstead, as well as the ubiquitous windmill, fence line and herds of sheep is an important representation of how the harsh, arid nature of the environment of this part of the country has shaped patterns of human habitation and interaction with the environment in the form of the predominant land use and economic activity practiced in the area over centuries of human habitation. The presence of, and spatial orientation of small Karoo towns, such as Prieska, engulfed by an otherwise rural environment, form an integral part of the wider Karoo landscape. As such the Karoo landscape as it exists today has value as a cultural landscape in a South African context. In the context of the types of cultural landscape listed above, the Karoo cultural landscape would fall into the second category, that of an organically evolved, “continuing” landscape.

In the context of the study area, the various landscapes, as visible to the viewer, present excellent examples of such a Karoo cultural landscape. In addition to the features noted above, there are two other physical characteristics found in the study area that are unique to the dry west of the country; the impressive sociable weavers’ nests that are found along roads on telephone poles, as well as the Quiver tree or ‘Kokerboom’.

Figure 31: Sociable Weaver nest and windmill in the Study Area

The roads through the study area present good examples of these typical landscapes. The area is not typically visited as part of leisure tourism trips (although the Nelspoortje guest house markets itself as offering the visitor a typical Karoo farm stay), however the aesthetic quality of the landscape is nonetheless important, considering the study area's location in a wider context of proximity to the N10 highway route, the Orange River at Prieska and the highly scenic Doringberge which host a number of hiking trails. A significant change to this landscape has the potential to degrade its aesthetic quality and to threaten the conservation or preservation of the particular cultural landscape in a local context. In this context the significant potential visual intrusion posed by the proposed development in particular may have implications for the aesthetic quality and degradation of the visual character and thus the cultural landscape within the study area; although it is recognised that cultural landscapes are not necessarily static, but can be evolving.

Figure 32: A typical vista within the study area

6.8.3 Visual Sensitivity

The visual character as discussed above engenders the study area with a certain level of visual sensitivity. This sensitivity can be defined in the context of change of the visual environment, and the potential for the resource quality to be degraded by a development (such as the proposed development) which could result in change in the visual character of the area. As described above, the visual character of the study area is strongly linked to its natural and rural characteristics. Although large-scale objects do exist within the study area, these do not occupy a sufficiently large area or are not of sufficient densities to have a significant impact on the visual character of the area.

An important component of visual sensitivity is the presence, or absence of visual receptors that may value the aesthetic quality of that landscape. As described below, a number of receptor locations that are potentially sensitive receptors are present in the study area. In many instances visual sensitivity in such a rural setting is closely tied into the practising of leisure tourism in an area, especially that which relies on the aesthetics of the area as part of its attraction. There is significant tourism visitation in the area, however it is likely that only a very small and insignificant component of this is leisure-based. Most of the tourism demand (that has resulted in the tourism 'product' in the form of accommodation facilities having been established) relates to the presence of the Alkantpan Ammunitions Testing Range located to the south of Copperton, which draws business tourism to the local area.

Although no formal protected areas or leisure / nature-based tourism activities exist within the study area, the context of the study area as a rural area with a relatively low density of human change and influence in the landscape provides the landscape with a certain level of visual sensitivity.

- Visually sensitive areas within the site boundaries

Although most of the sensitive receptors are not located within the development site itself, there are a few receptor locations within the development area or very close to the site. In order to reduce direct visual impacts a buffer of 1km was created around each sensitive receptor location. Where these buffers fall within the site, it was determined that these buffers should be treated as exclusion zones in which no infrastructure, should be allowed to be developed.

6.8.4 Presence and Location of Sensitive Receptors

A sensitive receptor is defined as a receptor which could experience a potential adverse visual impact due to a development such as 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. As described below the adverse impact is often associated with the alteration of the visual character of the area in terms of the intrusion of the solar arrays into a 'view', which may affect the 'sense of place'. The identification of sensitive receptors was initiated in the scoping phase of the project and has been refined through ground-truthing in this phase of the project.

The table below lists all of the identified sensitive receptor locations that would be potentially visually affected by the proposed solar facility. The table includes those receptor locations within a 5km radius of the development site.

Sensitive Receptor Location	**Distance Band Zone in which Receptor is located**
Nelspoortjie Guest Farm and Farmstead	2km-5km
Humansrus Farmstead	0-500m
Platsjambok Farmstead*	Within Site
Vrede Farmstead	>5km
Who Can Tell Farmstead	>5km
Jonkerwater Farmstead	>5km
Graspan North Farmstead	2km-5km
Graspan South Farmstead	2km-5km

Grenaatskop Farmstead	2km-5km
KleinK'kolk Farmstead	1km-2km
Hoekplaas Farmstead*	0-500m
Voorspoed Farmstead	2km-5km
Mierdam Farmstead*	Within Site
Grootfourieskolk Farmstead	>5km
Klippan Farmstead	2km-5km

* - These farmsteads have been listed as sensitive receptor locations, although it should be noted that these are the residences of one of the landowners of the site.

5km has been selected as the radius within which receptor locations have been identified, as any significant visual impact is likely to be experienced within this zone. Beyond 5km, the visual impacts are less significant as the visibility of an object decreases exponentially over larger distances.

Of these static sensitive receptor locations a number have been designated as key observation locations on which the visual contrast rating has been undertaken.

The map below indicates the location of the sensitive receptors around the site.

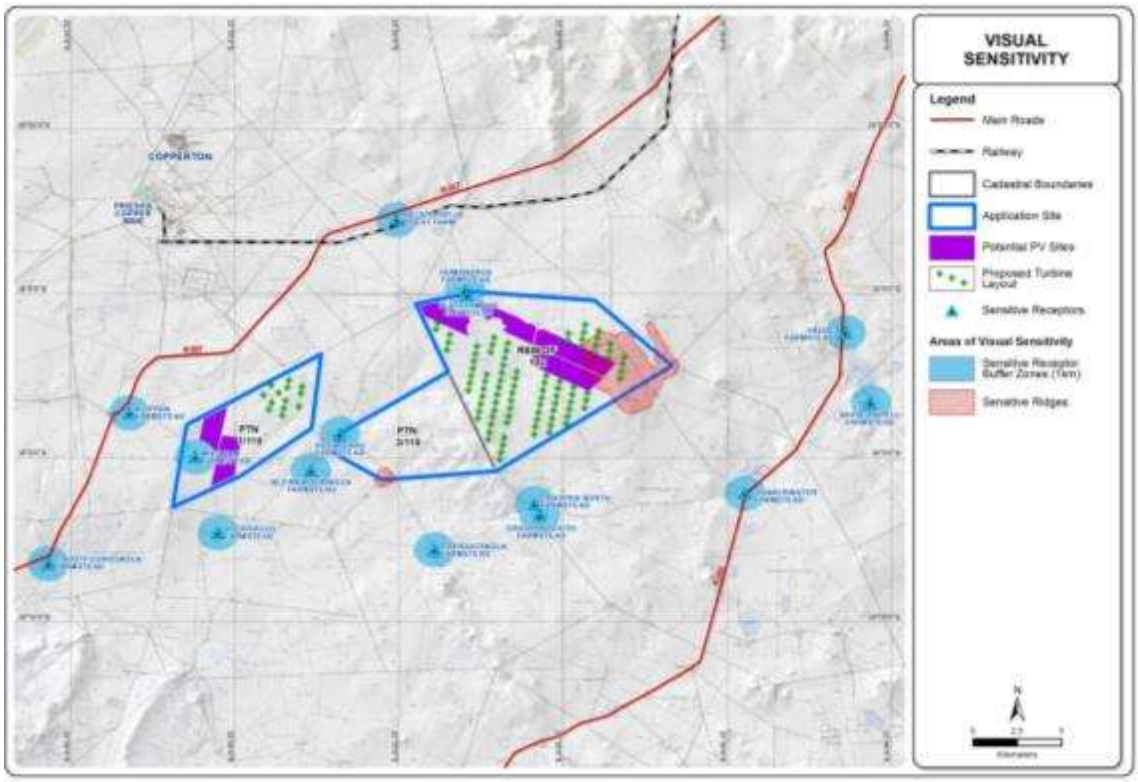

Figure 33: Map showing location of receptor locations in the study area

In many cases, roads, along which people travel, are considered as sensitive receptors. A number of public roads traverse the area around the development sites, the closest of which is the R357 un-surfaced road that runs to the north and west of the site (running within the 5km buffer of the site). The R386 also runs to the east of the site, but is at a much greater distance. In addition a local farm access road runs between the two components of the development site. None of these roads are considered to be sensitive receptor roads. They are used almost exclusively as local access roads, with very little use for any other purposes. As described above the area is not associated with any particular scenic value or any other tourism use. In addition the R357 passes close to the now disused Copperton Mine and associated slimes dam, as well as the Kronos Substation. Thus the area around the development site traversed by this road can be considered to be visually 'degraded' by a prevalence of large human infrastructure, and is highly unlikely to be associated with any visual sensitivity.

6.9 Geotechnical Aspects

The GeotechnicalAssessment was conducted by Mainstreamand is included in Appendix 6E.The environmental baseline from a geotechnical perspective is presented below.

Published geological records show that the site is underlain by a variety of bedrock parent materials including quartzite, sandstone and Tillite (consisting of consolidated masses of unweathered blocks and unsorted glacial till). The general succession of soil / rock at the site from a geotechnical engineering perspective as revealed by the trial pits include the following:

- Topsoil – generally loose sand/silt
- Bedrock - Weakly cemented Calcite/Sandstone/Siltstone becoming harder with depth

The Mierdam site is located in a shallow valley and it was observed that the bedrock there is weaker and more easily excavated.

6.10 Heritage

The Heritage Assessment was conducted by Dr. Johnny Van Schalkwyk and is included in Appendix 6F.The environmental baseline from a heritage perspective is presented below.

6.10.1 Regional Overview

It seems as if finds of Early Stone Age material this far to the west is very limited and no report of any such finds in the study region could be found. This is a fact that has been commented on by various authors (see Morris 2000b).

By the 19thcentury some Dutch speaking trekboers moved into the region, grazing their stock. As they depended on water for their live-stock, these farmers would have stuck close to available water sources and it was only during the wetter parts of the rain season that they might have accessed other areas for short periods of time. An investigation of the Title Deeds of most of the farms under consideration indicated that they were surveyed during the early part of the twentieth century, implying that they would have been occupied since then.

The one industrial activity that is practised in the region on a commercial basis is the mining of copper at nearby Copperton. The history of the development of mining activities at Copperton is graphically described by Hocking (n.d.). Although the existence of copper on the farm Vogelstruisbult was known since the early 20$_{th}$ century, little was done to exploit it. It was only during the late 1960s that the potential importance of the deposit was realised and a number of shafts were sunk: the Marais and Hutchings shafts. To house the workers at the mine a residential area was developed and named Copperton. The mine was closed down in 1991.

An investigation of the Title Deeds of most of the farms under consideration indicated that they were surveyed during the latter part of the nineteenth century, implying that they would have been occupied since then. Kaffirskolk was first surveyed in 1891.

- Identified Sites

The following Heritage sites, features and objects were identified in the proposed development area:

Archaeological Sites

Table 8: Archaeological sites Identified on the proposed site

Location	S 30.09346 S 30.07039	E 22.34082 E 22.35148
Stone tools were identified to occur specifically in areas where there are outcrops or lowhills and most commonly date to the Middle Stone Age, although one site also includedmaterial that can be dated to the Later Stone Age. None of the sites can be classified asquarry sites or factory sites and no indication of human settlement was found. Because oftheir location the sites are viewed to be lookout pointswhere people watched for game.The material used for the production of the tools ishardened shale, chalcedonyandquartziteand the tools include retouched flakes, blades and scrapers.One hammer stonewas found with the LSA material. The density of the toolscatters varies between 1 artifactper 1m²to 10artifactsper 1 m². None of these areas are bigger than 20 x 20 metres.		

Farmsteads

Farmsteads are complex features in the landscape, being made up of different yet interconnected elements. Typically these consist of a main house, gardens, outbuildings, sheds and barns, with some distance from that labourer housing and various cemeteries. In addition roads and tracks, stock pens and wind mills complete the setup. An impact on one element therefore impacts on the whole.

The architecture of these farmsteads can be described as an eclectic mix of styles modified to adapt to local circumstances. Farm buildings were generally single storied. Walls were thick and built in stone. The roof was either flat or ridged and thatched or with corrugated iron and was terminated at either end by simple linear parapet gables.

In some cases outbuildings would be in the same style as the main house, if they date to the same period. However, they tend to vary considerably in style and materials used as they were erected later as and when they were required.

Table 9: Farmsteads Identified on the proposed site

Location	S 30.08356	E 22.31290
The Mierdam farmstead datesto the 1940s, but burned down during the 1970s. Only oneof the outbuildings remained, but has since been renovated and altered to some extent.Itis rectangular, built with bricks, have a corrugated iron roof and wooden window frames.		

Figure 34: Farmstead on Mierdam Farm

Cemeteries

Apart from the formal cemeteries that occur in municipal areas (towns or villages), a number of these, some quite informal, i.e. without fencing, is expected to occur sporadically all over, but probably in the vicinity of the various farmsteads. Many might also have been forgotten, making it very difficult to trace the descendants in a case where the graves are to be relocated.

Most of these cemeteries, irrespective of the fact that they are for landowner or farm labourers (with a few exceptions where they were integrated), are family orientated. They therefore serve as important 'documents' linking people directly by name to the land.

6.11 Socio-economic Environment

The Socio-economic Assessment was conducted by Nonka Byker and An Kritzinger from MasterQ Research and is included in Appendix 6G. The environmental baseline from a socio-economic perspective is presented below.

The baseline profile (status quo) of the receiving environment is described in terms of the various socio-economic change processes (cf. Vanclay, 2002). The baseline profile mostly focused on

the local municipal area, but reference was made to the district and the province, where deemed necessary. The profile was structured according to the following social change processes:

- **Geographic processes**: land use patterns;
- **Demographic processes**: the composition of the local community;
- **Economic processes**: the way in which the local people make a living and the economic activities in the society;
- **Institutional and Legal processes**: the role and efficiency of the local authority and other service providers in the area in terms of their capacity to deliver services to the local area; and
- **Socio-cultural processes**: How the local population behave, interact and relate to each other, their environment, and the belief and value systems that guide these interactions.

6.11.1 Geographical Processes

The Siyathemba Local Municipality (SLM) is located in the Pixley Ka Seme District Municipality of the Northern Cape Province and is located quite centrally within the largely arid Northern Cape. It is bordered solely by other Northern Cape Municipalities, namely Siyancuma Local Municipality in the North, Thembelihle Local Municipality in the East, Emthanjeni Local Municipality in the South-East, Kareeberg Local Municipality in the South-West, and !Kheis Local Municipality in the West. The settlements of note in SLM are Prieska, Marydale, and Niekerkshoop with Prieska being the main centre locally.

There are several main roads in the SLM and one National Route – the N10, which runs right past Prieska on its way to Port Elizabeth. In addition, several large railways exist within SLM's borders, mostly to serve freight moving purposes. The LM is a sparsely populated with few settlements, large open spaces, and minimal infrastructure. It is also one which suffers from several socio-economic issues, pitfalls, and threats.

The Northern Cape District Management Area 07 (NCDMA07) is one of only a few DMAs nationally. These areas are usually only reserved for regions of conservation/national parks and/or areas which are extremely sparsely populated. In the case of NCDMA 07 it is the latter which prevails since the area has a minute population relative to the land area it occupies. Furthermore, it has been mentioned by The Municipal Demarcation Board that they wish to integrate all DMAs into existing Local Municipalities (LMs) in the near future. NCDMA07 is located in the Pixley Ka Seme District Municipality alongside eight Local Municipalities. The area consists of wide open spaces and a very low population.

According to the SLM IDP (2010) stock farming takes place throughout the region, mainly consisting of small stock (sheep and goats) that produces mutton and wool. Irrigated farming also takes place with irrigation from the Orange and Vaal Rivers, but is mostly confined to areas

surrounding these rivers. Despite the confined areas, irrigated farming forms a large part of the agricultural activities in the region and in include maize, peanuts, lucerne, grapes, dry beans, soya beans, potatoes, olives, popcorn, pecan nuts, pistachio nuts, and cotton farming.

Industries are mostly confined to light industries, but the IDP states that the constant supply of water (from the Orange and Vaal Rivers) offers the potential of using the products produced in the area as a basis for benefaction.

The proposed site is located along the R357, approximately 6km southeast of the Copperton Mine and 45km southwest of Prieska. Some social impacts can be expected in Prieska as the closest town. Both sites are bisected by existing power lines (66kV, 132kV and 400kV lines). An existing Eskom substation lies to the west of the sites, adjacent to the R357. The area is further characterised by a number of scattered households, three of which are located on the sites itself.

The table below summarises the findings of the socio-economic study.

Table10: Summary of Socio-Economic findings

Social parameter	**Findings**
Baseline Demographic processes	
Population Size and Growth	Sparsely populated and has shown remarkable growth.
Race, Age & Gender Composition	46.9% male and 53.1% female. The most prevalent racial group is Coloured people followed by the Black / African group. Dominant language is Afrikaans. The age profile is unpredictable, revealing that forces may be at play such as possible migration and disease.
Baseline Economic processes	
Return of energy and resources demand	The gradual local and worldwide recovery from the recent economic recession signals a return of the demand for resources and energy.
Security of Power Supply	Short to medium term electricity supply security is instrumental in securing economic growth and investor confidence.
International focus on clean energy	A preference for financing cleaner energy is likely to influence the energy sector.
Levels of Education	Levels of education are quite low. Highest level of education varies, but a great proportion has been exposed to some secondary education.
Skill Levels	Skill levels are quite low. Majority involved in elementary occupations, heavily reliant on agriculture.

Employment	There has been growth in the number of employed people. 41.4% of the population are employed in the SLM, whereas 74.5% are employed in the NCDMA07. Agricultural, hunting, fishing, and forestryindustries are responsible for employing majority of the local population. Low construction employment reveals low growth in the LM.
Income Levels	Income levels are very low in the area with 46.5% indicating no income at all. Most place within the low income bracket (R801 - R1 600) whilst few people are high earners in the LM.
Social Grants	26.7% of citizens made use of some form of social grant in 2007 with the most popular being child support.
Baseline Institutional and Legal Processes	
Housing and Household Status	Number of households increased in line with the population increases. Good progress made in order to provide formal housing with 89.6% of the population having formal housing in 2007.
Water and Sanitation	51.6% of people received piped water within their dwelling and 40.6%within their yard. Sanitation standards have shown marked improvements. 91.5% had access to sanitation at RDP standards (all persons should have access to at least a VIP flush toilet with ventilation) in 2007.
Refuse removal	In 2007, 82.2% of all refuse was collected and removed by authorities/private companies at least once a week. Only 3.9% of all people had no refuse removal whatsoever.
Energy Usage and Sources	Energy is mainly used for cooking, lighting and heating. Energy is mainly sourced from electricity but small amounts are sourced from paraffin and wood. Majority of electricity is supplied by Eskom.
Crime Statistics	In Prieska, the most prevalent crimes are assaults, burglaries and theft. There is no sign of any increases in criminal activity. Drug-related crimes are quite high and may indicate larger social difficulties.
Emergency, Safety & Security Infrastructure	In terms of emergency, safety and security, the local municipality has 3 police stations and prisons, as well as a fire brigade.
Health Infrastructure	The Hospital in Prieska services the major health-related needs of the community. More clinic services and further access to HIV/AIDS medication and education are required. Private health professionals operate within local municipality but only provide services to those who can afford them.
Baseline Socio-Cultural Processes	
Cultural history	Prieska was proclaimed as a municipality in

	1878. Today it mostly serves the surrounding farms. The predominant racial group is Colouredand they mostly speak Afrikaans in the form of 'Kaapse Taal' (a creolised dialect of Afrikaans) and 'Pure Afrikaans' (formal Afrikaans).

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 will be implemented according to Guideline 4 of the NEMA (107/1998) and 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 receipts were sent to those submitting comments.
- Comments were addressed in the Comments & Response Report.

7.1 Overview of the Public Participation Process to date

The public participation process for the EIA phase was initiated on 29 March 2012. The EIA Newsletter was distributed via email to all stakeholders. Stakeholders were 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 will ensure that I&APs are kept informed regarding the EIA phase (the full stakeholder database list is included in Appendix 5F).

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 address their main concerns.

An advertisement was placed in the *Die Echo*(in English and Afrikaans) to advertise the public meeting and availability of the draft Environmental Impact Report. Posterswere also be placed within the town of Prieska notifying the public of the public meeting and availability of the report.

7.3 Proof of Notification

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

- Public Meeting and DEIR availability text (Appendix 5B)
- Proof of advertisements in the newspapers (Appendix 5C) - Proofs will be included in the Final EIR
- EIA Newsletter (Appendix 5A)
- Correspondence to registered I&APs and key stakeholders (Appendix 5B)

7.4 Focus Group Meetings

A Focus Group Meeting (FGM) will be held inApril 2012. 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 11: Focus Group meeting

Venue	Interested Parties	Date	Time
Boardroom, Pixley Ka Seme, Culvert Street, De Aar	Municipal Manager and Officials of Pixley ka Seme District Municipality	Tuesday 24 April 2012 **To be confirmed**	14h00 - 16h00
Boardroom, Victoria Street, Prieska	Municipal Manager and Officials of Siyathemba Local Municipality	Monday 23 April 2012 **To be confirmed**	14h00 - 16h00
Mierdam Farm	Surrounding Agricultural Union and Landowners	Tuesday 24 April 2012 **To be confirmed**	09h00 - 11h00

Minutes of this meeting will be compiled and forwarded to all attendees for their review and comment (Appendix 5G). 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 DEIR with representatives from various Provincial Government Departments as well as various organs of state and NGOs, such as WESSA.

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 DEIR as well as to raise any further comments and/or concerns that they may have.

The workshopis scheduled to take place as follows:

Table 12: Key Stakeholder Workshop

Venue	Date	Time
La Casa Mia, 27A Carters Road, Hadison Park, Kimberley	Friday, 02 April 2012	10h00 – 12h00

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 5G).

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 13: Public Meetings / Open Days

Venue	Date	Time
Prieska Town Hall, Victoria Street, Prieska	Monday, 23 April 2012	18h00 - 20h00

This meeting has been advertised in *Die Echo*(in English and Afrikaans). Invitation letters will also be sent out via mail and e-mail to all registered I&APs on the project's database.

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

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

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

7.7 Public review of Environmental Impact Report

The Draft EIR will be made available for review at the following venues from 30 March 2012 to 02 May 2012:

Table 14: Venues where Scoping Report will be publically available

Venue	Street Address	Hours	Contact No.
Prieska Library	Steward Street, Prieska	Mondays – Fridays 09h00 – 17h00	053 353 5300 x 305
Alfa Library	Alfa Street, Alfa	Mondays – Fridays 09h00 – 17h00	053 353 5300 x 307

All comments received on this report will be incorporated into the Comments and Response Report.

7.8 Comments and response report

Issues, comments and concerns raised during the public participation process will be captured in the Comments and Response Report (C&RR) – Appendix 5E. This C&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 Assessment (including fauna, flora and avifauna)
- Surface Water Assessment
- Agricultural Potential and Soils Assessment
- Visual Impact Assessment
- Geotechnical Assessment
- Heritage Impact Assessment
- Socio-economic Assessment

Each specialist assessed the impact of all the wind and solar energy facilities that Mainstream are proposing to develop near Prieska. It should, however, be noted that the findings of these studies have been separated according to the impact of each individual proposed facility and the results for the proposed 40MW PV Facility on Mierdam Farm are presented below.

8.1 Biodiversity

The site is very uniform in nature with very few distinct sensitive areas. The low ridge that is present on the site provides critical habitat on the site and is considered to be sensitive. Drainage lines on the site are not well defined to the infrequent rains that occur. Those that have been clearly identified are considered to be sensitive as they provide rare habitat on the site when water is available.

Areas of topographical change are also considered to be sensitive as they provide difference microclimates on a site that is very uniform in nature.

No “no-go” areas have been identified from a biodiversity perspective on the site. Strict mitigation measures have however been identified to ensure that habitat on the site is not unnecessarily destroyed. This sensitivity map should be viewed in conjunction with the surface water specialist study which details surface water features in more detail.

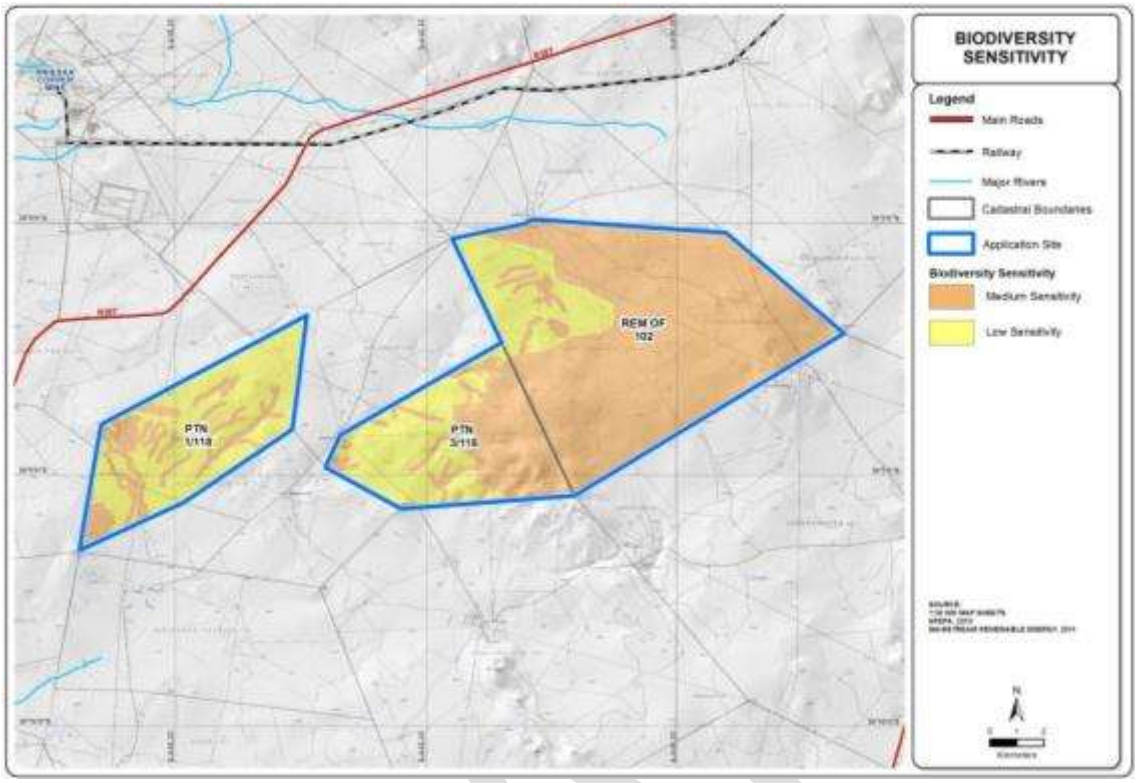

Figure 35: Biodiversity Sensitivity

From an avifaunal sensitivity perspective the farmsteads and adjacent gardens are the habitats associated with the most diverse bird life, which harbour species that do not appear occur in other habitats on the site. Due to this factor, these areas have been designated as highly sensitive, as any transformation of these areas could result in an impact on these important habitats and possibly result in a loss of avian biodiversity on the site. It is strongly recommended that these areas be kept free from development. It is unlikely that the immediate surrounds of the existing farmsteads on the site would be seen as being developable, but these areas should be also marked as exclusion zones.

Feedlots and their surrounds should also be seen as sensitive areas due to their importance for birds; it is expected that the retention of these feedlots would be prioritised as these are critical to the livestock rearing that will be likely to continue on the affected properties if the development proceeds. However these feedlots should be seen as sensitive areas from an avifaunal perspective and an attempt made to retain these as far as possible. Similarly all drainage lines should be retained as no-go areas, and a 100m buffer retained around these features.

8.1.1 Potential impacts during construction

The potential impacts of the proposed development mainly related to loss of habitat for red data and general species; potential loss of species richness, edge effect and erosion. The impact of the proposed development will be limited to the PV construction areas and the associated infrastructure such as roads. Surrounding vegetation will remain intact and will not be impacted upon. As such, the impact is localised and if the mitigation measures are implemented, the overall impact can be reduced.

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

- Flora

A number of potential impacts could be associated with the proposed development. The clearing for the PV plant and associated infrastructure is likely to result in loss of vegetation and more importantly natural vegetation. This can also result in habitat fragmentation due to loss of ecological linkages which may be present across the site. The clearing of vegetation could also result in the introduction of exotic species into the study area.

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

The construction of the PV plant does not result in clearing of all vegetation i.e. a large amount of vegetation will remain between the PV panels.

The destruction of trees must be avoided as these are locally important for habitat provision.

- Mammals

The proposed PV plant could potentially result in the destruction of the habitat available for these species. The impact of the PV plant is likely to be higher during construction as displacement will occur as a result of foundations and road construction.

The impact associated with the mammal population on site relates to the loss of habitat and disturbance during construction. The area does not have a large mammal population due to the arid nature of the climate and as mentioned above the surrounding area contains the same habitat into which mammal species can move during construction.

Care must be taken not to affect breeding of rare mammals such as the black footed cats.

- Reptiles

The proposed PV plant could potentially result in habitat destruction for these reptile species.

The area has been determined to be rich in reptile species as these species adapt well to the arid environment. The impacts associated with reptiles relate, as with other faunal groupings, to habitat loss. Cumulatively however, a large amount of habitat surrounding the site is present into which these species can move during construction. These species will also be able to re-colonise the vegetation around the PV panels during operation.

- Amphibians

The construction of the proposed PV plant could result in habitat destruction for amphibian species.

Due to the extreme weather which characterises the study area, amphibians are scarce. Some specimens are however present, particularly near the drainage lines. It is unlikely that these species would be affected by the proposed development.

- Bats

    - Destruction of foraging habitat

All bat foraging habitats on this site are already included within the proposed buffer zones and will therefore not be destroyed by construction.

    - Destruction of roosts

No meaningful roosting opportunities exist within the site and will therefore not be impacted by construction.

8.1.2 Potential impacts during operation

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

The spread of alien plants is the major impact that can be predicted to be associated with the proposed development. In addition, there is the risk that the area will not be recolonised by species not returning to the area as a result of the development.

The full Biodiversity Assessment is included in Appendix 6A.

During the operational phase the following impacts are predicted in terms of avifauna.

- Avifauna

    - Generic Impacts on birds associated with Solar Power Plants

The primary impact relating to solar power plants relates to the physical transformation of habitat due to the solar arrays. The arrays typically cover an area in which thousands of photovoltaic solar panels are placed adjacent to each other. Although the vegetation under the panels is not cleared, the presence of the panels in a concentrated array transforms the area from its existing state into an altered state, similar to the manner in which a housing development would. The transformation of the area would make the affected area unsuitable for many bird species, although others may be able to adapt to the changed scenario. It is likely that the certain bigger more sensitive species, in particular terrestrial birds such as korhaans, bustards, coursers, etc. would be most affected and likely to no longer inhabit the area. The disturbance factor associated with movement of people and vehicles is likely to further exacerbate the impact of the panels, compared to a current scenario in which there is minimal human presence in the context of sheep farming rangeland.

Some studies have examined the impact of solar power plants on birds. A clear distinction must be made between concentrating solar power and the photovoltaic power, with the former much more likely to exert an impact on birds, especially if the 'power tower' model is utilised. Under this scenario a wide array of mirrors focuses in on a central receptor. The tremendously high levels of solar radiation which are focussed onto the area around the receptor could be fatal for birds flying into the immediate vicinity. Studies which examined such a CSP facility in the USA (e.g. McCrary et al, 1986) indicated that the facility was responsible for bird mortalities, but these findings are not necessarily relevant to this development as they relate to a different technology.

There is no scientific evidence of fatality risks to birds associated with solar PV arrays. PV panels are dark black rather than reflective (in the case of heliostats), as they are designed to absorb rather than reflect sunlight. There is no firm evidence of bird strikes associated with solar PV plants (RSPB, 2011). According to the RSBP paper this lack of evidence might reflect absence of monitoring effort rather than absence of collision risk. Collision is most likely to be a risk for waterfowl, which may be attracted to PV panels, as viewed from above the panels may resemble water – especially in an arid environment. There is however little evidence for this (RSPB, 2011).

The primary potential risk of solar panels on birds thus relates to habitat transformation and destruction, as well as to collision risk associated with power lines, as discussed below.

- Generic Impacts related to power lines

Power lines are large structures and can have significant negative, as well as some positive impact on birds. The power line-related impacts on birds are listed below:

i. Electrocutions
ii. Collisions with overhead wires, leading to bird mortalities
iii. Habitat Destruction
iv. Disturbance
v. New nesting and roosting opportunities (positive impact)

Collisions with overhead power lines are the most important of these impacts (Van Rooyen, 2004), especially as they tend to affect mostly larger birds such as cranes, bustards, raptors and certain types of water fowl. These birds are often susceptible to collision, especially with the earthing wire which is not highly visible, due to their lack of manoeuvrability and restriction in vision. Unfortunately many of the collision prone species are threatened and Red Data listed, with low breeding rates exacerbating the problem of adult mortalities caused by power lines. This impact is explored further below in the context of the birds occurring on the site.

- Site specific impacts of the proposed PV plant

As described above there are a number of sensitive areas from an avifaunal perspective on the site, areas where avian biodiversity is higher, or where an unusual habitat in the context of the site is located. These areas should ideally be avoided by the proposed development in order to avoid disturbance of these areas of higher diversity and bird densities. The development area is split into two spatially distinct components, and the implications of the layouts are discussed separately below.

Mierdam Farm

Most of the Mierdam site consists of rocky Karoo scrubveld and is thus not as sensitive. Apart from the suite of birds typically associated with the rocky low scrubveld, there are two areas on the Mierdam site which were identified to be associated with higher avifaunal diversity and density, due primarily to availability of water, cover and foraging opportunities. These areas are the Mierdam farmstead, and a feedlot and windmill in the centre of the site where concentration of bushier shrub vegetation and a number of watering points exist. Both of these areas are avoided by the proposed infrastructure, with the two PV alternative sites being located in the western part of the site. Thus none of the PV infrastructure is located in areas of particular sensitivity and thus relocating the infrastructure would appear to be unnecessary. There is thus no preference from an avifaunal perspective in terms of the two PV site alternatives.

The proposed solar plants are located very close to existing power lines. A large power line servitude crosses the northern part of the farm, and a set of much smaller lines run north-

southwards to the east of the Mierdam farmstead. The location of the proposed infrastructure close to the power lines is both advantageous and disadvantageous in the context of the way that power lines can be both beneficial and negative for birds. It would be advantageous in the sense that the existing power lines represent a collision risk, thus being located close to the power lines would cut down the need for the construction of further power lines to link to the grid, thus minimising new collision opportunities. In a negative context, there appears to be evidence from information provided by local farmers and from birds sightings on the site that certain of the bigger collision-prone species, in particular raptors, utilise the existing power lines as 'corridors' along which to move, and also as roosting perches when visiting the area. This is probably most likely for the large power lines that run east-west across the northern tip of the Mierdam site.

- Impacts off associated infrastructure

Power lines

In the context of the potential impacts associated with the proposed power lines, the proposed alignment of the new lines parallel to existing power lines is expected to be a significant positive factor. The current thinking in terms of power line impacts on birds is that clusters of lines would make the lines more visible to birds flying in the vicinity and the birds are thought to be already aware of the presence of power lines in this location. They are thus, less likely to collide with them (Avian Power Line Interaction Committee - 1994). All of the alternatives run parallel to existing lines, so from an avifaunal perspective this is believed to be a strong mitigating factor. The alignment parallel to existing power lines retains the footprint of the proposed lines to within an existing impacted area, and thus a new impact will not be created where none existed before. This factor will also reduce potential fragmentation and human disturbance associated with the lines. Although the possibility of bird strikes occurring has not been ruled out, it is thought that this possibility would be greatly reduced by the alignment of the lines parallel to existing lines. In spite of this, the implementation of bird flappers along the new line segments is strongly recommended.

In a positive context the lines could provide new opportunities for nesting and roosting. The species that is most likely to utilise the new towers for nesting in the Sociable Weaver. In the study area, Sociable Weavers' nests primarily occur along the R357 road and other tarred roads that access the hamlet of Copperton. Very few if any nests were observed away from these roads, with a large nest observed on one of the power line towers in the eastern part of the Platsjambok site. It is likely that these birds would colonise certain of the new towers along the road, and as such the towers would present new nesting locations for these birds, as well as to the Pygmy Falcon which uses the Sociable Weaver nests for nesting. In this way, the density of both species in this part of the study area could increase.

Roads

Roads represent a human impact where none existed before, and by being physical barriers can cause fragmentation of natural habitats. Due to the presence of vehicles, roads would introduce a human disturbance factor into a previously un-impacted area. This may cause certain bird species to no longer frequent the area. Although birds would not be impacted by roads as barriers in the way in which certain invertebrates or reptiles may be, roads could have an impact on species that are drawn to the roads as areas in which to forage, or even perch or roost. This would then raise the risk of these nocturnal species being killed or injured by being hit be vehicles at night time. The EMPr of the development should contain measures that specify certain driving practices that would reduce the potential for night-time road mortalities, such as prohibiting speeding, and drivers being educated of the possible presence of birds on roads at night.

In a positive context, roads may present new attractive foraging areas for many birds. These include; raptors such as the Pale Chanting Goshawk, that are drawn to roads by the presence of open areas and increased hunting opportunities as runoff from the road often encourages more vigorous growth of vegetation as compared to the surrounding area, thus attracting a higher density of their prey species.

- Impact on priority species

The potential impacts of the development on the priority species listed earlier in this report needs to be examined. However, in doing this a number of caveats and limitations which limit the level of confidence of this study need to be highlighted. Firstly, solar power plants on birds, especially in terms of bird mortalities, are unknown. Secondly, no detailed bird monitoring has yet been undertaken on the site to establish trends of species occurrence in terms of species-specific spatial distribution and seasonality. There is thus insufficient data on which to confidently assess the likely impacts of the proposed development on the priority species that occur in the study area. With these limitations in mind, the possible ways in which the proposed development could impact certain priority species has been examined.

i. Ludwig's Bustard

The Ludwig's Bustard was originally listed as a 'vulnerable' Red Data Species. According to the text for the Bird in the Southern African Bird Atlas, this status was based on an assumed decline in range from the Highveld grassland areas. However, research has shown that historically the species only marginally occurred in the western-most parts of the grassland biome, and that the conservation concern may have been overstated. The Atlas however stresses that the species is highly susceptible to collisions with overhead power lines and thus requires monitoring (Harrison *et al*, 1997). This concern is stated clearly by material released by the Percy FitzPatrick Institute that indicates that the bird is threatened across its Karoo range by the single factor of collisions with overhead power lines. Studies have revealed that collision rates on high voltage transmission lines in the De Aar area of the Karoo may exceed one bird per kilometre per year, and another study by Jenkins *et al* 2009showed preliminary resultsthat these levels of mortality

are much more widespread over an much greater area of its range. Ludwig's Bustards are particularly susceptible to collision because they are large and heavy, and lack sufficient manoeuvrability to avoid unexpected obstacles. For this reason the IUCN Red Data status of the bird was changed in 2010 to globally Endangered, based on the anticipated population decline stemming from the high degree of deaths attributable to power line collision. According to the EWT's website (http://www.ewt.org.za/FORYOU/LatestNews/tabid/85/EntryId/42/NEW-RESEARCH-HELPS-CONSERVATIONISTS-MITIGATE-BIRD-AND-POWER-LINE-COLLISIONS.aspx), surveys show that at least 11-15% of the population may be killed annually on high-voltage transmission lines, although actual mortality is probably much higher. This level of mortality is considered to be unsustainable in the context of 56 000 - 81 000 birds in the late 1980s. The movement of the species across its range is poorly understood; this species has nomadic tendencies that are thought to relate to rainfall across its range.

Bearing in mind the limitations of the level of bird monitoring undertaken to date in the area, a number of sightings of the species were made in the northern parts of the Platsjambok Farm and Humansrus Farm to the west. All of the sightings occurred on the rocky low scrubveld habitat type, suggesting that in this area this bird tends to occur exclusively within this habitat type. The sightings are clustered around the area in which the three grassy pans occur, which has been listed as a sensitive part of the site. Apart from introducing the potential for collisions, the increased level of development and human activity may result in birds avoiding this area. Due to the above limitations, it is not known to what degree the proposed development will impact on the birds in this area, and the degree to which the birds are resident and even breed in the study area. In the context of the entire development site, this sensitive area should be avoided as much as possible by the proposed development, with large parts of the site being currently underutilised by the proposed PV plant. In the context of the location of all sightings being limited to this part of the site, the application of the precautionary principle would favour the relocation of development areas away from this part of the site to other less sensitive areas.

ii. Kori Bustard

The Kori Bustard is listed as a vulnerable species under the BirdLife South Africa Red Data List. In a very similar manner in which the Ludwig's Bustard is being threatened, the Kori Bustard is under threat from power line-related mortalities. Examination of the SABAP1 distribution data shows that the bird was recorded patchily across the wider area, and owing to its nomadic nature is likely to be an occasional visitor to the site. The SABAP1 text states that in the Karoo Regions this species is often associated with tree lined watercourses which it uses for shelter from the heat and for refuge when disturbed. Although there are no such watercourses in the study area, the bird may utilise bushier parts of the site (quartzite ridges and bushy feedlots) in this way. The risk of the project to this species is expected to be low due to its occasional presence on the site, but any impacts on it could be significant in the context of its low density of occurrence in the wider area.

iii. Karoo Korhaan

The Karoo Korhaan has been included on the list of priority species as it is a large bird, and also potentially subject to aerial collisions. According to Allan and Anderson (2010) the Karoo Korhaan is subject to threats from locust poisoning, and on a much wider level is potentially threatened by climate change. According to BirdLife International (BirdLife International, 2012), this species has a very large range and does not approach the thresholds for vulnerable under the range size criterion. According to the fact sheet for the species, its population trend appears to be increasing, and although the population size has not been quantified, but it is not believed to approach the thresholds for Vulnerable under the population size criterion. For these reasons, the species is evaluated as Least Concern under the IUCN Red List for birds. Allan and Anderson (2010) do not list it as one of the species that is vulnerable to collisions relating to power lines.

Karoo Korhaans were noted to be relatively common during the two site visits to the study area. These birds were noted to occur across the study area, mainly occurring in the rocky Karoo scrubveld, but also occurring in the sandier scrubveld and within the grassy pans.

The PV solar array is likely to have a localised impact on this species by removing a certain area of foraging habitat. These birds are expected to have a relatively large range. Birds are typically thought to be sedentary rather than being nomadic and studies in the Karroo indicate that groups of birds tend to have a range of between 0.5-3.3km^2 (Hockey and Boobyer, 1994). Thus, certain groups may be individually affected by the proposed development components. The removal of foraging habitat from part of the range of a group / groups of these birds may be significant in the context of a few groups, but is thought to be unlikely to have a significant impact on the ability of the birds inhabiting the site to continue inhabiting the site. However, the disturbance factor may be more significant in driving birds away from the wider area, although the probability of this occurring is unknown. Birds are known to 'colonise' and utilise disturbed areas, and thus over time birds may start to utilise the areas around the solar arrays.

iv. Northern Black Korhaan

Like the Karoo Korhaan above, the Northern Black Korhaan is not believed to be threatened due to its very wide range and stable population size (BirdLife International, 2012) and as such is listed as a species of Least Concern. These birds are mostly sedentary, although showing marked movements and increased in abundance in relation to changing conditions (e.g. rainfall related). According to Allan and Anderson 2010, this species is one of the least threatened species and is only threatened by degradation of habitat. The species was noted to be very common on the site occurring in most of the habitats on the site.

v. The aerially-displaying larks

Although not listed as being threatened in any way, these lark species could be affected by transformation, and thus loss of habitat by the proposed solar arrays. Monitoring of these species, prior to, and post-construction, in particular during the breeding season is strongly recommended.

vi. Sclaters Lark

The Sclaters Lark is the only lark species likely to occur on the site that carries a Red Data listing.According to BirdLife International (2012) this species is listed as Near Threatened because it is thought to have a moderately small population, although there is currently no evidence to suggest that this species is experiencing a population decline. The bird is highly nomadic, moving into, and disappearing from certain areas based on food availability due to rainfall. There is strong evidence to suggest that the species benefits from the presence of stock watering points as it is usually located within accessible distance of a surface water point (the record of this species on the development site was an observation of a bird drinking at such a stock watering point). Due to the nomadic nature of the species, coupled with the relatively low footprint of the proposed development in its preferred habitat (stony plains characterised by dwarf shrubs) it would appear unlikely that it would be adversely affected at either a local or regional level by the proposed development. Birds arriving in an area to take advantage of suitable conditions for foraging or even breeding would be likely to find sufficient habitat for both activities, although the disturbance factor on this species is unknown. This species does not appear to undertake aerial displays and thus would not appear to be particularly susceptible to aerial collisions.

vii. Secretarybird

The Secretarybird is listed as vulnerable by the IUCN as recent evidence from across its continental range suggests that its population is experiencing a rapid decline, probably owing to habitat degradation, disturbance, hunting and capture for trade (BirdLife International, 2012). In a South African context previous studies indicate that it underwent a population decrease in the Karoo in the latter part of the twentieth Century (Boshoff et al, 1983). Apart from foraging primarily in a terrestrial manner, the Secretarybird also has the habit of soaring at very high levels. The nature of the occurrence of this species in the study area is unknown, with only the one record of a pair near the Hoekplaas Farmstead in early December. The bird is thought to be highly nomadic in arid areas (Harrison et al, 1997), and thus is likely to be an irregular visitor to the study area. There appear to be few suitable nesting sites in the area. This appears to be borne out by the very patchy distribution of the bird in the wider Nama Karoo area during the SABAP 1 project. The species is thus unlikely to be subject to significant risks associated with the proposed development, although any impacts may be significant due to its low abundance levels over the wider area.

viii. Other priority species

A number of other priority species have been identified that could potentially frequent the area. These species are mostly large birds (cranes and raptors) that would be at risk of collision due to their aerial habits or poor manoeuvrability in the air. These species are all likely to be occasional visitors to the site. Their low frequency of occurrence in the study area entails that the development is not likely to cause a significant impact on these species, but the risk of these

species being affected does remain. Any impact would be significant, considering that most of these species are Red Data-listed species.

8.2 Surface Water

Although surface water features are not a significant part of the natural biophysical features on the site due to the very arid nature of the area, they should nonetheless be considered as sensitive features. All surface water features, irrespective of characteristics and state are provided protection under the National Water Act, as the Act's definition of a surface water feature is very wide ranging to include drainage features in which flow would only be highly periodic. The potential impacts of the development on surface water features has thus been considered as part of this EIA. The footprint of certain of the development components would be large and thus certain surface water features on the site may be physically affected as discussed below.

8.2.1 Impacts related to roads

Roads can have a significant impact on surface water features. Depending on the design of the road crossing the surface water feature may be physically impacted as the footprint of the road may affect the hydrology and habitat.

Roads will be used and are required to access different parts of the site during both construction and operation. There is a basic network of farm access tracks that cross the development site, but due to the nature of the materials being transported onto the site they will need to be upgraded and new roads will need to be constructed to access parts of the site. It is thus inevitable that roads will need to cross surface water features.

Although the drainage lines / watercourses on the site are not as sensitive to impacts, as would be the case if above ground or near surface underground movement of water was present, the design of roads through watercourses should nonetheless be conducted to take into account the potential presence of flow within the watercourse at intervals.Surface water featuresshould also be considered sensitive areas. The degree of impact depends to a large degree on the type of the road crossing. Spanning a water feature by building a bridge or similar structure typically has much less of an impact than if a causeway is constructed through the feature. Roads will tend to have a much greater physical footprint within a surface water feature in the latter case as foreign substrate may need to be laid and imported into the bed and banks of the feature. The type of design to be used is unknown, however it is likely that due to the large nature of the trucks

carrying the structural parts to various parts of the site that formal structures to cross watercourses will have to be constructed.

The most important type of impact that would relate to new roads being constructed into and across surface water features is the potential alteration of the hydrological regime and the potential for erosion generation. The design of the crossing should thus need to take into account the presence of flow, and thus the structure should be designed and constructed accordingly.

Roads can also be associated with stormwater inputs into nearby drainage lines, especially if the road has an impermeable surface. Stormwater input into a drainage line could artificially increase the flow within the feature, resulting in potential knock-on effects such as scour and erosion.Stormwater may also pick up pollutants that are spilt onto the road surface, especially fuel, oil and other hydrocarbons that could pollute the downstream surface water feature. Lastly, but just as importantly stormwater may also feed silt from the catchment or road surface itself into a watercourse, thus altering the habitat integrity of the feature.

As the alignment of roads has not been specified at this point in time, it is not possible to individually assess the impact of roads on drainage lines on the development site.

8.2.2 Impacts related to underground cabling

Underground cabling is required to connect the PV arrays as part of the internal electricity grid. These buried cables may need to cross surface water features, and thus may exert an impact on these features. Owing to the nature of construction of cabling which normally would involve the excavation of a trench in order for the cabling to be placed underground, the most important potential impact of the proposed cabling on surface water features relates to the disturbance and erosion of substrate within and immediately adjacent to the surface water feature. In most cases a trenching method is used to lay cables and thus the laying of the cabling would entail the disturbance and removal of vegetation, and the excavation of soils within the surface water feature. Although unlikely to be a factor during construction, water is an erosive force, and the exposed soils could be eroded, creating silt that could be transported downstream. Excessive siltation reduces habitat heterogeneity, thus affecting the resource quality.

8.2.3 Impacts related to power lines

Power lines are not typically associated with impacts on most wetlands and rivers, as the power lines do not have a physical footprint over the length of the power line other than the footprint of each tower position. As the lines are strung above the ground and as the towers are spread approximately 200m apart (although it may vary between 250m and 375m depending on the

ground profile and terrain), most wetlands are able to be 'spanned' by the power lines and thus avoided from being physically affected. Power lines can however be associated with impacts on surface water resources if the towers are placed within a river or wetland. In order to ameliorate this risk, no towers should be located within any surface water feature.

8.2.4 Impacts related to the proposed PV plants

The PV plant is designed in such a way that an array of solar panels would be densely packed within the footprint of the layout. This layout would entail that the plant would have a physical footprint over most of the layout area. Thus any surface water feature occurring within the footprint of the PV plant would be likely to be physically affected in the same way as described above, leading to the destruction of riparian habitat and the alteration of the hydrology of the feature. The site-specific concerns relating to the proposed layouts are discussed below.

8.2.5 Implications of the proposed final PV layout and Infrastructure

There are two PV alternatives proposed the Mierdam site. Analysis of the 1:50 000 maps (the layouts were not available at the time of the EIA field visits and thus could not be assessed in the field) indicates that three of the alternatives have ephemeral drainage lines running through them – both of the alternatives for the Mierdam site. Although none of the PV layouts are considered to be fatal flaws from a surface water perspective, it is recommended that the layouts be altered slightly to either avoid the drainage lines completely, or to ensure that these drainage lines are not physically affected by the proposed PV arrays. In the latter case, the detailed stormwater design should carefully consider the impact of stormwater from the PV field on these drainage lines in the event of rainfall so that no erosion of the watercourse is created.

8.3 Agricultural Potential and Soils

From an agricultural perspective the loss of high value farm land and / or food security production, as a result of the proposed activities, is the primary concern of this assessment. In South Africa there is a scarcity of high potential agricultural land, with less than 14% of the total area being suitable for dry land crop production (Smith, 2006). Consequently areas which can sustainably accommodate dry land production need to be protected from non-agricultural land uses. The desktop assessment, field verification and agricultural potential has shown that the study area is unsuitable for dry land crop production and is dominated by unimproved grazing land.

The proposed development's primary impact on agricultural activities will involve the construction of the PV field and associated infrastructure. The construction entails the clearing of vegetation around the footprint of the PV arrays and the crane hardstand, as well as creating service roads (Section 1.2).

The construction of these facilities will only influence a portion of assessed area. The remaining land will continue to function as they did prior to the development. Normal grazing (the dominant agricultural activity) may be permitted within the PV field. All three farms, which constitute the study area, are dominated grazing land and this activity is considered to be of low sensitivity when assessed within the context of the proposed development. Consequently, the impact of the proposed development on the study area's agricultural potential will be extremely low, with the loss of agricultural land being attributed to the creation of hardstand and around the PV fields. The photovoltaic (PV) plant will have a maximum capacity of 40MW and cover a maximum area of 257 ha on Portion 1 of Meirdam. If grazing is not permitted within the PV Fields approximately 4% of the total area under assessment land will be lost.We re-iterate that these losses are considered of low consequence within the context of this assessment. However, it is recommended that to the option of allowing seasonal grazing within the PV Fields be considered further by Mainstream in consultation with the landowner to further mitigate the loss of grazing land.

There are no centre pivots, irrigation schemes or active agricultural fields which will be influenced by the proposed development. Therefore, from an agricultural perspective, there are no problematic or fatal flaw areas for the site (Figure 36).

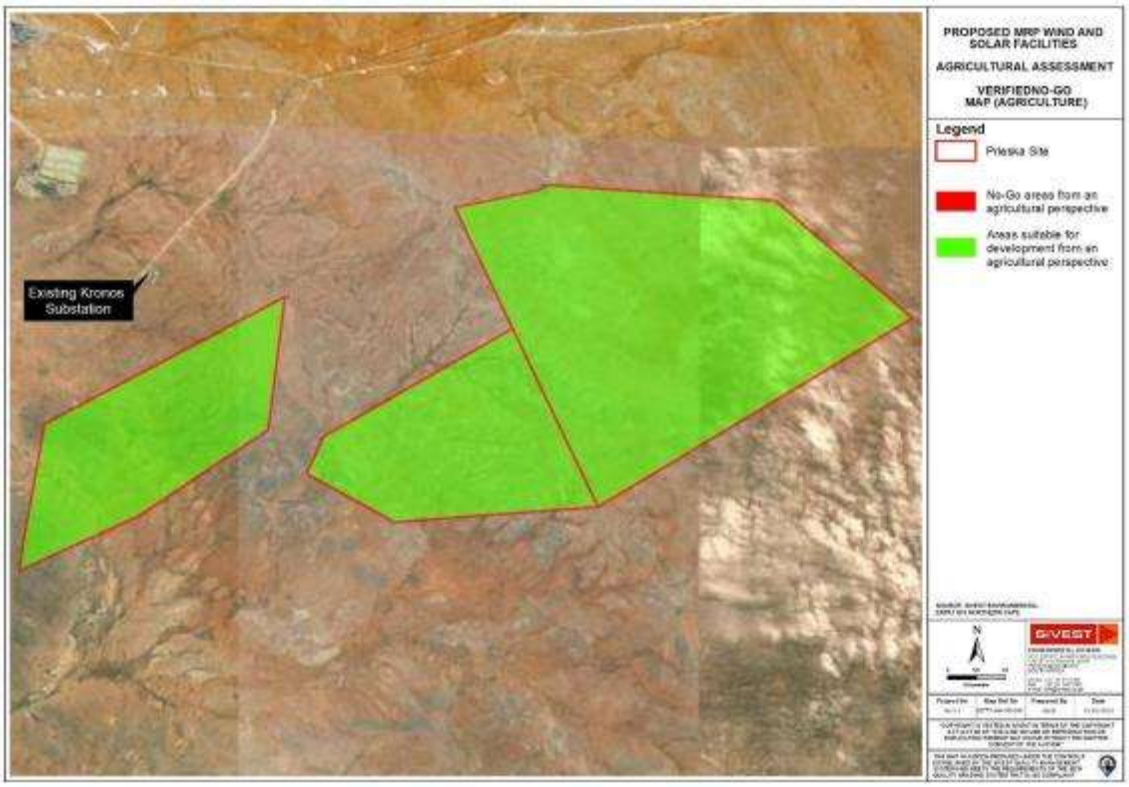

Figure 36: No Go Area Map from an Agricultural Perspective

The full Agricultural Potential and Soils Assessment is included in Appendix 6C.

8.4 Visual

8.4.1 Typical visual issues related to solar plants

The solar power component of the proposed energy generation facility consists of photovoltaic (PV) panels, which grouped together form a 'solar field'. As mentioned above, each PV panel is a large structure, being between 5m and 10m in height (equivalent to one and a half storeys to two and a half storeys in height). The height of these objects will make them visible, especially in the context of a flat landscape. More importantly, the concentration of these panels will make them highly visible, and depending on the number of panels in each solar field, and thus its spatial extent (or footprint) will be an important focal point in a landscape, especially if the landscape is natural in character. As most solar power plants tend to be located in vacant or uninhabited areas due to space availability, the landscape context is often natural; in this context the solar field

could be considered to be a visual intrusion that possibly acts to alter the visual environment, especially if the pre-development visual context is natural.

8.4.2 Typical visual issues related to the associated Infrastructure

The new substation (approximately 90m x 120m, with the height of the substation components being no greater than 10m) and overhead power lines by their nature are large objects and will typically be visible for great distances. Power lines consist of a series of tall towers thus making them highly visible. Power lines and substations are not features of the natural environment, but are representative of human (anthropogenic) alteration. Thus when placed in largely natural landscapes, they can be perceived to be highly incongruous in this setting.

Other associated infrastructure may also be associated with visual impacts. The PV arrays are inter-connected with a series of cables, which are likely to be buried, but which also may take the form of above-ground power lines. These cables may become a visual intrusion if placed in areas of the site that are visible to the surrounding areas, especially those areas that are located on the low ridges and associated sloping ground. A trench dug for the cable (both during construction and post-construction once the trench has become back-filled) may become prominent if it creates a linear feature that contrasts with the surrounding vegetation that is typically low shrubs and small trees on the ridges. A similar principle exists with respect to any access roads constructed in these parts of the site. Roads are likely to be wider than cable trenches and thus could be even more greatly visible than the cable servitude. Luckily, however the slopes on the site are not significant, and there is unlikely to be need to be any significant earthworks required in constructing roads, such as cutting of a 'terrace' into a steep side slope that would increase the visibility and contrast of the road against the surrounding vegetation.

Lastly buildings placed in prominent positions such as on ridge tops may also break the natural skyline, drawing the attention of the casual viewer.

8.4.3 Visual impact assessment matrix for static receptor locations

In order to assist in the assessment of the impact of the proposed development on the sensitive receptor locations listed above, a matrix that takes into account a number of factors was developed, and is applied to each receptor location.

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

- Distance of receptor away from the closest part of the layout (distance banding)
- Primary focus / orientation of the receptor

- Presence of screening factors (topography, vegetation etc.)
- Visual context

This rating matrix is a relatively simplified way to assign a likely representative visual impact which allows a number of factors to be considered. Part of its limitation lies in the quantitative assessment of what is largely a qualitative or subjective impact. The simplified matrix also has certain limitations in that in certain cases the complete screening of the source of the impact from the receptor may not be taken into account. An example of this would be where the nature of the topography completely hides the proposed development from view at a receptor location. In order to take this factor into account, an 'override' function has been introduced to the matrix. The override allows the visual rating assigned to a receptor location to be either increased or lowered based on the one of the following factors:

- The receptor location is completely screened from the proposed development by topographical features such as ridges or slopes
- The features of the development are outside of the viewshed of the receptor location, and thus are not visible

It should be remembered that the matrix is a receptor-based impact assessment of potential impacts, focussing on factors specific to the location and characteristics of the individual receptor location. The matrix should be viewed in conjunction with the assessment of the visual impacts associated with the proposed PV fields as undertaken later in this report.

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

Table 15: Visual Impact Assessment at Sensitive Receptor Locations

Receptor Location	**Visual Impact Rating**	**Overriding Factors?**	**Corrected Visual Rating**
Nelspoortjie Guest Farm and Farmstead	**MODERATE**		
Humansrus Farmstead	**LOW**		
Platsjambok Farmstead*	**LOW**		
Vrede Farmstead	**MODERATE**	Topography shields receptor	**NO IMPACT**
Who Can Tell Farmstead	**LOW**	Topography shields receptor	**NO IMPACT**
Jonkerwater Farmstead	**LOW**	Shielding vegetation	**NO IMPACT**

		completely obscures view	
Graspan North Farmstead	**LOW**		
Graspan South Farmstead	**MODERATE**	Shielding vegetation completely obscures view	**NO IMPACT**
Grenaatskop Farmstead	**MODERATE**	Shielding vegetation and structures completely obscure view	**NO IMPACT**
Vrugbaar Farmstead	**MODERATE**		
Hoekplaas Farmstead*	**MODERATE**		
Voorspoed Farmstead	**LOW**		
Mierdam Farmstead*	**MODERATE**	Shielding completely obscures view	**NO IMPACT**
Grootfourieskolk Farmstead	**MODERATE**	Distance factor renders impact negligible	**NEGLIGIBLE IMPACT**
Klippan Farmstead	**MODERATE**		

As can be seen from the table above, of the 15static sensitive receptor locations located within a radius of the site, none have been assessed to be likely to experience a high degree of visual impact associated with the proposed development. However, some locations (4) are likely to experience a moderate visual impact by virtue of their locality and characteristics. The indication given by the matrix is that although the intensity of a visual impact would not be very high at any of the receptor locations, an impact could nonetheless be experienced. This must be understood in the context of the setting at each of the receptor locations, as well as relative 'sensitivity' of the receptor. For example a receptor location which is inhabited by a landowner who stands to benefit financially from the presence of the PV field on his / her property is much less likely to view the project as an unwelcome intrusion than another receptor totally unconnected with the proposed PV project. The existing level of human influence in the landscape, as one gets closer to Copperton, as well as the potential visual impact of other wind and solar developments close to the site (which along with the development would exert a much greater cumulative change impact); may affect the perception of the viewers. The majority of these static receptor locations are working farmsteads, and indications given by some inhabitants is that the proposed renewable power developments would be welcomed if they provided more power for local use.

The remainder of the receptor locations have been assessed to be likely to experience a low degree of impact. The most important factor for the rating at these receptor locations is the distance factor. Many receptors are located well beyond 5km from the PV fields, and thus the solar arrays would be a much less important factor that if the receptor were situated closer to the layout.

At certain locations however, factors inherent in the landscape; i.e. topography will ensure that the solar facility site in its entirety would be completely shielded from view. Higher ground located close to the receptor location, and lying between the receptor location and the site would block all views towards the site from the receptor location, thus entailing that there would be no visual impact experienced from this location.It must be remembered however that the rating of 'no impact' that has been assigned to certain locations where vegetation and other features would completely shield the proposed development components from view, relates only to that particular location, and a visual impact may be experienced from nearby points that are not shielded by the vegetation surrounding the receptor location.

Not all of these static receptor locations have been selected as key observation locations, as certain of these will be unlikely to experience a visual impact. The visual modelling and visual contrast rating undertaken below has been undertaken from the key receptor locations.

8.4.4 Visual impacts associated with the proposed solar arrays

As mentioned above, the solar panels are between 5m and 10m in height, and thus could be visible over a wide area due to the combination of the height (equivalent to a building height of between 1 ½ and 2 stories) and the sheer number of panels, spread over an area of approximately 2km^2. An exercise was undertaken to assess the visual contrast and visual intrusion of the PV arrays from receptor locations within a 5km radius of the PV arrays.

Mierdam PV

Receptor Location	Alt 1 (South) - Visual Contrast	Alt 2 (North) – Visual Contrast	Visual Intrusion created?
Klippan	The solar array will be visible in the view looking east from the receptor location; however the Mierdam farmstead with its tall trees will lie between the receptor location and the PV plant, thus blocking the view of part of the PV plant. Due to this factor, the distance factor that will make the PV plant an insignificant feature on the eastern horizon, and the visual context of the landscape in which the Klippan farmstead is located, a very weak level of visual contrast will be created. **Degree of visual contrast created : weak**	The solar array will be visible in the view looking east from the receptor location; however the distance factor will render the PV panels relatively insignificant on the horizon. The Mierdam farmstead with its tall trees will lie adjacent to the PV plant, thus the PV plant will not appear on its own. Due to this factor, and primarily the distance factor that will make the PV plant an insignificant feature on the eastern horizon, and the visual context of the landscape in which the Klippan farmstead is located, a very weak level of visual contrast will be created. **Degree of visual contrast created : weak**	The very low prominence of the PV plant and its location either behind, or adjacent to the Mierdam Farmstead will entail that it will be highly unlikely to constitute a visual intrusion from this location. **Thus the PV Plant will not be a visual intrusion.**
Mierdam	The solar array will be very visible on rising ground due to the short distance between the receptor location and the array, thus occupying a certain potion of the skyline in the spectral array of the viewer. The array, as viewed from	The solar array will be very visible on rising ground due to the short distance between the receptor location and the array, thus occupying a certain potion of the skyline in the spectral array of the viewer. The array, as viewed from	Both alternatives will be visible in the middle ground of the view, taking up part of the horizon formed by the rising ground to the north. Although visible, the PV arrays will not dominate the view to the degree that they will

	this point will draw the attention of the viewer, but will be unlikely to completely dominate the view. A number of mitigating factors include the dense vegetation that would shield the actual household (the above view reflects a view from the road near the farmstead), as well as the existing visual context which is influenced by existing large structures such as power lines and the Kronos Substation. **Degree of visual contrast created : moderate**	this point will draw the attention of the viewer, but will be unlikely to completely dominate the view. A number of mitigating factors include the dense vegetation that would shield the actual household (the above view reflects a view from the road near the farmstead), as well as the existing visual context which is influenced by existing large structures such as power lines and the Kronos Substation **Degree of visual contrast created : moderate**	constitute a visual intrusion. **Thus the PV Plant will not be a visual intrusion.**
Voorspoed	The solar array will be visible in the view looking north from the receptor location; however the distance factor will render the PV panels relatively insignificant on the horizon. The Mierdam farmstead with its tall trees will appear to lie adjacent to the PV plant, thus the PV plant will not appear as a human object on its own. Due to this factor, and primarily the distance factor that will make the PV plant an insignificant	The solar array will be visible in the view looking north from the receptor location; however the distance factor will render the PV panels relatively insignificant on the horizon. The Mierdam farmstead with its tall trees will appear to lie adjacent to the PV plant, thus the PV plant will not appear as a human object on its own. Due to this factor, and primarily the distance factor that will make the PV plant an insignificant	The very low prominence of the PV plant and its location adjacent to the Mierdam Farmstead will entail that it will be highly unlikely to constitute a visual intrusion from this location. **Thus the PV Plant will not be a visual intrusion.**

	feature on the northern horizon, a very weak level of visual contrast will be created. **Degree of visual contrast created : weak**	feature on the northern horizon, a very weak level of visual contrast will be created. **Degree of visual contrast created : weak**	
Vrugbaar	The PV array will not be visible from this location so no visual contrast will be created	The PV array will not be visible from this location so no visual contrast will be created	**There will be no visual intrusion**

- Visual Analysis

The above tables show that the PV arrays will mostly not be associated with any degree of visual intrusion to the closest sensitive receptors due to a number of factors including their height, the distance of the receptors away from the PV arrays, and in some cases the visual context of the landscape in which they would occur. As a further mitigation measure, many of the receptor locations have shielding vegetation, and thus the above tables represent a worst-case scenario with no shielding factors present.

As the PV array alternatives are not typically associated with visual impacts at any of the receptor locations, all are favourable from a visual perspective.

8.4.5 Visual Impacts of Associated Infrastructure

- Power lines

Each site component would be linked to the existing grid by a power line that would run from the site to the Kronos Substation that is located near the R357 road to the east of the old Copperton Mine. Two alternatives have been provided for the grid access to the Mierdam Farm.

Importantly from a visual impact perspective, all of the proposed alignments *run parallel to existing power lines.* The Mierdam power line alignment alternatives would run parallel to a 400kV line or a smaller 66kV line. This factor is significant from a visual perspective, as these existing lines constitute an existing human influence in the landscape which could arguably be termed a visual impact in an otherwise natural environment. Thus, the development of new power lines in the area would occur in the context of this existing human influence, and the power lines would not create a new visual intrusion in an otherwise 'un-impacted' context. The placement of the power lines would rather be consolidating an existing human presence in the landscape.

In the case of the northern Mierdam power line alternative, the proposed 132kV lines would run parallel to existing 400kV lines which are much larger than the proposed lines. Thus the proposed lines would easily be able to be incorporated into the landscape. For this reason, it is strongly recommended that this northern alignment be selected as the preferred alignment, as the alternative alignment would run along 66kV lines that are much smaller than the proposed lines, thus the larger lines could thus constitute a visual impact on their own.

It could be argued that the addition of another line may increase the visual impact of the lines by creating a cumulative impact, increasing the visible footprint of the lines. While this may be true, in the largely natural context of the study area it is thought to be much more preferable to consolidate the visual impact associated with the lines, rather than creating new areas of visual impact. It must also be remembered that the power lines would only be developed if the development were to proceed.

- Substations and other building infrastructure

The substation sites associated with the development components are all proposed to be located immediately adjacent to the development component (i.e the PV array). In the case of the PV arrays, the height of the substation component would be equivalent to, or slightly higher than the PV panels. Due to the location immediately adjacent to each of the respective PV arrays, the substation and O&M building would be likely to be viewed as a component of the solar array, and not a separate infrastructural component in an otherwise natural landscape. As none of the PV arrays have been assessed to be associated with significant visual impacts, it is highly unlikely that the substation or O&M buildings would thus be associated with visual impacts.

The full Visual Impact Assessment is included in Appendix 6D.

8.5 Geotechnical

Based on the geotechnical findings, the civil engineering requirements for the road, PV foundations, substation foundations and MV cables were assessment. The results of which are outlined below.

- Access Roads

The existing surface is thinly vegetated and underlain with competent dense/hard materials. Access roads can best be built on the site by clearing vegetation and overlaying the cleared surface with a coarse graded granular stone of thickness 0.3m.

The site gradients are generally sufficiently flat to allow the access roads to be built at gradients to match the natural topography and avoid any significant cutting and filling.

- PV Foundations

Any form of driven or rammed pile foundation type is unlikely to be suitable for the PV panel mounting system at the sites due to the hardness of the near surface strata. On this basis, either drilled pile foundations or shallow concrete spread foundations are likely to be the most suited to the site.

- Substation Foundations:

Peak bearing pressures in the range 50-100kN/m2 are typically applied below the foundations of structures within the substation area. Shallow spread foundations founded at about 1m below ground level are likely to be suitable for a substation located at the site.

- MV Cables:

Cable trench excavation to about 1m depth should be achievable with a TLB at Mierdam generally with recourse to use of a rock breaker.

The presence of groundwater (mildly brackish – conductivity results awaited) will require special measures to be taken in reinforced concrete design at the site.

The full Geotechnical Assessment is included in Appendix 6E.

8.6 Heritage

8.6.1 Heritage Assessment Criteria and Grading

The NHRA stipulates the assessment criteria and grading of archaeological sites. The following categories are distinguished in Section 7 of the Act:

- **Grade I**: Heritage resources with qualities so exceptional that they are of special national significance;
- **Grade II**: Heritage resources which, although forming part of the national estate, can be considered to have special qualities which make them significant within the context of a province or a region; and
- **Grade III**: Other heritage resources worthy of conservation on a local authority level.

The occurrence of sites with a Grade I significance will demand that the development activities be drastically altered in order to retain these sites in their original state. For Grade II and Grade III sites, the applicable of mitigation measures would allow the development activities to continue.

8.6.2 Statement of Significance

In terms of Section 7 of the NHRA, all the sites currently known or which are expected to occur in the study area are evaluated to have a grading as identified in the table below. Three categories of significance are recognized: low, medium and high. This allowed some form of control over the application of similar values for similar sites. The matrix applied to each identified site is included as Appendix 1 of the Heritage Assessment.

Table 16: Summary of identified heritage resources in the study area

Identified Heritage Resources	
Category, according to the NHRA	*Identification / Description*
Formal protections (NHRA)	
National heritage site (Section 27)	None
Provincial heritage site (Section 27)	None
Provincial protection (Section 29)	None
Place listed in heritage register (Section 30)	None
General protections (NHRA)	
Structures older than 60 years (Section 34)	Yes
Archaeological site or material (Section 35)	Yes
Palaeontological site or material (Section 35)	None
Graves or burial grounds (Section 36)	Yes
Public monuments or memorials (section 37)	None
Other	
Any other heritage resources (describe)	None

The Heritage Assessment is included in Appendix 6F.

8.7 Socio Economic

The socio-economicimpacts that could be expected as a result of the project are discussed according to the various change processes.

It should be noted that while this report, primarily presents the environmental impact findings of the proposed 40MW PV plant on Mierdam Farm, it is assumed that should this PV development go ahead, so too will the two proposed 75MW PV facilities on Platsjambok Farm. As such, the socio economic impact of the proposed developments have been assessed cumulatively as the collective impact of all the PV facilities are important from a socio-economic perspective. Therefore, the socio-economic impacts that could be expected as a result of the total proposed development of a 190MW PV facility (40MW + 75MW + 75MW) are discussed below, according to the various change processes.

8.7.1 Potential impacts during pre-construction

- Geographical Change Processes

Based on the results of all the specialist studies, a buildable area within the site was identified. The buildable area avoids all social sensitive areas within the sites

In terms of other structures on site, both substation alternatives 1 and 2 on the Mierdam site are located away from any social sensitive points.

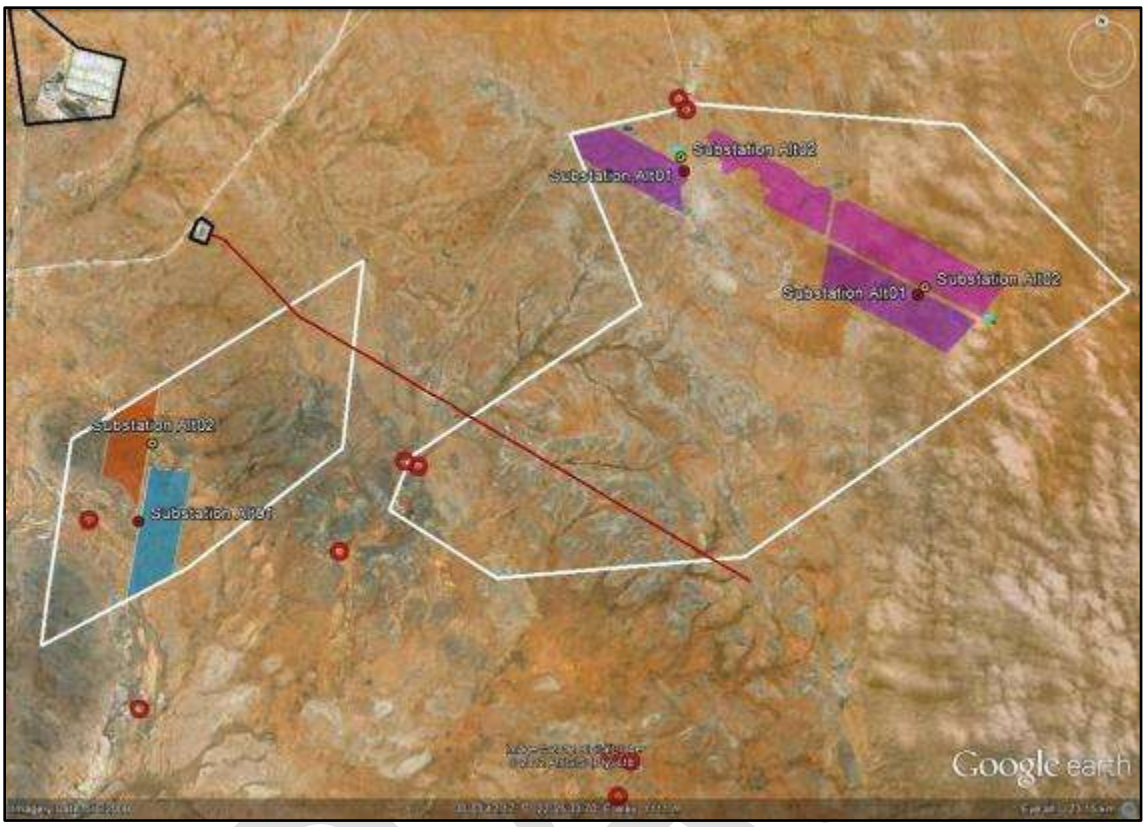

Figure 37: Buildable area and other infrastructure within the Prieska sites in relation to social sensitive areas

No relocation will be required during the pre-construction phase and therefore no impacts are foreseen in this regard apart from a nuisance factor to neighbouring landowners during the construction phase.

- Demographical Changes

At this stage it is foreseen that a very small team will be involved with the site testing and monitoring and that the site clearing will mostly entail unskilled labour that can be sourced locally. As such it is not foreseen that there will be any significant changes brought about to the size and composition of the local population during the pre-construction phase and hence no impact are foreseen during this phase of the project.

- Institutional and Legal Changes

During the preconstruction phase the lease agreements with the affected landowners will be finalised and effected. However, these negotiations are between the landowner and Mainstream and fall outside the scope of the study and as such have not been assessed in detail.

8.7.2 Potential impacts during construction

- Demographical Changes

It is expected that the construction of the PV plant, the substation and the transmission lines to link into the Eskom grid would 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. The influx of construction workers and job seekers are expected.

  - Influx of construction workers

Table 17 below provides an overview of the estimated size of the construction team. The size of the team should not be confused with employment opportunities, as it is expected that the bulk of these positions will be filled by skilled employees appointed by the contractor. However, Mainstream have indicated that they intend to source the bulk of the unskilled labour from the local area wherever possible.

Table 17**:** Number of workers required and the nature of their origin during construction – PV Plant

Anticipated Achievement of SA Citizens Employed: Construction Phase				
Activity	**Education/Skill Level**	**RSA Based Employees**	**SA Citizens**	**Local Community Citizens (Months)**
Project Management and Engineering	E Lower D Upper	69	50	10
Site Management	D Upper	153	119	17
Installation	B Lower	211	211	132
Commissioning	D Upper	6	0	0
Site Mobilisation & Temporary Infrastructure	B Upper C Lower	55	55	24
DC Distribution	C Lower	48	48	0
AC Distribution (Auxiliary supply)	C Upper	24	24	0

Cables	B Upper	24	24	0
Lighting Arrester/Earthing Systems	C Upper	28	28	12
Container/Buildings	B Lower/A	28	28	12
Foundation & Support Structure for modules	B Upper	85	34	34
Civil Works	A	141	141	88
Total		872	762	329

Source: Mainstream

As reflected above, a construction team consists of a certain 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 is expected to be limited. Once the project has been completed, construction workers who form part of a contractor's permanent workforce will move on to a next project and will seldom stay in the area.

Although the site is located in the NCDMA07, it is expected that a population influx will impact on Prieska as the closest town. Prieska forms part of the Siyathemba Local Municipality and as previously indicated, the total population size in this Municipality is estimated at 20,121 people, of which approximately 11,236 are resident in Prieska. Even when a phased approach is not followed, the sudden influx of approximately 872 people of the construction team will result in a temporary population increase of approximately 7.8%, which the town should be able to absorb.

- Increase of 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.

Unfortunately, projects in the public domain often unintentionally create unrealistic expectations, especially amongst communities where unemployment is high and poverty is rife. Job seekers 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). It is then likely that the presence of job seekers could lead to the formation or expansion of informal settlements (cumulative impact).

As is the case with the influx of construction workers, the actual in-migration of unemployed jobseekers might not yield a significant change to the community (although that is dependent on the uncertain number of jobseekers). Their *presence* can lead to a number of change processes and impacts, such as the expansion of informal settlements giving rise to an additional demand on municipal services, conflict situations over job opportunities and other limited resources, etc

- Economic Changes

    - Direct Employment and Output

During its construction (expected to last close to four years), the 190MW solar plants are expected to create around 2600 jobs within the local area, with 988 sourced locally (38%), 1 300 or 50% sourced on a national level and 312 or 12% from abroad. The direct increase in local production could be close to R 129 m per annum for the four year period.

    - Economic Multiplier Effects

It is estimated that additional temporary jobs in the local economy could be around 19 jobs due to increased activity of local traders and producers of construction materials and equipment, transport services, accommodation services etc. Local production could potentially increase by an additional R3.5m due to supply linkages with the construction of the Prieska solar plants.

The induced effect of income spending by local workers directly and indirectly employed through the solar plant could result in an additional R7m output generated for the local economy and an associated 24 local jobs.

Since the larger part of the inputs during the construction phase will be acquired from the larger South African economy (with the exception of the PV modules that will be purchased from abroad) the indirect contribution towards jobs and production will be higher at 230 jobs and R56m per annum respectively with an additional R11m in output and close to 36 jobs expected to result to be induced from spending of salaries and wages directly or indirectly earned during construction.

    - The Total Impact on the Local and National Economy during the Construction Phase

The total annual impact of the construction of the Prieska solar plants on local and national employment and output levels is expected to last four years and can be summarised as follows:

Table 18: Total annual impact of the solar facility on local and national employment

Type of impact	Local employment (nr of jobs)	Local output: Gross value added (Rm)	% of local Siyathema [(1)] employment (3 276 jobs in 2010)	% of local Siyathema [(1)] output (R656m in 2010)	Employment SA (incl local) (nr of jobs)	Output SA (incl local) Gross value added (Rm)	% of SA employment (total=8.2m formal jobs in 2010)	% of SA output (total = R2412bn in 2010)
Direct impact	2 600 (988 locally sourced)	129	79.4	19.7	2 600	129	0.03	0.005
Indirect impact	19	4	0.6	0.6	249	75	0.003	0.003
Induced impact	24	7	0.7	1.1	60	35	-	0.001
Total impact	**2 643**	**140**	**80.7**	**12.3**	**2 909**	**239**	**0.035**	**0.008**

Sources: Based on information supplied by developer, IHS Global Insight, 2012, Stats SA, 2007 and 2011, DBSA, 2011

Table 19: The total impact on the Siyathemba and Kareeberg labour force for years 1 and 2 of construction

Number of jobs created for local people by the PV plant = 1501 jobs	
Total number of formal jobs in local economy (Siyathemba)	= 3 274 in 2010
Total number of informal jobs	= 256 in 2010
Total number of unemployed people in the local area	= 1 492 in 2010
% unemployment	= 30% of the labour force
Locally created jobs as % of informal employment and unemployment	= 86%
Total number of formal jobs in local economy (Kareeberg)	= 1 245 in 2010
Total number of informal jobs	= 163 in 2010
Total number of unemployed people in the local area	= 1 901 in 2010
% unemployment	= 57% of the labour force
Locally created jobs as % of informal employment and unemployment	= 73%

Table 20: The total impact on the Siyathemba and Kareeberg labour force for years 3 and 4 of construction

Number of jobs created for local people by the PV plant = 1031 jobs	
Total number of formal jobs in local economy (Siyathemba)	= 3 274 in 2010
Total number of informal jobs	= 256 in 2010
Total number of unemployed people in the local area	= 1 492 in 2010
% unemployment	= 30% of the labour force

Locally created jobs as % of informal employment and unemployment	= 59%
Total number of formal jobs in local economy (Kareeberg)	= 1 245 in 2010
Total number of informal jobs	= 163 in 2010
Total number of unemployed people in the local area	= 1 901 in 2010
% unemployment	= 57% of the labour force
Locally created jobs as % of informal employment and unemployment	= 50%

- 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, the power relationships between groups and how people are able to negotiate through situations that might affect their lives. During the construction phase the most significant expected change to occur is the need to accommodate the construction team.

The professional team is normally housed in formal accommodation (guest houses, lodges, etc.) in town. At this stage it is assumed that the hospitality industry in the area would be able to absorb the additional demand in housing for the length of the construction period and that, in line with Mainstream's intention, there will not be a need for a residential construction camp (also given the fact that unskilled labour will be sourced from the local area and therefore already resident in the area, i.e. they will not require housing). Where existing housing is used, it is not foreseen that additional demand on municipal services will be exerted within town.

- 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.

  - Risk for Social Mobilisation (Conflict)

Attitudes are formed by means of people's take on a specific issue, coupled with their past experiences associated with either the issue itself or, more likely, the way it has been dealt with by those responsible for creating the situation in the first place. A person's attitude towards a certain issue or situation can strongly influence the way in which that person views subsequent

issues/situations of a similar nature. If local residents are unsupportive of either the proposed project in question or of the project proponent, it could lead to social mobilisation.

The risk for social mobilisation greatly increases if the project proponent is perceived as distrustful, i.e. if they do not deliver on their undertakings with the local residents in terms of employment creation, etc. 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.

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 affect social well-being.

- Health and Safety

In this context health and safety impacts focus mainly on the spread of certain sexually transmitted infections (STI), including HIV/AIDS. It is not uncommon for construction workers who are separated from their families for a period of time to establish temporary sexual relationships with members of the local community. Disempowered and desperate local women often view construction workers as financially well-off. This can lead to an increase in prostitution. Other women just enter into normal (sexual) relationships with construction workers believing that they will be supported financially. These situations have the potential to lead to an increase in pregnancies within the local community and eventually single parent households without financial support.The spread of STIs and HIV then become matters of great concern, also in light of the fact that construction workers move out of the area into another areas where the spread of STIs and HIV may continue.

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.

8.7.3 Potential impacts during operation

- Geographical Changes

The identification and assessment of social impacts arising from geographical change processes within a social context, focuses on how the proposed development might impinge on the behaviour and/or lives of landowners and/or land users in the affected area.

- Long Term Loss of Land

There will be a long term loss of land on the site for the operational lifetime of the project. Based on a review of maps and IDP documentation it does not appear that any institutional loss of land will occur due to this project (i.e. planned developments and/or currently existing municipal/institutional infrastructure). For this reason any indication thereof within the scoping report has been dismissed for this SEIA. Potential loss of private land is according to the section below.

- Change in access to resources that sustain livelihoods

Any effect on agricultural processes could hold negative outcomes for those employed in agriculture, those who hold ownership over the agricultural activities, and for food security locally. Mainstream have indicated that they are considering fencing off the PV plant facility, which would result in a loss of grazing land for the operational lifetime of the PV plant. It is however assumed that if this decision is taken forward, that it would form part of the lease agreement with the landowner.

The nature of these impacts would largely be of an economic nature and as such have been assessed in the Economic section of this report.

- Construction of roads and connection routes to the site

Mainstream have stated that they plan to construct roads on the site areas in order to connect the administration buildings and other planned infrastructure. These roads will almost entirely be within the confines of the site area (as existing farm roads will be used as far as possible). This means that further road infrastructure will be created but largely within an area in which major infrastructure is already planned and in an area that will not be accessed by the general public.

Alterations to existing roads would include strengthening them, the creation of turning circles for large trucks, and the construction of culverts over gullies and rivers should this be required.

- Economic Changes

  - Direct employment and output

During the operational phase of the solar plant, 138 permanent jobs are expected to be created mainly locally sourced jobs (123). The solar plant could in addition be expected to add an additional R 54m towards local production (excluding profits).

  - Economic multiplier effects

It is expected that increased production due to supply links to the solar plant during the operational phase could add an additional R 13m to the local economy and around R15m to the broader national economy resulting in an additional 28 local jobs and 30 national jobs.

In addition, R9m in output and close to 30 jobs expected to result to be induced from spending of local salaries and wages directly or indirectly earned during construction. In the broader national economy an additional R3m and 10 jobs is expected to result from spending of salaries and wages during the operational phase of the solar plant.

  - The total impact on the local and national economy during the operational phase

The total impact of the operational phase of the Prieska solar plants on local and national employment and output levels can be summarised as follows:

Table 21: Total impact of the operation and maintenance on local and national employment

Type of impact	Local employment (nr of jobs)	Local output: Gross value added (Rm)	% of local Siyathema [(1)] employment (3 276 jobs in 2010)	% of local Siyathema [(1)] output (R656m in 2010)	Employment SA (incl local) (nr of jobs)	Output SA (incl local) Gross value added (Rm)	% of SA employment (total=8.2m formal jobs in 2010)	% of SA output (total = R2412bn in 2010)
Direct impact	138 (123 locally sourced)	54 (333 including profits)	4.2	8.2	138	333 including profits	0.002	0.012
Indirect impact	28	13	0.9	2.0	58	28	-	0.001
Induced impact	31	8	0.9	1.2	41	11	-	-
Total impact	**197**	**75 (354 including profits)**	**6.0**	**11.4**	**221**	**372 including profits**	**0.002**	**0.013**

Sources: Based on information supplied by developer, IHS Global Insight, 2012, Stats SA, 2007 and 2011, DBSA, 2011

Table 22: The total impact on the Siyathemba and Kareeberg labour force

Number of jobs created for local people by the PV plant	= 182 jobs
Total number of formal jobs in local economy (Siyathemba)	= 3 274 in 2010
Total number of informal jobs	= 256 in 2010
Total number of unemployed people in the local area	= 1 492 in 2010
% unemployment	= 30% of the labour force
Locally created jobs as % of informal employment and unemployment	= 10%
Total number of formal jobs in local economy (Kareeberg)	= 1 245 in 2010
Total number of informal jobs	= 163 in 2010
Total number of unemployed people in the local area	= 1 901 in 2010
% unemployment	= 57% of the labour force
Locally created jobs as % of informal employment and unemployment	= 9%

- Diversification of the local economy

The tress index shows the level of diversification of an economy with an index value of 100 showing an economy relying on only one sector while an index value of 0 shows a perfectly diversifies sector where all sectors contribute equally to the total economy. In 2009 the Northern Cape economy had a tress index of 47.8, significantly higher than the 39.6 of the national economy (IHS Global Insight, 2012). Underlying the relatively high tress index value of the Northern Cape is the high contributions made by the mining, finance and services sectors.

The surrounding Siyathema Local Municipality economy is mainly dependent on agriculture (24% of output in 2010) and public services (14% of output in 2010) – a typical situation in many undeveloped rural economies. The development of the renewable energy industry could therefore play a significant role to diversify the economy away from the climate-dependent agricultural sector and the public service sector.

- Social Income

<u>Additional Central Government Tax Revenue</u>

For the PV plant an additional R97m (26% of R372m value added) of central tax revenue could be expected.

<u>Net Income to Local Government</u>

Municipal income from property tax will increase since the new structure would most probably be classified as public service infrastructure (not exempt) and not as plant and equipment (exempt) (Interview with DDP Valuers, 20120).

Corporate Social Investment

It should be noted that if the solar plant replaces the solar facility, the social funds will decrease significantly to R 5.5m for the enterprise development fund and social economic development fund and R14m of 5% retained profits per annum, i.e. a total of close to R 20m per annum or 3% of local output per annum.

Given the size and the potentially large influence of corporate social investments planned for the project we have also focussed on approaches in terms of institutional arrangements towards social investment funds as well as potential corporate social investment (CSI) priority areas for the Northern Cape.

Corporate Social Investment Structures and Approaches

The first question to answer is who are the communities that should participate - ultimately the beneficiaries? The communities need to be defined, communal structures established and representatives identified and/or elected.

In applying this process experience has shown that there are significant benefits to be derived from building on a variety of existing community structures and groupings. Initiatives that strive to develop entirely new community body(s) often find they are undermined by existing structures, frustrated by gate keeping and/or become politicised. The community/beneficiaries would be typically represented by Board members or Trustees depending on the institutional models applied.

It is critical that at the time of establishing the community representative bodies that clear purpose and criteria for the allocation of funds are developed and captured in the founding documentation (statues). These criteria should indicate the criteria on which the basis of funding amounts and allocations are to be made and detail the decision making process to be applied. The criteria and process to be applied need to be openly and effectively communicated to all stakeholders. The majority of problems experienced with community participation models revolve around conflicts pertaining to the allocation of funds, often resulting in the total collapse of the community representative body. Most of these challenges can be address trough developing clearly defined purposes for fund allocation, criteria for funding decisions and defined and transparent decision making process.

The challenge is to ensure that the revenues generated are effectively and efficiently applied in accordance with the community priorities. The community and/or individuals in the community

could potentially participate in the benefits of the social trust fund in a variety of ways, namely through:

i. Local government structures
    1. Local Economic development Forums
ii. Direct community involvement
    1. Entrepreneurial participation directly in the venture or provision of supporting services e.g. maintenance and transport
    2. Community participation (Trusts and section 21 companies), intern investing in or supporting community development initiatives
    3. Community bodies (societies and associations) addressing a variety of community needs and interests
iii. Non-governmental organisations:
    1. Development programmes e.g. school feeding schemes, market gardening schemes, HIV Aids programmes etc.

Community development priorities

The Northern Cape Provincial Growth and Development Strategy (NCPGDS) states that poverty reduction is the most significant challenge faced by the provincial government and its growth and development partners.

Increasingly emphasis in CSI programmes is being placed on supporting social investment to address basic needs through the following priority interventions:

ii. Provision of basic services: There is increasing focus in development initiatives on focusing scare resources on providing basic services. In this regard the key priorities are in addressing:
    1. The backlogs in sanitation and housing through for example the continued roll out of access to flush toilets in line with the sated National Government priorities.
    2. Improving the access to water, particularly potable drinking water and livestock drinking water. This could be through investing in community wells and boreholes following models applied successfully in other parts of Southern Africa.
    3. The improvement of road infrastructure, particularly upgrading deteriorating gravel roads and tarring more major roads. In this regard to maximise community participation and also support poverty relief and employment consideration could be given to the Zibambele process applied successfully in KZN, where

communities take responsibility for maintaining sections of road for a maintenance fee.

iii. Provision of improved education: There is an increasing acceptance that a key development intervention in depressed rural areas, characterised by limited job opportunities and high unemployment, is to improve education to enable job seekers to migrate and secure jobs in urban centres. In this regard most community based development initiatives are placing significant priority on improving education standards through investing in educational infrastructure.

iv. Direct poverty and health interventions: The Northern Cape rural communities are characterised by significantly high levels of poverty, coupled with specific challenges pertaining to health, particularly in terms of AIDs, Alcohol abuse and TB. In this regard investment into feeding schemes and improvements in access to healthcare facilities and services are regarded as a priority. Integrated models successfully being applied in the Eastern Cape could be considered, where the feeding schemes are integrated with supporting market gardening initiatives, which in turn provide produce to support school feeding schemes.

- Potential Opportunity Costs of the Development

Development Opportunities

No alternative development projects are currently under review for the site.

Agricultural Output

Combining the total land area of the Northern Cape of 361,830 square km and 98% used for stock farming (Department of Agriculture, undated) with agricultural output and employment figures of R3 938 m (IHS Global Insight, 2012) and 44 000 jobs respectively in 2010 (Department of Agriculture Forestry and Fisheries, 2010) it is deduced that the average agriculture output and employment for the province is R11 105 and 0.12 jobs per square kilometer respectively.

Of the 490 square kilometres planned for the Prieska solar facility only 1% of agricultural land (4.9 sq km) is expected to be displaced as cattle will be allowed to graze inside the facility. Assuming provincial averages for the area, we can roughly surmise that around R 54 400 of agricultural output and no agricultural job per annum could be forfeited by changing the land use of the area from agriculture to a solar facility. However it is more likely that excess farming stock will be shifted to adjacent areas with no economic implications but with potentially implications for bio-diversity resulting from over-grazing.

In addition, the solar plant is assumed to take about 3ha per MW, i.e. given the 190MW planned, about 570ha or 5.7 square km of agricultural land could potentially be lost due to the solar plant. Agricultural output could hence decline with R63 300 but also with no loss of jobs due to the PV plant.

Tourism

The contribution of hotels and accommodation towards total output is very low (0.1%) in The surrounding Siyathema Local Municipality compared to the contribution of the sector of 1.4% in the tourism intensive economy of the Western Cape. This suggests the relative low importance of tourism activities in the area (IHS Global Insight, 2012).

- Socio-Cultural Change Processes

The most important socio-cultural change during the operation and maintenance phase relates to a change in 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 (Petrich 1993). Thereafter, any additional impacts on the landscape have a correspondingly smaller effect. Hence, the aesthetic impact of placing any form of development 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 *"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."*

In addition to considering the psychosocial and emotional aspects, an assessment of sense of place also has to consider the physical placement of the infrastructure associated with the PV Plant within a demarcated site area that would affect as few people as possible. Problem areas in this regard were highlighted as part of geographical change processes during pre-construction impacts.

The Socio-economic Assessment is included in Appendix 6G.

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 24.

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 23: 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 24: 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

IMPACT TABLE FORMAT		
Probability	4	1
Reversibility	4	1
Irreplaceable loss	4	1
Duration	4	1
Cumulative effect	4	1
Intensity/magnitude	4	1
Significance rating	-96 (high negative)	-6 (low negative)
Mitigation measures	Outline/explain the mitigation measures to be undertaken to ameliorate the impacts that are likely to arise from the proposed activity. Describe how the mitigation measures have reduced/enhanced the impact with relevance to the impact criteria used in analyzing the significance. These measures will be detailed in the EMPr.	

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

9.2 Environmental Impact Assessment

9.2.1 Construction - Biodiversity

Table 25: Rating of impacts related to loss of habitat for red data / general species

IMPACT TABLE	
Environmental Parameter	Biodiversity
Issue/Impact/Environmental Effect/Nature	Loss of habitat for red data / general species
Extent	The impact is only expected to affect the site.
Probability	The impact may occur (Between a 25% to 50% chance of occurrence).
Reversibility	The impact is partly reversible but more intense mitigation measures are required.

IMPACT TABLE		
Irreplaceable loss of resources	The impact 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 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	2	1
Cumulative effect	3	1
Intensity/magnitude	2	1
Significance rating	-24 (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.	

IMPACT TABLE	
	▪ 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.

Table 26: Rating of impacts related to edge effect

IMPACT TABLE	
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 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 minor cumulative effects
Intensity/magnitude	Impact alters the quality, use and integrity of the system/component but system/ component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).

IMPACT TABLE		
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	4	2
Reversibility	2	1
Irreplaceable loss	2	1
Duration	2	1
Cumulative effect	3	1
Intensity/magnitude	2	1
Significance rating	-28 (low 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).	

Table 27: Rating of impacts related to loss of physical habitat for birds

IMPACT TABLE	
Environmental Parameter	Loss of / transformation of habitat associated with the proposed solar plant
Issue/Impact/Environmental Effect/Nature	The construction of the PV arrays could result in loss of physical habitat for birds in the study area, thus potentially having an impact on the occurrence of birds on the site.
Extent	Site (1)
Probability	Definite (4)
Reversibility	Partly reversible (2)

IMPACT TABLE		
Irreplaceable loss of resources	Marginal loss of resources (2)	
Duration	Mediumterm (2)	
Cumulative effect	Low cumulative impact (2)	
Intensity/magnitude	Medium (2)	
Significance Rating	**Medium Negative Impact**	
	Pre-mitigation impact rating	**Post mitigation impact rating**
Extent	1	1
Probability	4	4
Reversibility	2	2
Irreplaceable loss	2	2
Duration	2	2
Cumulative effect	2	2
Intensity/magnitude	2	1
Significance rating	-26 (low negative)	- 13 (low negative)
Mitigation measures	▪ Refer to section10.2.	

Table 28: Rating of impacts related to destruction of foraging habitat for bats

IMPACT TABLE	
Environmental Parameter	Destruction of foraging habitat
Issue/Impact/Environmental Effect/Nature	All major bat foraging habitats on this site are already included within the proposed buffer zones and will therefore not be destroyed by construction.
Extent	Site.
Probability	Unlikely
Reversibility	The impact is barely reversible should the project be placed in an area of high bat sensitivity.
Irreplaceable loss of resources	Marginal without mitigation.

IMPACT TABLE		
Duration	For the duration of the operating solar facility with or without mitigation.	
Cumulative effect	Negligible	
Intensity/magnitude	Considered low without mitigation.	
Significance Rating	**Prior to mitigation measures:** Lownegative impact without mitigation. **After mitigation measures:** The low negative impact will persist after mitigation.	
	Pre-mitigation impact rating	**Post mitigation impact rating**
Extent	1	1
Reversibility	3	1
Irreplaceable loss	2	1
Duration	3	3
Cumulative effect	1	1
Intensity/magnitude	1	1
Probability	1	1
Significance rating	-11 (low negative)	-8 (low negative)
Mitigation measures	▪ None required	

It should be noted that a slightly different methodology was used to determine the significance of the impacts related to bats. This is due to the fact that although no bat activity was noted on the site, it can vary greatly on a seasonal basis. Impacts such as, bat mortality during migration, would be a very big concern if it were to occur, however the chances of it occurring are relatively slim. Therefore, significance has been calculated by multiplying all the factors with the probability of the impact occurring using the following formula:

(Extent + reversibility + irreplaceability + duration + cumulative effect + magnitude/intensity) x probability

9.2.2 Construction – Surface Water

Table 29: Rating of impacts related tosurface water features

IMPACT TABLE		
Environmental Parameter	Surface Water Impacts	
Issue/Impact/Environmental Effect/Nature	The constructionof the PV arrays and the linear associated infrastructure could result in both direct and indirect impacts on surface water features. These activities could result in the physical transformation of surface water features, as well as indirect impacts such as alteration of hydrology regimes, erosion and associated downstream siltation and pollution.	
Extent	Site (1)	
Probability	Possible (2)	
Reversibility	Partly reversible (2)	
Irreplaceable loss of resources	Marginal loss of resources (3)	
Duration	Long term (2)	
Cumulative effect	Low cumulative impact (2)	
Intensity/magnitude	Low (1)	
Significance Rating	**Medium Negative Impact**	
	Pre-mitigation impact rating	**Post mitigation impact rating**
Extent	1	1
Probability	2	2
Reversibility	2	2
Irreplaceable loss	3	3
Duration	2	2
Cumulative effect	2	2
Intensity/magnitude	1	1
Significance rating	-12 (low negative)	-12 (low negative)
Mitigation measures	▪ Refer to section 10.2.	

9.2.3 Construction – Agricultural Potential and Soils

Table 30: Rating of impacts related to the degradation of local soil and land use resources

IMPACT TABLE		
Environmental Parameter	Soil and Land Use Resources	
Issue/Impact/Environmental Effect/Nature	Loss of agricultural land and / or production as a result of the proposed activities	
Extent	**Site**: Impacts will be restricted to the site.	
Probability	**Probable**: The degradation of local soil and land resources will likely occur.	
Reversibility	**Completely Reversible**: The land can be returned to grazing after the construction phase.	
Irreplaceable loss of resources	**Marginal Loss**: The construction of the solar field and associated infrastructure will result in a very marginal loss of agricultural land and production.	
Duration	**Short Term**: The impact and its effects will continue or last for the construction phase of the development.	
Cumulative effect	**Negligible Cumulative Impact:** A slight increase in pressure on adjacent grazing land could occur.	
Intensity/magnitude	**Low**	
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	1	1
Probability	3	2
Reversibility	1	1
Irreplaceable loss	2	2
Duration	1	1
Cumulative effect	1	1
Intensity/magnitude	1	1
Significance rating	-9 (low negative)	-8 (low negative)
Mitigation measures	▪ Due to the overarching site characteristics and the nature of the proposed development viable mitigation measures are limited and will most likely revolve around erosion control:	

IMPACT TABLE	
	○ Clearing activities should be kept to a minimum (road and PV site footprint). ○ In the unlikely event that heavy rains are expected activities should be put on hold to reduce the risk of erosion. ○ If additional earthworks are required, any steep or large embankments that are expected to be exposed during the 'rainy' months should either be armoured with fascine like structures. ▪ If earth works are required then storm water control and wind screening should be undertaken to prevent soil loss from the site

9.2.4 Construction – Visual

Table 31: Rating of visual impacts during construction

IMPACT TABLE	
Environmental Parameter	Visual Impact associated with the construction of the proposed PV plant.
Issue/Impact/Environmental Effect/Nature	Large construction vehicles and equipment during the construction phase will alter the natural character of the study area and expose visual receptors to visual impacts associated with the construction phase.
Extent	Local / District (2)
Probability	Probable (3)
Reversibility	Partly reversible (2)
Irreplaceable loss of resources	Marginal loss of resources (2)
Duration	Medium term (2)
Cumulative effect	Low cumulative impact (2)
Intensity/magnitude	Medium (2)
Significance Rating	**High Negative Impact**

IMPACT TABLE		
	Pre-mitigation impact rating	**Post mitigation impact rating**
Extent	2	2
Probability	3	2
Reversibility	2	2
Irreplaceable loss	2	1
Duration	2	2
Cumulative effect	2	1
Intensity/magnitude	2	1
Significance rating	-26 (low negative)	-10 (low negative)
Mitigation measures	▪ Carefully plan to reduce the construction period. ▪ 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. ▪ Ensure that dust suppression techniques are implemented on all access roads.	

9.2.5 Construction – Heritage

Table 32: Rating of impacts related to stone age sites

IMPACT TABLE	
Environmental Parameter	Pre-colonial: stone age sites
Issue/Impact/Environmental Effect/Nature	Many sites are still unknown. Their potential and significance is therefore unknown. The impact will be the physical disturbance of the material and its context. Impact will be focused on a particular node, i.e. tower positions or access/ inspection roads.
Extent	Local / district
Probability	Possible
Reversibility	Irreversible
Irreplaceable loss of resources	Complete loss of resources

IMPACT TABLE		
Duration	Permanent	
Cumulative effect	High	
Intensity/magnitude	Medium	
Significance Rating	The impact will have medium negative effects. The sites have a low significance on a region level (viewed as NHRA Grade III sites). Distinguish from find spots, which have a low significance.	
	Pre-mitigation impact rating	**Post mitigation impact rating**
Extent	2	2
Probability	2	2
Reversibility	4	4
Irreplaceable loss	4	3
Duration	4	4
Cumulative effect	4	4
Intensity/magnitude	2	2
Significance rating	-40 (medium negative)	-38 (medium negative)
Mitigation measures	▪ Once sites are identified, if the location is to be used for development purposes, then mitigation of the site will be necessary. This could require excavation, or at least mapping and collection of surface material.	

Table 33: Rating of impacts related to farmsteads

IMPACT TABLE	
Environmental Parameter	Colonial period: farmsteads
Issue/Impact/Environmental Effect/Nature	The various features are subject to damage. Easier to identify and therefore easier to avoid. Variety of interconnected elements makes up the whole. Impact on part therefore implies an impact on the whole.
Extent	Local / district
Probability	Possible
Reversibility	Partly reversible

IMPACT TABLE		
Irreplaceable loss of resources	Complete loss of resources	
Duration	Permanent	
Cumulative effect	High	
Intensity/magnitude	Medium	
Significance Rating	The impact will have medium negative effects. The sites have a high significance on a region level (viewed as NHRA Grade III sites).	
	Pre-mitigation impact rating	**Post mitigation impact rating**
Extent	2	2
Probability	2	1
Reversibility	2	1
Irreplaceable loss	4	1
Duration	4	4
Cumulative effect	4	1
Intensity/magnitude	2	1
Significance rating	-36 (medium negative)	-10 (low negative)
Mitigation measures	▪ Isolate known sites and declare them as no-go areas with sufficient large buffer zones around them for protection. In exceptional cases mitigation can be implemented after required procedures have been followed.	

Table 34: Rating of impacts related to cemeteries

IMPACT TABLE	
Environmental Parameter	Colonial period: cemeteries
Issue/Impact/Environmental Effect/Nature	The various features are subject to damage. They area easier to identify and therefore easier to avoid. Variety of interconnected elements makes up the whole. Impact on part therefore implies an impact on the whole.
Extent	Local / district
Probability	Possible

IMPACT TABLE		
Reversibility	Irreversible	
Irreplaceable loss of resources	Complete loss of resources	
Duration	Permanent	
Cumulative effect	High	
Intensity/magnitude	Medium	
Significance Rating	The impact will have medium negative effects. The sites have a high significance on a region level (viewed as NHRA Grade III sites). Distinguish from find spots, which have a low significance.	
	Pre-mitigation impact rating	**Post mitigation impact rating**
Extent	2	2
Probability	2	1
Reversibility	4	1
Irreplaceable loss	4	1
Duration	4	4
Cumulative effect	4	1
Intensity/magnitude	2	1
Significance rating	-40 (medium negative)	-10 (low negative)
Mitigation measures	▪ Isolate known sites and declare them as no-go areas with sufficient large buffer zones around them for protection. In exceptional cases mitigation can be implemented after required procedures have been followed.	

9.2.6 Construction – Socio-economic

Table 35: Rating of impacts related to employment and output creation

IMPACT TABLE	
Environmental Parameter	Employment and output creation in the construction phase

IMPACT TABLE		
Issue/Impact/Environmental Effect/Nature	The creation of local jobs and income during the construction of the PV plant	
Extent	988 local jobs and R129m towards local production per annum for 4 years.	
Probability	High	
Reversibility	N/A	
Irreplaceable loss of resources	N/A	
Duration	2 years	
Cumulative effect	An additional 43 jobs and R11m in local output per annum due to indirect and induced effects during construction. Total impact = 31.5% of local employment and 12.3% of local output)	
Intensity/magnitude	High	
Significance Rating	High	
	Pre-mitigation impact rating	**Post mitigation impact rating**
Extent	3	4
Probability	4	4
Reversibility	0	0
Irreplaceable loss	0	0
Duration	1	1
Cumulative effect	1	1
Intensity/magnitude	2	3
Significance rating	18 (low positive)	30 (medium positive)
Mitigation measures	▪ Ensure that the unskilled local jobs created are linked to a skills development programme for permanent employment.	

Table 36: Rating of impacts related to social mobilisation

IMPACT TABLE	
Environmental Parameter	Note: As it would be difficult for the contractor to control conflict situations where they occur when construction workers spend their free time in the local community, this assessment focusses

IMPACT TABLE	
	on conflict situations that the contractor can control. Conflict between Mainstream (or its contractors) and landowners should be avoided by abiding to terms and conditions set out during negotiation process, especially in terms of potential problem areas such as access to properties, fencing and security.
Issue/Impact/Environmental Effect/Nature	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.
Extent	Where conflict occurs with regard to the issues mentioned above, Mainstream (or its contractors) should aim to restrict it to the landowner in question to prevent problems from extending to other areas.
Probability	The chance of occurrence is dependent on how the construction process is managed, which is difficult to predict – it might therefore be possible that the impact will occur, just as it might be possible that it will not occur.
Reversibility	Conflict situations are for the most part completely reversible if problems are rectified.
Irreplaceable loss of resources	A loss of resources might be the cause for conflict (e.g. a gate left open lead to missing cattle) – again this will be difficult to gauge at this stage and therefore the safest option would be to say that there might be a marginal loss of resources.
Duration	Conflict situations for the most part will be limited to the construction phase.
Cumulative effect	One conflict situation with a particular landowner can spread to other landowners so that they are antagonistic against the contractor even before they arrive on site. Other conflict situations can also arise in other areas as outlined in the body of the report, i.e. between jobseekers and construction workers, between construction workers and the local community and between the local community and Mainstream. Although all of these conflict situations might have small centralised points, collectively the local community as a whole can start resenting the presence of the construction team.
Intensity/magnitude	Conflict can range from barely perceptible (e.g. a contained conflict situation with one landowner that gets resolved quickly) to dispersed conflict situations that lead to high costs of

IMPACT TABLE		
	remediation (e.g. community members protesting against the project).	
Significance Rating	Negative Low	
	Pre-mitigation impact rating	**Post mitigation impact rating**
Extent	1	1
Probability	2	1
Reversibility	2	1
Irreplaceable loss	2	1
Duration	1	1
Cumulative effect	2	2
Intensity/magnitude	2	1
Significance rating	-20 (low negative)	-7 (low negative)
Mitigation measures	▪ Problem areas that are brought under the attention of the contractor should be rectified immediately. If the contractor is unable to so, this should be communicated to the landowner along with a plan on how and when the problem will be addressed. The landowner should be given regular feedback on the matter. ▪ All mitigation measures contained in the EMPr should be implemented and monitored by an ECO. Remedial action should be taken where the contractor fails to comply with the EMPr.	

Table 37: Rating of impacts related to health and safety

IMPACT TABLE	
Environmental Parameter	Reduce the risk spreading Sexually Transmitted Infections including HIV.
Issue/Impact/Environmental Effect/Nature	HIV/AIDS has numerous impacts ranging from the obvious health impacts to the less obvious economic impacts as result of a reduced workforce, loss of breadwinners resulting an alteration in family structures.
Extent	For the duration of the project the impact of HIV infections might be restricted to the local area, but as people move to other areas, so too does the virus.
Probability	The probability that construction workers will engage in sexual

IMPACT TABLE		
	relationships with locals is quite high. This is beyond the control of the contractor, but the contractor can supply condoms and information material to reduce the probability of HIV and other STI infections.	
Reversibility	Once infection has occurred, the impact is irreversible. It is therefore important to develop and implement a Health and Safety Plan, including a HIV/AIDS prevention plan during the construction phase.	
Irreplaceable loss of resources	HIV/AIDS will eventually lead to the loss of human resources, which would have an economic impact on the contractor who would have to spend time and money on training new employees	
Duration	Until such time that a cure is found, HIV infection is permanent	
Cumulative effect	Humans are transportable; therefore these infections can be spread when the construction worker migrates to a new area and perpetuates old behaviour (i.e. engage in a new casual sexual relationship). The death of parents and breadwinners alters family structures so that children become heads of households, restricting them from completing their education, holding them in downward poverty cycles.	
Intensity/magnitude	HIV infections can severely impair the functionality of the construction process due to illness and absenteeism.	
Significance Rating	Negative High impact (pre-mitigation) to Negative Low impact (post-mitigation)	
	Pre-mitigation impact rating	**Post mitigation impact rating**
Extent	4	2
Probability	3	2
Reversibility	4	3
Irreplaceable loss	3	2
Duration	2	2
Cumulative effect	4	3
Intensity/magnitude	3	2
Significance rating	-60 (high negative)	-28 (low positive)

IMPACT TABLE	
Mitigation measures	▪ Mainstream or its contractor should appoint a service provider or local NGO to develop, implement and manage an HIV/AIDS prevention programme. The service provider or NGO should specialise in the field of HIV/AIDS. ▪ The HIV/AIDS prevention programme should extend to the local community and should pay special attention to vulnerable groups such as women and youth.

It should be noted that, due to the standard format of the impact rating system, it is not possible to accurately reflect the irreversibility of infection (negative impact) once it has occurred alongside the implementation of an effective HIV/AIDS prevention plan (positive impact) in the table above. Overall the impact therefore appears negative, but the reader should bear in mind that there are positive components in terms of advocating healthier and safer sexual practices that can bear positive impacts within communities.

9.2.7 Operation – Biodiversity

Table 38: Rating of impacts related to loss of habitat for red data / general species

IMPACT TABLE	
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

IMPACT TABLE		
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
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 site.	

Table 39: Rating of impacts related to edge effect

IMPACT TABLE	
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).

IMPACT TABLE		
Reversibility	The impact is partly reversible but more intense mitigation measures are required.	
Irreplaceable loss of resources	The impact will result in marginal loss of resources	
Duration	The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 50 years)	
Cumulative effect	The impact would result in minor cumulative effects	
Intensity/magnitude	Impact alters the quality, use and integrity of the system/component but system/ component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).	
Significance Rating	**Prior to mitigation measures:** There will be a negative low impact i.e. the anticipated impact will have moderate negative effects and will require moderate mitigation measures **After mitigation measures:** After mitigation measures, a negative low impact will be achieved.	
	Pre-mitigation impact rating	**Post mitigation impact rating**
Extent	1	1
Probability	2	2
Reversibility	2	1
Irreplaceable loss	2	1
Duration	3	1
Cumulative effect	3	1
Intensity/magnitude	2	1
Significance rating	-26 (low negative)	-7(low negative)
Mitigation measures	▪ A programme of weed control should be implemented. ▪ The spread of exotic species occurring throughout the site should be controlled.	

IMPACT TABLE	
	▪ All exotic vegetation must be removed from the site (if present).

Table 40: Rating of impacts related to disturbance on birds / creation of the barrier effect

IMPACT TABLE		
Environmental Parameter	Disturbance Factor / Creation of Barrier effect	
Issue/Impact/Environmental Effect/Nature	The construction of the PV arrays could result in disturbance of birds and create a barrier effect that could affect the continued presence of sensitive species in the area, and which could affect the movement of birds onto the, and within the site.	
Extent	Local / District (2)	
Probability	Possible (2)	
Reversibility	Partly reversible (2)	
Irreplaceable loss of resources	Marginal loss of resources (2)	
Duration	Long term (3)	
Cumulative effect	Low cumulative impact (2)	
Intensity/magnitude	Medium (2)	
Significance Rating	**Medium Negative Impact**	
	Pre-mitigation impact rating	**Post mitigation impact rating**
Extent	2	2
Probability	2	2
Reversibility	2	2
Irreplaceable loss	2	2
Duration	3	3
Cumulative effect	2	2
Intensity/magnitude	2	2
Significance rating	-26 (low negative)	- 26 (low negative)

IMPACT TABLE	
Mitigation measures	▪ Refer to section10.2.

9.2.8 Operation – Surface Water

Table 41: Rating of impacts related to surface water features

IMPACT TABLE		
Environmental Parameter	Surface Water Impacts	
Issue/Impact/Environmental Effect/Nature	The operation of the PV plant could result in both direct and indirect impacts on surface water features. These activities could result in the physical transformation of surface water features, as well as indirect impacts such as alteration of hydrology regimes, erosion and associated downstream siltation and pollution.	
Extent	Site (1)	
Probability	Possible (2)	
Reversibility	Partly reversible (2)	
Irreplaceable loss of resources	Marginal loss of resources (3)	
Duration	Long term (2)	
Cumulative effect	Low cumulative impact (2)	
Intensity/magnitude	Low (1)	
Significance Rating	**Medium Negative Impact**	
	Pre-mitigation impact rating	**Post mitigation impact rating**
Extent	1	1
Probability	2	2
Reversibility	2	2
Irreplaceable loss	3	3
Duration	2	2

IMPACT TABLE		
Cumulative effect	2	2
Intensity/magnitude	1	1
Significance rating	-12 (low negative)	-12 (low negative)
Mitigation measures	▪ Refer to section 10.2.	

9.2.9 Operation – Agricultural Potential and Soils

Table 42: Rating of impacts related to a loss of agricultural land and / or production

IMPACT TABLE		
Environmental Parameter	Agricultural potential and soils	
Issue/Impact/Environmental Effect/Nature	Loss of agricultural land and / or production as a result of the proposed activities	
Extent	**Site**: Impacts will be restricted to the site.	
Probability	**Definite**: Loss of grazing land will definitely occur.	
Reversibility	**Completely Reversible**: The land can be returned to grazing after the project has been decommissioned.	
Irreplaceable loss of resources	**Marginal Loss**: The solar field and associated infrastructure will result in a very marginal loss of agricultural land and production.	
Duration	**Long Term**: The impact and its effects will continue or last for the entire operational life of the development. The life span of the development is greater than 20 years.	
Cumulative effect	**Negligible Cumulative Impact:** A slight increase in pressure on adjacent grazing land could occur.	
Intensity/magnitude	**Low**	
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	1	1
Probability	4	4
Reversibility	1	1
Irreplaceable loss	2	2

IMPACT TABLE		
Duration	3	3
Cumulative effect	1	1
Intensity/magnitude	1	1
Significance rating	-12 (low negative)	-12 (low negative)
Mitigation measures	▪ It is recommended that to the option of allowing seasonal grazing within the PV Fields be considered further by Mainstream in consultation with the landowner to further mitigate the loss of grazing land.	

9.2.10 Operation – Visual

Table 43: Rating of visual impacts associated with the PV plant

IMPACT TABLE		
Environmental Parameter	Visual Impact associated with the proposed PV solar arrays	
Issue/Impact/Environmental Effect/Nature	The proposed solar arrays could create a visual impact on sensitive receptors in the study area by creating visual change and visual intrusion	
Extent	Local / District (2)	
Probability	Definite (4)	
Reversibility	Partly reversible (2)	
Irreplaceable loss of resources	Marginal loss of resources (2)	
Duration	Long term (3)	
Cumulative effect	Low cumulative impact (2)	
Intensity/magnitude	Low (1)	
Significance Rating	**High Negative Impact**	
	Pre-mitigation impact rating	**Post mitigation impact rating**
Extent	2	2
Probability	4	4

IMPACT TABLE		
Reversibility	2	2
Irreplaceable loss	2	2
Duration	3	3
Cumulative effect	2	2
Intensity/magnitude	1	1
Significance rating	-17 (low negative)	-17 (low negative)
Mitigation measures	▪ Refer to section 10.2.	

9.2.11 Operation – Heritage

Table 44: Rating of impacts related to stone age sites

IMPACT TABLE		
Environmental Parameter	Pre-colonial: stone age sites	
Issue/Impact/Environmental Effect/Nature	Many sites are still unknown. Their potential and significance is therefore unknown. The impact will be the physical disturbance of the material and its context. Impact will be focused on a particular node, i.e. tower positions or access/ inspection roads.	
Extent	Local / district	
Probability	Possible	
Reversibility	Irreversible	
Irreplaceable loss of resources	Complete loss of resources	
Duration	Permanent	
Cumulative effect	High	
Intensity/magnitude	Medium	
Significance Rating	The impact will have medium negative effects. The sites have a low significance on a region level (viewed as NHRA Grade III sites). Distinguish from find spots, which have a low significance.	
	Pre-mitigation impact	**Post mitigation impact**

IMPACT TABLE		
	rating	**rating**
Extent	2	2
Probability	2	2
Reversibility	4	4
Irreplaceable loss	4	3
Duration	4	4
Cumulative effect	4	4
Intensity/magnitude	2	2
Significance rating	-40 (medium negative)	-38 (medium negative)
Mitigation measures	▪ Once sites are identified, if the location is to be used for development purposes, then mitigation of the site will be necessary. This could require excavation, or at least mapping and collection of surface material.	

Table 45: Rating of impacts related to farmsteads

IMPACT TABLE	
Environmental Parameter	Colonial period: farmsteads
Issue/Impact/Environmental Effect/Nature	The various features are subject to damage. They are easier to identify and therefore easier to avoid. Variety of interconnected elements makes up the whole. Impact on part therefore implies an impact on the whole.
Extent	Local / district
Probability	Possible
Reversibility	Partly reversible
Irreplaceable loss of resources	Complete loss of resources
Duration	Permanent
Cumulative effect	High
Intensity/magnitude	Medium
Significance Rating	The impact will have medium negative effects. The sites have a high significance on a region level (viewed as NHRA Grade III sites).

IMPACT TABLE		
	Pre-mitigation impact rating	**Post mitigation impact rating**
Extent	2	2
Probability	2	1
Reversibility	2	1
Irreplaceable loss	4	1
Duration	4	4
Cumulative effect	4	1
Intensity/magnitude	2	1
Significance rating	-36 (medium negative)	-10 (low negative)
Mitigation measures	▪ Isolate known sites and declare them as no-go areas with sufficient large buffer zones around them for protection. In exceptional cases mitigation can be implemented after required procedures have been followed.	

Table 46: Rating of impacts related to cemeteries

IMPACT TABLE	
Environmental Parameter	Colonial period: cemeteries
Issue/Impact/Environmental Effect/Nature	The various features are subject to damage. They are easier to identify and therefore easier to avoid. Variety of interconnected elements makes up the whole. Impact on part therefore implies an impact on the whole.
Extent	Local / district
Probability	Possible
Reversibility	Irreversible
Irreplaceable loss of resources	Complete loss of resources
Duration	Permanent
Cumulative effect	High
Intensity/magnitude	Medium
Significance Rating	The impact will have medium negative effects. The sites have a high significance on a region level (viewed as NHRA Grade III

IMPACT TABLE		
	sites). Distinguish from find spots, which have a low significance.	
	Pre-mitigation impact rating	**Post mitigation impact rating**
Extent	2	2
Probability	2	1
Reversibility	4	1
Irreplaceable loss	4	1
Duration	4	4
Cumulative effect	4	1
Intensity/magnitude	2	1
Significance rating	-40 (medium negative)	-10 (low negative)
Mitigation measures	▪ Isolate known sites and declare them as no-go areas with sufficient large buffer zones around them for protection. In exceptional cases mitigation can be implemented after required procedures have been followed.	

9.2.12 Operation – Socio-economic

Table 47: Rating of impacts related to employment and output creation

IMPACT TABLE	
Environmental Parameter	Employment and output creation in the operational phase
Issue/Impact/Environmental Effect/Nature	The creation of local jobs and income during the operation of the PV plant
Extent	123 local jobs and R54m value added (excluding profits)
Probability	High
Reversibility	NA
Irreplaceable loss of resources	NA
Duration	average design life of the PV plant
Cumulative effect	An additional 59 jobs and R21m in local production due to backward linkages and spending multipliers. Total impact =

IMPACT TABLE		
	6.0% of local employment and 11% of local output	
Intensity/magnitude	Medium	
Significance Rating	Medium	
	Pre-mitigation impact rating	**Post mitigation impact rating**
Extent	1	2
Probability	4	4
Reversibility	0	0
Irreplaceable loss	0	0
Duration	3	3
Cumulative effect	1	2
Intensity/magnitude	2	3
Significance rating	18 (low positive)	33 (medium positive)
Mitigation measures	▪ Linking new and existing local businesses to the supply chain of the PV plant.	

Table 48: Rating of impacts related to tax income

IMPACT TABLE	
Environmental Parameter	Tax income during the operational phase
Issue/Impact/Environmental Effect/Nature	Increase in central and local tax income during operations
Extent	Revenue generated for central government through direct taxes (company and personal taxes) as well as indirect taxes (e.g. VAT) an estimated R97m Net increase in local government income due to increase in property taxes
Probability	High
Reversibility	N/A
Irreplaceable loss of resources	N/A

IMPACT TABLE		
Duration	As long as the PV Plant is in operation	
Cumulative effect	None	
Intensity/magnitude	Small	
Significance Rating	Small in terms of national and local tax revenue	
	Pre-mitigation impact rating	**Post mitigation impact rating**
Extent	2	2
Probability	4	4
Reversibility	0	0
Irreplaceable loss	0	0
Duration	3	3
Cumulative effect	4	4
Intensity/magnitude	1	1
Significance rating	14 (low positive)	14 (low positive)
Mitigation measures	▪ None	

Table 49: Rating of impacts related to corporate social investment

IMPACT TABLE	
Environmental Parameter	Corporate social investment
Issue/Impact/Environmental Effect/Nature	1.5% of expected revenue will be retained for development in the form of an enterprise development fund (0.4%) and socio economic development fund (1.1%). An additional 5% of profits (est at R44m per annum) is expected to be paid out as a community dividend as part of a community development fund.
Extent	Total social funds for 190 MW solar plant: R 20m per annum, 3% of local production.
Probability	Medium
Reversibility	N/A

IMPACT TABLE		
Irreplaceable loss of resources	N/A	
Duration	As long as the PV Plant is in operation	
Cumulative effect	Development impacts	
Intensity/magnitude	High	
Significance Rating	High	
	Pre-mitigation impact rating	**Post mitigation impact rating**
Extent	3	4
Probability	2	2
Reversibility	0	0
Irreplaceable loss	0	0
Duration	3	3
Cumulative effect	1	3
Intensity/magnitude	3	4
Significance rating	27 (low positive)	48 (medium positive)
Mitigation measures	▪ Using the most effective community structures for the trust fund, inclusion of existing structures, transparent rules in allocating funds, prioritisation according to community needs and building on existing regional synergies.	

Table 50: Rating of impacts related to agricultural output

IMPACT TABLE	
Environmental Parameter	Agricultural output
Issue/Impact/Environmental Effect/Nature	Displacing existing agricultural production
Extent	Potential maximum loss of R63 000 in output and no jobs lost per annum
Probability	Low
Reversibility	High

IMPACT TABLE		
Irreplaceable loss of resources	Low	
Duration	As long as the PV Plant is in operation	
Cumulative effect	Low	
Intensity/magnitude	Low	
Significance Rating	Low	
	Pre-mitigation impact rating	**Post mitigation impact rating**
Extent	1	1
Probability	2	2
Reversibility	3	3
Irreplaceable loss	1	1
Duration	3	3
Cumulative effect	1	1
Intensity/magnitude	1	1
Significance rating	-11 (low negative)	-11 (low negative)
Mitigation measures	▪ None	

Table 51: Rating of impacts related to tourism

IMPACT TABLE	
Environmental Parameter	Local tourism to the area
Issue/Impact/Environmental Effect/Nature	Diverting/Attracting tourism from or to area
Extent	None (the effect could be positive instead of negative)
Probability	Low
Reversibility	High
Irreplaceable loss of resources	Low

IMPACT TABLE		
Duration	As long as the PV Plant is in operation	
Cumulative effect	Low	
Intensity/magnitude	Low	
Significance Rating	Low	
	Pre-mitigation impact rating	**Post mitigation impact rating**
Extent	1	1
Probability	1	1
Reversibility	2	2
Irreplaceable loss	1	1
Duration	3	3
Cumulative effect	1	1
Intensity/magnitude	1	1
Significance rating	-10 (low negative)	-10 (low negative)
Mitigation measures	▪ None	

Table 52: Rating of impacts related to property prices

IMPACT TABLE	
Environmental Parameter	Property prices
Issue/Impact/Environmental Effect/Nature	Change in property prices adjacent to the new development (positive or negative)
Extent	Unknown.
Probability	Low
Reversibility	High
Irreplaceable loss of resources	Low
Duration	As long as the PV Plant is in operation

IMPACT TABLE		
Cumulative effect	Low	
Intensity/magnitude	Low	
Significance Rating	Low	
	Pre-mitigation impact rating	**Post mitigation impact rating**
Extent	1	1
Probability	1	1
Reversibility	2	2
Irreplaceable loss	1	1
Duration	3	3
Cumulative effect	1	1
Intensity/magnitude	1	1
Significance rating	-10 (low negative)	-10 (low negative)
Mitigation measures	▪ None	

Table 53: Rating of impacts related to sense of place

IMPACT TABLE	
Environmental Parameter	Much of what is valuable in a culture is embedded in place, which cannot be measured in monetary terms.
Issue/Impact/Environmental Effect/Nature	The presence of PV plant and associated infrastructure such as the substation and the transmission power lines would change the landscape of the area from open spaces to 'spoilt' which could affect the way in which people related to the land and the sense of connectedness they have with the area, in short, their sense of place.
Extent	The impact on sense of place should be considered in the context of the study area as a whole, as the impact on sense of place per farm portion will depend on a number of variables, such as the visual impact, the biodiversity impact, the placement of turbines in relation to dwellings, the activities on the land, the attachment of the landowner to the land, etc.
Probability	Most of the study area is currently 'unspoiled' with vast open

IMPACT TABLE		
	spaces; the negative impact on sense of place is highly probable.	
Reversibility	The impact on sense of place can be reversed after decommissioning, provided that rehabilitation is done to a satisfactory level.	
Irreplaceable loss of resources	It is not foreseen that an impact on sense of place would lead to any loss of resources.	
Duration	The impact will be experienced during the lifetime of the project, but it can be expected that the PV Plant will eventually become part of the landscape and absorbed as part of the cultural landscape.	
Cumulative effect	The presence of such infrastructure can also set an unintended precedent for further land use change in future, which could further alter people's sense of place.	
Intensity/magnitude	The impact on sense of place will be different for different people and will also depend on the way the land is utilised.	
Significance Rating	Negative Low	
	Pre-mitigation impact rating	**Post mitigation impact rating**
Extent	2	1
Probability	2	1
Reversibility	3	2
Irreplaceable loss	2	2
Duration	3	3
Cumulative effect	2	1
Intensity/magnitude	2	2
Significance rating	-24 (low negative)	-20 (low negative)
Mitigation measures	▪ Implement mitigation measures detailed in the Visual Impact Assessment ▪ The impact on livelihoods should be monitored and evaluated before and after the construction of the PV Plant.	

9.2.13 Decommissioning – Biodiversity

Table 54: 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 positive 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 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

IMPACT TABLE FORMAT		
Intensity/magnitude	1	1
Significance rating	+8 (low positive)	+6(low positive)
Mitigation measures	▪ Maintain footprint strictly during decommissioning ▪ All infrastructure must be removed from the site. ▪ A rehabilitation plan must be compiled by a qualified ecologist. ▪ Re-vegetation of affected areas must be made a priority to avoid erosion. ▪ Suitable stormwater / wind controls must be put in place until rehabilitation is complete ▪ Constant removal of alien invasive species in and around plant.	

Table 55: 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 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.

IMPACT TABLE FORMAT		
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 present).	

9.2.14 Decommissioning – Surface Water

Impacts associated with the decommissioning phase relate to those of the construction phase.

9.2.15 Decommissioning – Agricultural Potential and Soils

Impacts associated with the decommissioning phase relate to those of the construction phase.

9.2.16 Decommissioning – Visual

Impacts associated with the decommissioning phase relate to those of the construction phase.

9.2.17 Decommissioning – Heritage

Impacts associated with the decommissioning phase relate to those of the construction phase.

9.2.18 Decommissioning – Socio-economic

Impacts associated with the decommissioning phase relate to those of the construction phase.

10 CUMULATIVE IMPACTS AND MITIGATION MEASURES

10.1 Cumulative Impacts

Table 56: Cumulative impacts resulting from the proposed development

Environmental Parameter	Cumulative Impact
Biodiversity	**Construction** ▪ The movement of construction teams into the area (for all the projects in the area) could result in additional dust generation which could affect the vegetation and grazing potential in the area. Strict road maintenance is required. The Mainstream team must ensure that the construction footprint is strictly maintained to the absolute necessary to ensure that only the minimum area is utilised. This will minimise potentially cumulative impacts. **Operation** ▪ Ecological movement through the proposed development is critical to ensure movement of species. Emergence of alien species due to the influx of infrastructure is a risk that must be strictly managed through the EMPr. ▪ Bird mortalities as a result of the development could have cumulative threats on vulnerable bird species, however the significance is impossible to predict at this stage. **Decommissioning** ▪ Decommissioning of the plant will result in the elimination of the cumulative impacts mentioned above.
Surface Water	▪ As the impacts on the surface water features would be of low intensity, and as surface water features are likely to be mostly avoided by the proposed development, no cumulative impacts are anticipated.
Agricultural Potential and Soils	▪ The cumulative impact will negligible. A slight increase in pressure on adjacent grazing may occur.
Visual	▪ The proposed development is not the only renewable energy development proposed for the study area. If the proposed development along with other wind and solar facilities are

	approved and developed, the cumulative visual impact on certain of these receptor locations may be exacerbated. This may have the overall effect of changing the visual character of the area, making it an industrial energy node, with an altered visual baseline from what currently exists.
Geotechnical	▪ No cumulative impacts areanticipated..
Heritage	▪ The cumulative effects on heritage resources could be high if stone-age, farmsteads or cemetery sites are physically disturbed or damaged.
Socio-economic	▪ The perception or expectation (even it if is unrealistic on the part of locals) that the project will offer employment often results in locals informing family and friends from elsewhere that there are jobs available in the area, which in turn then leads to the in-migration of jobseekers. This can make it difficult to distinguish between a permanent resident and an opportunistic jobseeker, which in turn can complicate a fair job allocation system should unskilled labour be required – even more so where there is very little demand, but an oversupply of labour. ▪ If a simultaneous in-migration of unemployed jobseekers occurs, this can intensify the temporary increase in need for housing. Some of the jobseekers might find shelter with friends or family while others are left destitute. This can then lead to the creation and/or expansion of informal settlements, which in turn can place additional strain on already limited resources (municipal services, available land, job opportunities, etc.). The expansion of informal settlement puts the local municipality under pressure as it increases the housing backlog with more and more people requiring formal housing and municipal services on par with RDP standards. ▪ If a HIV/AIDS prevention plan is implemented effectively within the local communities on a level that they understand, and if the necessary resources are easily available and accessible to the community (e.g. condoms, information posters, VCT centres, support groups) for the duration of the construction phase, this would leave an informed and empowered community behind who would be able to continue to prevent HIV infections by informing and empowering others. ▪ The presence of the PV Plant and associated infrastructure (substation and transmission line) can set an unintended

	precedent for further land use change. For example: If additional transmission lines are required in future it is oftentimes preferred to place such lines next to existing lines as the area is already regarded as disturbed. ▪ The cumulative impact of corporate social investments through Mainstream's proposed trust can be high. Economic empowerment (through funds and land), improved healthcare, business growth, skills development, and higher education are massive for the local people. These would increase earning potentials, improve livelihoods, increase life-spans, benefit quality of life variables, hasten local people out of poverty (where applicable), and assist future generations and relatives of those who benefit directly.

10.2 Mitigation Measures

10.2.1 Biodiversity

- Pre-construction site specific mitigation measures

The following mitigation measures are recommended for the study area:

  - A full seasonal, pre-construction bird monitoring programme should be reinstated on the site. This monitoring would be critical to acquire a better understanding of the trends relating to the occurrence on the site of the priority species.
  - The proponent should consider moving the PV infrastructure to parts of the site that are less sensitive. This recommendation is subject to the findings of the pre-construction bird monitoring.

- 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.
  - Demarcation of sensitive areas prior to construction activities starting.
  - Use of appropriate construction methods in the sensitive area.

- Intensive environmental audits (frequently in sensitive areas) by an independent party during this construction period.
- A copy of the Environmental Impact Report and associated Environmental Management Programme as well as the specialist study must be present at the construction site for easy reference to specialist recommendations in sensitive areas.
- It is recommended that the construction crew be educated about the sensitivities involved in these areas as well as the potential species they could encounter. 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.
- 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.

- 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.

- Decommissioning Mitigation and Management measures

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

10.2.2 Surface Water

The following mitigation measures are recommended for the study area:

- Mitigation measures related to roads

The following mitigation measures are recommended for the study area:

  - Where at all possible, access roads should avoid crossing drainage lines.
  - Existing access roads and tracks across wetlands must be used as far as possible, as these are typically associated with an existing impact on a wetland / stream. It is preferable for existing drifts / causeways to be upgraded rather than new road structures built into an un-impacted section of the surface water feature.
  - Where surface water features cannot be spanned by bridges, road design must incorporate a sufficient number and volume of culverts to allow flow that may occur within the feature to bypass the road in as natural a manner as possible.
  - Measures to minimise stormwater ingress into surface water features off roads should be included in the design of the road. Stormwater from a road in the catchment of the feature should be directed into a deposition / swale area where it can infiltrate the ground and flow slowly into the feature, and not directly into it.
  - Road design should take into account the potential for flooding and spate flows in wetlands, especially within valley bottom wetlands and along riverine corridors. Due to the nature of runoff in the study area, high flow peaks are likely to occur in the larger valley bottom drainage features due to the intermittent nature of rainfall and the development of soil crusting in many parts of the site. It is recommended that design be undertaken to withstand a 1:100 year flood.

- Mitigation measures related to underground cabling

The following mitigation measures are recommended for the study area:

- A simple mitigation measure would be to avoid the underground cables from being aligned across drainage lines. Alignment of the cabling should be routed to avoid crossing drainage lines as far as possible.
- In the event of a trench having to be excavated through a wetland, the following measures should apply:
    i. Care must be taken to avoid siltation in the wetland, and silt protection measures must be put in place downstream of the works.
    ii. If necessary re-vegetation should occur.
    iii. After construction the area should be monitored for the presence of any developing erosion.

10.2.3 Agricultural Potential and Soils

- Construction phase mitigation measures

The following mitigation measures are recommended for the study area:

- Clearing activities should be kept to a minimum (road and PV site footprint).
- In the unlikely event that heavy rains are expected activities should be put on hold to reduce the risk of erosion.
- If additional earthworks are required, any steep or large embankments that are expected to be exposed during the 'rainy' months should either be armoured with fascine like structures.
- If earth works are required then storm water control and wind screening should be undertaken to prevent soil loss from the site

- Operation phase mitigation measures

The following mitigation measures are recommended for the study area:

- It is recommended that to the option of allowing seasonal grazing within the PV Fields be considered further by Mainstream in consultation with the landowner to further mitigate the loss of grazing land.

- Decommissioning phase mitigation measures

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

10.2.4 Visual

The following mitigation measures are recommended for the study area:

- No recommendations provided.

10.2.5 Geotechnical

The following mitigation measures are recommended for the study area:

- PV Foundations

A detailed geotechnical investigation will be required when the PV layout is confirmed and it should include:

- Further trial pits concentrated at the selected plant location
- Dynamic probes at selected locations to assess if any areas are suited to pile driving/ramming

- Substation Foundations

When the substation site is selected, a detailed geotechnical investigation will be required and it should include:

- At least two (2) trial pits
- Thermal and electrical resistivity tests

- MV Cables:

When the plant layout is finalised, a detailed geotechnical investigation will be required and should include:

- Trial pits along anticipated cable routes
- Thermal resistivity tests

10.2.6 Heritage

Archaeological, historical and any other site or land considered of cultural value within the project boundary should be protected against vandalism, destruction and theft. Should these be

discovered during any of the project activities, they should be preserved and appropriately management in accordance with the NHRA.

The following mitigation measures are recommended for the study area:

- A person or entity, e.g. the Environmental Control Officer, should be tasked to take responsibility for the heritage sites and should be held accountable for any damage.
- Known sites should be located and isolated, e.g. by fencing them off. All construction workers should be informed that these are no-go areas, unless accompanied by the individual or persons representing the Environmental Control Officer as identified above.
- The contractors and workers should be notified that archaeological sites might be exposed during the construction activities.
- Should any heritage artefacts be exposed during excavation, work on the area where the artefacts were discovered, shall cease immediately and the Environmental Control Officer shall be notified as soon as possible.
- All discoveries shall be reported immediately to a heritage practitioner so that an investigation and evaluation of the finds can be made. Acting upon advice from these specialists, the Environmental Control Officer will advise the necessary actions to be taken;.
- Under no circumstances shall any artefacts be removed, destroyed or interfered with by anyone on the site.
- Contractors and workers shall be advised of the penalties associated with the unlawful removal of cultural, historical, archaeological or palaeontological artefacts, as set out in the National Heritage Resources Act (Act No. 25 of 1999), Section 51 (1).
- In areas where the vegetation is threatening the heritage sites, e.g. growing trees pushing walls over, it should be removed, but only after permission for the methods proposed has been granted by SAHRA. A heritage official should be part of the team executing these measures.

10.2.7 Socio-economic

- Construction phase mitigation measures

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.

Employment and Output Creation

- Ensure that the unskilled local jobs created are linked to a skills development programme for permanent employment

Social Mobilisation

- Problem areas that are brought under the attention of the contractor should be rectified immediately. If the contractor is unable to so, this should be communicated to the landowner along with a plan on how and when the problem will be addressed. The landowner should be given regular feedback on the matter.
- All mitigation measures contained in the EMPr should be implemented and monitored by an ECO. Remedial action should be taken where the contractor fails to comply with the EMPr.

Health and Safety

- Mainstream or its contractor should appoint a service provider or local NGO to develop, implement and manage an HIV/AIDS prevention programme. The service provider or NGO should specialise in the field of HIV/AIDS.
- The HIV/AIDS prevention programme should extend to the local community and should pay special attention to vulnerable groups such as women and youth.

- Operation phase mitigation measures

The following mitigation measures are recommended for the study area:

Employment and Output Creation

- Linking new and existing local businesses to the supply chain of the PV Plant.

Corporate Social Investment

- Using the most effective community structures for the trust fund, inclusion of existing structures, transparent rules in allocating funds, prioritisation according to community needs and building on existing regional synergies.

Sense of Place

- Implement mitigation measures detailed in the Visual Impact Assessment
- The impact on livelihoods should be monitored and evaluated before and after the construction of the PV Plant.

- Decommissioning phase mitigation measures

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

11 DESCRIPTION AND COMPARATIVE ASSESSMENT OF ALL ALTERNATIVES IDENTIFIED

There are several alternatives for the proposed development. The site in question will be utilised on a lease basis which will benefit the landowner for the duration of the project.

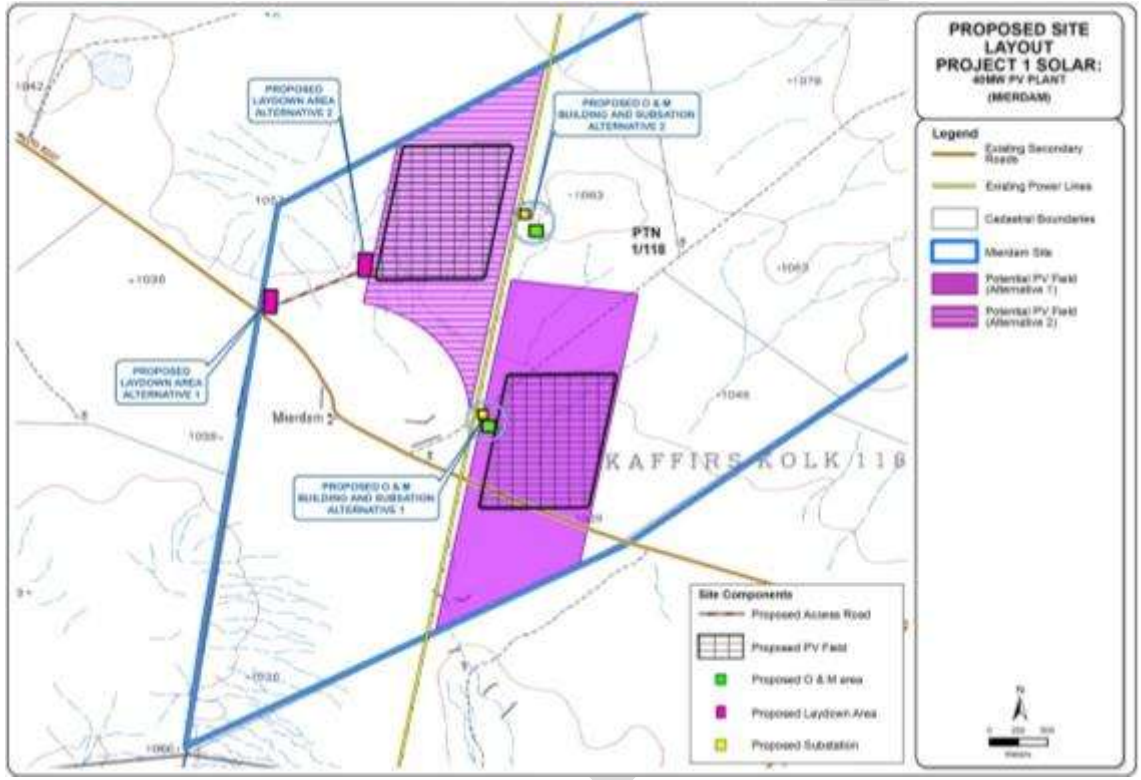

Figure 38: Site Layout Alternatives

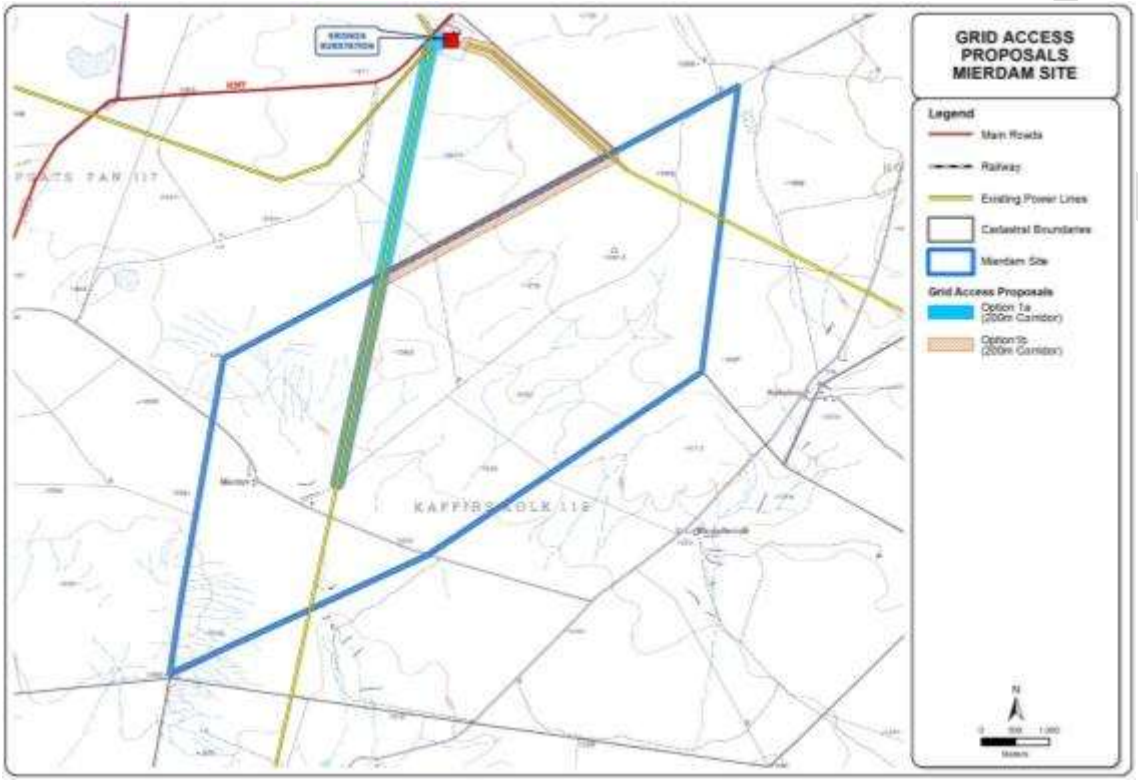

Figure 39: Grid Access Alternatives

Table 57 highlights the issues and preferences associated with each alternative thereby identifying the preferred alternative.

Key

ELIMINATED	
PREFERRED	

Table 57: Alternatives Assessment for the proposed 40MW PV plant on Mierdam Farm

Alternative	Environmental Aspect	Preference / Concerns	Fatal Flaws
PV Field Alternative 1	**Biodiversity**	Preferred - located in areas that are transformed by farming activities (Incl. prickly pear planting).	No Fatal Flaws
	Surface Water	Preferred – fewer surface water features will be affected.	No Fatal Flaws
	Agricultural Potential and Soils	Favourable – the sitehas an extremely low potential for crop production andthere are no centre pivots, irrigation schemes or active agricultural fields, therefore the entire site is considered suitable for the proposed development and there are no preferences.	No Fatal Flaws
	Visual	Favourable – no PV array alternatives are associated with visual impacts from any receptor locations, therefore no preferences.	No Fatal Flaws
	Heritage	Favourable – no major concerns. The closest archaeological site is located more than 500m south-east of the PV field.	No Fatal Flaws
	Socio-economic	No site specific preferences.	No Fatal Flaws
PV Field Alternative 2	**Biodiversity**	Not preferred – located on more intact veld and away from road infrastructure.	No Fatal Flaws
	Surface Water	Not preferred – there is a greater density of ephemeral drainage lines on the site.	No Fatal Flaws
	Agricultural Potential and Soils	Favourable – the sitehas an extremely low potential for crop production andthere are no centre pivots, irrigation schemes or active agricultural fields,	No Fatal Flaws

Alternative	Environmental Aspect	Preference / Concerns	Fatal Flaws
		therefore the entire site is considered suitable for the proposed development and there are no preferences.	
	Visual	Favourable – no PV array alternatives are associated with visual impacts from any receptor locations, therefore no preferences.	No Fatal Flaws
	Heritage	Preferred – no major concerns or heritage sites in close proximity, but no major preference.	No Fatal Flaws
	Socio-economic	No site specific preferences.	No Fatal Flaws
Substation Alternative 1	**Biodiversity**	Preferred– adjacent to power line and close to road infrastructure.	No Fatal Flaws
	Surface Water	Preferred – not close to any surface water features.	No Fatal Flaws
	Agricultural Potential and Soils	Favourable – the sitehas an extremely low potential for crop production andthere are no centre pivots, irrigation schemes or active agricultural fields, therefore the entire site is considered suitable for the proposed development and there are no preferences.	No Fatal Flaws
	Visual	Not Preferred – located closer to the farmstead on the farm, however it is not considered sensitive, therefore no major preference.	No Fatal Flaws
	Heritage	Favourable – no major concerns or preferences.	No Fatal Flaws
	Socio-economic	No site specific preferences.	No Fatal Flaws
Substation Alternative 2	**Biodiversity**	Not preferred – intact veld, away from existing infrastructure.	No Fatal Flaws
	Surface Water	Not preferred – it will physically affect an ephemeral drainage line.	No Fatal Flaws

Alternative	Environmental Aspect	Preference / Concerns	Fatal Flaws
	Agricultural Potential and Soils	Favourable – the site has an extremely low potential for crop production and there are no centre pivots, irrigation schemes or active agricultural fields, therefore the entire site is considered suitable for the proposed development and there are no preferences.	No Fatal Flaws
	Visual	Preferred – located further away from the farmstead on the farm, however it is not considered sensitive, therefore no major preference.	No Fatal Flaws
	Heritage	Favourable – no major concerns or preferences.	No Fatal Flaws
	Socio-economic	No site specific preferences.	No Fatal Flaws
Operation and Maintenance Building Alternative 1	**Biodiversity**	Preferred– adjacent to power line and close to road infrastructure.	No Fatal Flaws
	Surface Water	Preferred – it will not be close to any surface water features.	No Fatal Flaws
	Agricultural Potential and Soils	Favourable – the sitehas an extremely low potential for crop production andthere are no centre pivots, irrigation schemes or active agricultural fields, therefore the entire site is considered suitable for the proposed development and there are no preferences.	No Fatal Flaws
	Visual	Not Preferred – located closer to the farmstead on the farm, however it is not considered sensitive, therefore no major preference.	No Fatal Flaws
	Heritage	Favourable – no major concerns or preferences.	No Fatal Flaws
	Socio-economic	No site specific preferences.	No Fatal Flaws
Operation and Maintenance Building Alternative 2	**Biodiversity**	Not preferred - intact veld, away from existing infrastructure.	No Fatal Flaws
	Surface Water	Not preferred – it will physically affect an ephemeral drainage line.	No Fatal Flaws

Alternative	Environmental Aspect	Preference / Concerns	Fatal Flaws
	Agricultural Potential and Soils	Favourable – the sitehas an extremely low potential for crop production andthere are no centre pivots, irrigation schemes or active agricultural fields, therefore the entire site is considered suitable for the proposed development and there are no preferences.	No Fatal Flaws
	Visual	Preferred – located further away from the farmstead on the farm, however it is not considered sensitive, therefore no major preference.	No Fatal Flaws
	Heritage	Favourable – no major concerns or preferences.	No Fatal Flaws
	Socio-economic	No site specific preferences.	No Fatal Flaws
Laydown Area Alternative 1	**Biodiversity**	Preferred– located adjacent to existing road.	No Fatal Flaws
	Surface Water	Preferred – it will not be close to any surface water features.	No Fatal Flaws
	Agricultural Potential and Soils	Favourable – the sitehas an extremely low potential for crop production andthere are no centre pivots, irrigation schemes or active agricultural fields, therefore the entire site is considered suitable for the proposed development and there are no preferences.	No Fatal Flaws
	Visual	Not preferred – located slightly closer to Klippan Farmstead (sensitive receptor), however no major preference as the two alternatives are only 500m apart.	No Fatal Flaws
	Heritage	Favourable – no major concerns or preferences.	No Fatal Flaws
	Socio-economic	No site specific preferences.	No Fatal Flaws
Laydown Area Alternative 2	**Biodiversity**	Not preferred – within the grazing camp and far from existing infrastructure such as roads.	No Fatal Flaws

Alternative	Environmental Aspect	Preference / Concerns	Fatal Flaws
	Surface Water	Not preferred – it will physically affect an ephemeral drainage line.	No Fatal Flaws
	Agricultural Potential and Soils	Favourable – the sitehas an extremely low potential for crop production andthere are no centre pivots, irrigation schemes or active agricultural fields, therefore the entire site is considered suitable for the proposed development and there are no preferences.	No Fatal Flaws
	Visual	Preferred – located slightly further away from Klippan Farmstead (sensitive receptor), however no major preference as the two alternatives are only 500m apart.	No Fatal Flaws
	Heritage	Favourable – no major concerns or preferences.	No Fatal Flaws
	Socio-economic	No site specific preferences.	No Fatal Flaws
Power Line Alternative 1 Option 1a	**Biodiversity**	Preferred – The line follows existing infrastructure.	No Fatal Flaws
	Surface Water	Favourable – neither alignment traverses any major surface water resource, therefore no preference.	No Fatal Flaws
	Agricultural Potential and Soils	Favourable – the sitehas an extremely low potential for crop production andthere are no centre pivots, irrigation schemes or active agricultural fields, therefore the entire site is considered suitable for the proposed development and there are no preferences.	No Fatal Flaws
	Visual	Favourable – aligned parallel to an existing power line.	No Fatal Flaws
	Heritage	Favourable – no major concerns or heritage features in close proximity.	No Fatal Flaws
	Socio-economic	No site specific preferences.	No Fatal Flaws
Power Line	**Biodiversity**	Not preferred – the line traverses greenfield land.	No Fatal Flaws

Alternative	Environmental Aspect	Preference / Concerns	Fatal Flaws
Alternative 2 Option 1b	**Surface Water**	Favourable – neither alignment traverses any major surface water resource, therefore no preference.	No Fatal Flaws
	Agricultural Potential and Soils	Favourable – the sitehas an extremely low potential for crop production andthere are no centre pivots, irrigation schemes or active agricultural fields, therefore the entire site is considered suitable for the proposed development and there are no preferences.	No Fatal Flaws
	Visual	Preferred – aligned parallel to an existing larger 400kV power line.	No Fatal Flaws
	Heritage	Favourable – no major concerns or heritage features in close proximity.	No Fatal Flaws
	Socio-economic	No site specific preferences.	No Fatal Flaws

As depicted in the table above, certain alternatives have been eliminated as they are considered to be less preferable from an environmental perspective, based on the specialist findings. It should however be noted that although a preferred alternative has been selected for each component, no fatal flaws were identified for any of the alternatives and therefore they are all considered to be feasible alternatives that are environmentally acceptable.

As previously mentioned, the option of constructing a new 132kV power line has been assessed as an alternative to connecting directly into the existing line which traverses the site. From an environmental perspective, connecting directly into the existing power lines is preferable, as it would not result in any additional impacts, however both options are considered to be feasible and environmentally acceptable, as the new lines are routed to follower the existing power lines. From an avifaunal perspective, developing the new power parallel to the existing line is even considered to be a positive factor, as clusters of lines make the lines more visible to birds flying in the vicinity.

11.1 No Go Alternative

The No-Go Alternative is the option of not establishing the PV Plant near Prieska. 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 Prieska in the form of short term employment and long term job creation and financial injection.

The No-Go alternative has thus been eliminated due to the fact that the identified environmental impacts can be suitably mitigated and that by not building the project, the socio-economic benefits would be lost.

12 ENVIRONMENTAL MONITORING AND AUDITING

The Environmental Management Programme (EMPr) becomes a tool by which compliance on the proposed site can be measured against. In order to utilise this tool, environmental monitoring needs to take place with regular audits against the EMPr to ensure that all aspects are attended to.

Environmental monitoring establishes benchmarks to judge the natural and magnitude of potential environmental and social impacts.

Some of the key parameters for monitoring and auditing of the proposed project include the following inter alia:

- Soil erosion and siltation.
- Oil spillages
- Dust and gaseous emissions.
- Water quality
- Noise and vibration
- Change in biodiversity
- Socio-economic change
- Land use changes.

The overall objective of environmental and social monitoring is to ensure that mitigation measures are implemented and that they are effective. Environmental and social monitoring will also enable responses to new and developing issues of concern. The activities and indicators that have been recommended for monitoring are presented in the EMPr.

Environmental monitoring will be carried out to ensure that all construction activities comply and adhere to environmental provisions and standard specifications, so that all mitigation measures are implemented. The contractor shall employ an officer responsible for implementation of social/environmental requirements. This person will maintain regular contact with the local / district Environmental Officers. The contractor and proponent will have a responsibility to ensure that the proposed mitigation measures are properly implemented during the construction phase.

The environmental monitoring program will operate through the preconstruction, construction, and operation phases. It will consist of a number of activities, each with a specific purpose with key

indicators and criteria for significance assessment. The following aspects will be subject to monitoring:

- Encroachment into sensitive areas
- Maintenance of project footprint
- Vegetation maintenance around project work sites, workshops and camps
- Health & Safety

Monitoring should be undertaken at a number of levels. Firstly, it should be undertaken by the Contractor at work sites during construction, under the direction and guidance of the Supervision Consultant who is responsible for reporting the monitoring to the implementing agencies. It is not the Contractor's responsibility to monitor land acquisition and compensation issues. It is recommended that the Contractor employ local full time qualified environmental inspectors for the duration of the Contract. The Supervision Consultant should include the services of an international environmental and monitoring specialist on a part time basis as part of their team.

Environmental monitoring is also an essential component of project implementation. It facilitates and ensures the follow-up of the implementation of the proposed mitigation measure, as they are required. It helps to anticipate possible environmental hazards and/or detect unpredicted impacts over time.

Periodic ongoing monitoring will be required during the life of the Project and the level can be determined once the Project is operational.

The EMPr is included in Appendix 9.

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 58 below indicates that all applicable performance standards have been complied with.

The performance standards which have not been addressed at this stage as indicated inTable 58below 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

Appendix 10 includes a handbook highlighting how the client plans to comply with the IFC Standards.

Table 58: Compliance with Equator Principles

PRINCIPLES	COMPLIANCE LEVEL	REFERENCE
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 Chapter 8.8
6. Third party		Refer to Chapter 8.8
7. Mitigation measures		Refer to Chapter 10.2 and the EMPr - Appendix 9
8. Documentation of 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 10
11. Training		Refer to Appendix 10
12. Grievance mechanism	The proponent will 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 10
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 10
2. Working relationship		Refer to Appendix 10
3. Working conditions with and terms of employment		Refer to Appendix 10
4. Workers organization		Refer to Appendix 10
5. Non discrimination and equal opportunities		Refer to Appendix 10
7. Occupational Health and Safety		Refer to Appendix 10
8. Non-employee workers		Refer to Appendix 10
9. Supply Chain		Refer to Appendix 10
10. Labor Assessment Component of a Social and Environmental Assessment		Refer to Appendix 10

Performance Standard 3, Pollution		
1. Pollution Prevention, Resource Conservation & Energy Efficiency		Refer the EMPr - Appendix 9
2. Wastes		Refer the EMPr - Appendix 9
3. Hazardous material		Refer the EMPr - Appendix 9
4. Emergency preparedness & response	The proponent commit to full compliance with this standard when financial closure has been reached. The proponent is fully aware of the implications of this standard and this information will be made available in due course as part of the development planning for the project.	Refer to Appendix 10
5. Technical guidance – ambient considerations		Refer to Appendix 10
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 - Appendix 9
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 6.5 and 8.1**
Performance Standard 7, Indigenous People		**Refer to Chapter 8.8**
Performance Standard 8, Cultural Heritage		**Refer to Chapter 8.7**

14 EVALUATION AND RECOMMENDATIONS

Table 59 summarises the key recommendations for the environmental issues identified in the EIR. In order to achieve appropriate environmental management standards and ensure that the findings of the environmental studies are implemented through practical measures, the recommendations from this EIA must be included within an Environmental Management Programme (EMPr). This EMPr should form part of the contract with the contractors appointed to construct and maintain the proposed. The EMPr would be used to ensure compliance with environmental specifications and management measures. The implementation of this EMPr for all life cycle phases (i.e. construction, operation and de-commissioning) of the proposed project is considered to be key in achieving the appropriate environmental management standards as detailed for this project.

An Environmental Management Programme is included with this Environmental Impact Report.

It is also recommended that the process of communication and consultation with the community representatives is maintained after the closure of this EIA process, and, in particular, during the construction phase associated with the proposed project.

14.1 Summary of Findings

Table 59: Summary of findings and Recommendations

Environmental Parameter	Summary of major findings	Recommendations
Biodiversity	It is not likely that the proposed development will be to the detriment of the biodiversity of the region due to the pristine nature of the area. A number of particularly sensitive bird habitats and priority bird species were identified. In spite of the relatively low density and total number of species on the site in the context of the area's aridity, a number of birds that are important in a national and southern African context would occur on the site.	▪ A walk down of the more sensitive areas to avoid any trees if possible and potential rare mammal breeding sites is recommended. ▪ A formal monitoring and reporting strategy/protocol should be developed for monitoring the impact on the vegetation and biodiversity in general in the area during construction. ▪ If Red Data species are located during construction, the relevant permits must be applied for from the relevant authorities. ▪ The precautionary principle should be applied during the construction and care taken to implement the recommended mitigation measures.
Surface Water	Surface water features are not a significant part of the natural biophysical features on the site due to the very arid nature of the area, however they should be considered as sensitive features. Roads and underground cabling can also have significant impacts on surface water features and therefore the mitigation measures (provided) will need to be adhered to.	▪ The PV layouts should be altered slightly to either avoid the drainage lines completely, or to ensure that these drainage lines are not physically affected by the proposed PV arrays. ▪ No power line towers should be located within any surface water feature.
Agricultural	The site is not classified as high potential nor is it a unique	▪ Clearing activities should be kept to a minimum (road

Potential and Soils	dry land agricultural resource. Thestudy area has been classified as having an extremely low potential for crop production due to an arid climate and highly restrictive soil characteristics but are considered to have a moderately low value as grazing land, its current use. Normal grazing (the dominant agricultural activity) may be permitted within the PV fields.The proposed site is dominated by grazing land and this activity is considered of low sensitivity when assessed within the context of the proposed development. The impact of the proposed development on the study area's agricultural potential will be extremely low, with the loss of agricultural land being attributed to the creation of the service roads within the PV Fields. There are no centre pivots, irrigation schemes or active agricultural fields which will be influenced by the proposed development. Therefore, from an agricultural perspective, there are no problematic or fatal flaw areas for the site.	and PV site footprint). ▪ In the unlikely event that heavy rains are expected activities should be put on hold to reduce the risk of erosion. ▪ If additional earthworks are required, any steep or large embankments that are expected to be exposed during the 'rainy' months should either be armoured with fascine like structures. ▪ If earth works are required then storm water control and wind screening should be undertaken to prevent soil loss from the site. ▪ It is recommended that to the option of allowing seasonal grazing within the PV Fields be considered further by Mainstream in consultation with the landowner to further mitigate the loss of grazing land.
Visual	The likely visual impact of the proposed solar power plant from most of the key receptor locations has been determined to be insignificant. This is mainly due to the extensive distance between the PV layouts and the key observation locations. The thick vegetation that surrounds most receptor locations is also very effective in shielding the actual receptor location (household) from views of the proposed project in particular. Farmsteads located within, or	▪ None

	on the boundaries of the development site would potentially be subject to a greater degree of visual impact. However due to these farmsteads belonging to, and being inhabited by the owners of the properties on which the development is proposed, these locations are not thought to be sensitive, as they will benefit from the project financially	
Geotechnical	The site is underlain by a variety of bedrock parent materials including quartzite, sandstone and Tillite (consisting of consolidated masses of unweathered blocks and unsorted glacial till). The general succession of soil / rock at the site from a geotechnical engineering perspective is: ▪ Topsoil – generally loose sand/silt ▪ Bedrock – Weakly cemented Calcite / Sandstone / Siltstone becoming harder with depth	▪ Detailed geotechnical investigation will be required once the PV layout is confirmed, the substation site is selected and the plant layout has been finalised.
Heritage	Only three heritage sites (incl. features and objects)were identified on the proposed development site, which include two stone age sites a farmstead. All of which can be classed as having high significance on a regional level.	▪ Sensitive heritage resource areas are to be excluded as no-go areas and a sufficient buffer zones must be implemented. ▪ All suggested mitigation measures must be implemented and included in the EMPr for the proposed development.
Socio-economic	Apart from the possibility of temporary employment, overall the construction phase is characterised by negative low social impacts. In certain instances the implementation of mitigation	▪ Address all social issues identified during the EIA phase 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

	measures can bring about positive changes. One such case would be the implementation of an effective HIV/AIDS prevention programme that extends to the local communities where construction workers will spend their free time, as this can also serve to inform and empower local people to make better and more informed decisions regarding their future (sexual) behaviour. Where Mainstream has the opportunity to bring about positive change to local communities they should pursue such opportunities where possible. Majority of impacts that would occur during the construction phase would affect people's sense of wellbeing and security within their social environment. A number of changes to the socio-economic environment would lead to economic impacts, but for the most part these impacts would be restricted to individuals or individual households and would not extend to the community at large. The presence of the solar facility during the operation and maintenance phase overall will have a low positive impact, although certain elements will yield medium positive impacts whereas other elements are expected to have a more negative connotation. Most positive impacts are of an economic nature, most significantly Mainstream's corporate social investment in the area, which in turn could lead to an array of other positive social upliftment projects (outside the	when necessary. ▪ Inform neighbouring landowners beforehand of any construction activity that is going to take place in close proximity to their property.Inform them of the number of people that will be on site and on the activities they will engage in. ▪ Ensure that 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.

	scope of this study). Negative impacts are expected to be on the low side and would in all probability be over-shadowed by the more positive contributions that Mainstream will make to the area through their CSI.	

Key

LOW NEGATIVE		**LOW POSITIVE**	
MEDIUM NEGATIVE		**MEDIUM POSITIVE**	
HIGH NEGATIVE		**HIGHPOSITIVE**	

Table 60: Impact rating summary for the proposed PV plant during the construction phase

Environmental Aspect	Environmental Impacts	Impact Rating without Mitigation	Impact Rating with Mitigation
Biodiversity	Loss of habitat for red data / general species	-24 (low negative)	-6(low negative)
	Edge Effect	-28 (low negative)	-7(low negative)
	Destruction of foraging habitat for bats	-11 (low negative)	-8 (low negative)
	Loss of physical habitat for birds	-26 (low negative)	- 13 (low negative)
Surface Water	Impacts on surface water features	-12 (low negative)	-12 (low negative)
Agricultural Potential and Soil	Degradation of local soil and land use resources	-9 (low negative)	-8 (low negative)
Visual	Visual impacts	-26 (low negative)	-10 (low negative)
Heritage	Disturbance of stone age sites	-40 (medium negative)	-38 (medium negative)
	Damage to farmsteads	-36 (medium negative)	-10 (low negative)
	Damage to cemeteries	-40 (medium negative)	-10 (low negative)
Social-economic	Employment and output creation	18 (low positive)	30 (medium positive)
	Social mobilisation	-20 (low negative)	-7 (low negative)
	Health and safety	-60 (high negative)	-28 (low negative)

Table 61: Impact rating summary for the proposed PV plant during the operational phase

Environmental Aspect	Environmental Impacts	Impact Rating without Mitigation	Impact Rating with Mitigation
Biodiversity	Loss of habitat for red data / general species	-10 (low negative)	-6(low negative)
	Edge effect	-26 (low negative)	-7(low negative)
	Disturbance on birds / creation of the barrier effect	-26 (low negative)	-26 (low negative)
Surface Water	Impacts on surface water features	-12 (low negative)	-12 (low negative)
Agricultural Potential and Soil	Loss of agricultural land and / or production	-12 (low negative)	-12 (low negative)
Visual	Visual impacts	-17 (low negative)	-17 (low negative)
Heritage	Disturbance of stone age sites	-40 (medium negative)	-38 (medium negative)
	Damage to farmsteads	-36 (medium negative)	-10 (low negative)
	Damage to cemeteries	-40 (medium negative)	-10 (low negative)
Social-economic	Employment and output creation	18 (low positive)	33 (medium positive)
	Tax income	14 (low positive)	14 (low positive)
	Corporate social investment	27 (low positive)	48 (medium positive)
	Agricultural output	-11 (low negative)	-11 (low negative)
	Tourism	-10 (low negative)	-10 (low negative)
	Property prices	-10 (low negative)	-10 (low negative)
	Sense of place	-24 (low negative)	-20 (low negative)

Table 62: Impact rating summary for the proposed PV plant during the decommissioning phase

Environmental Aspect	Environmental Impacts	Impact Rating without Mitigation	Impact Rating with Mitigation
Biodiversity	Loss of habitat for red data / general species	+8 (low positive)	+6(low positive)
	Edge effect	+10 (low positive)	+7(low positive)

14.2 Preferred Alternative Selection

A sensitivity map was compiled for the proposed study area, based on the alternatives assessment and the negative mapping exercise that was undertaken by all the specialists. This is indicated in Figure 40 below.

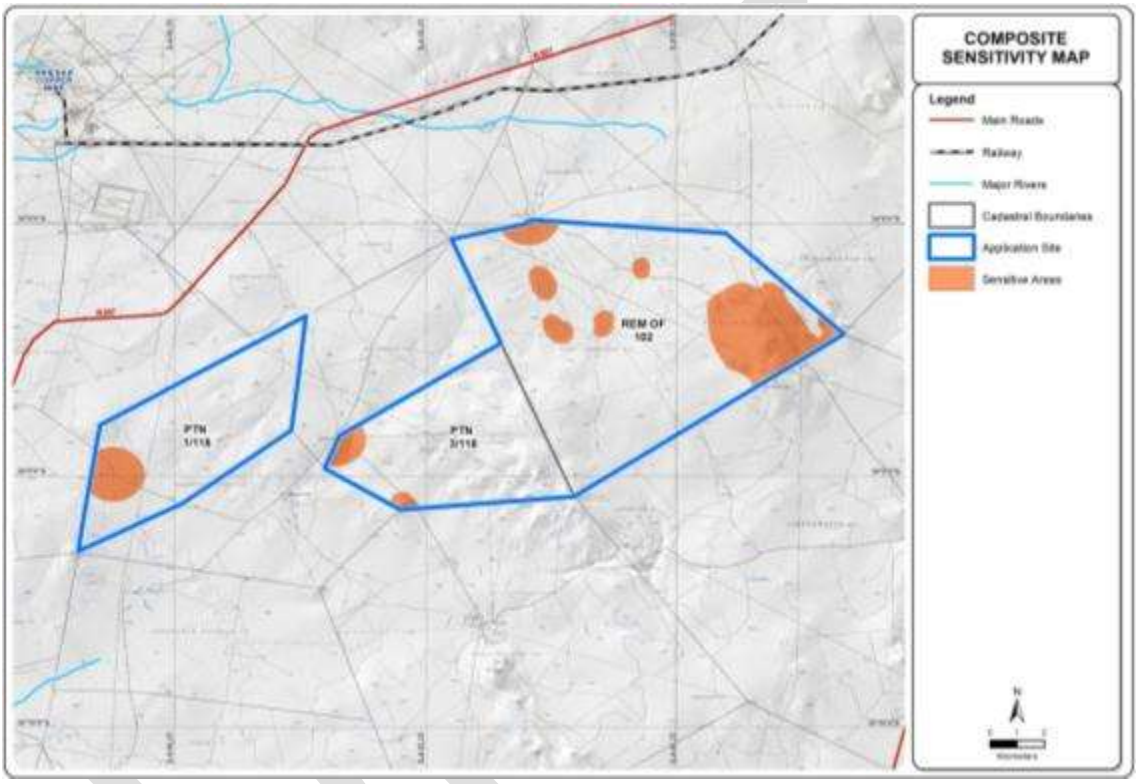

Figure 40: Composite Sensitivity Map

Based on this sensitivity mapping the following preferred layout and grid access was decided upon.

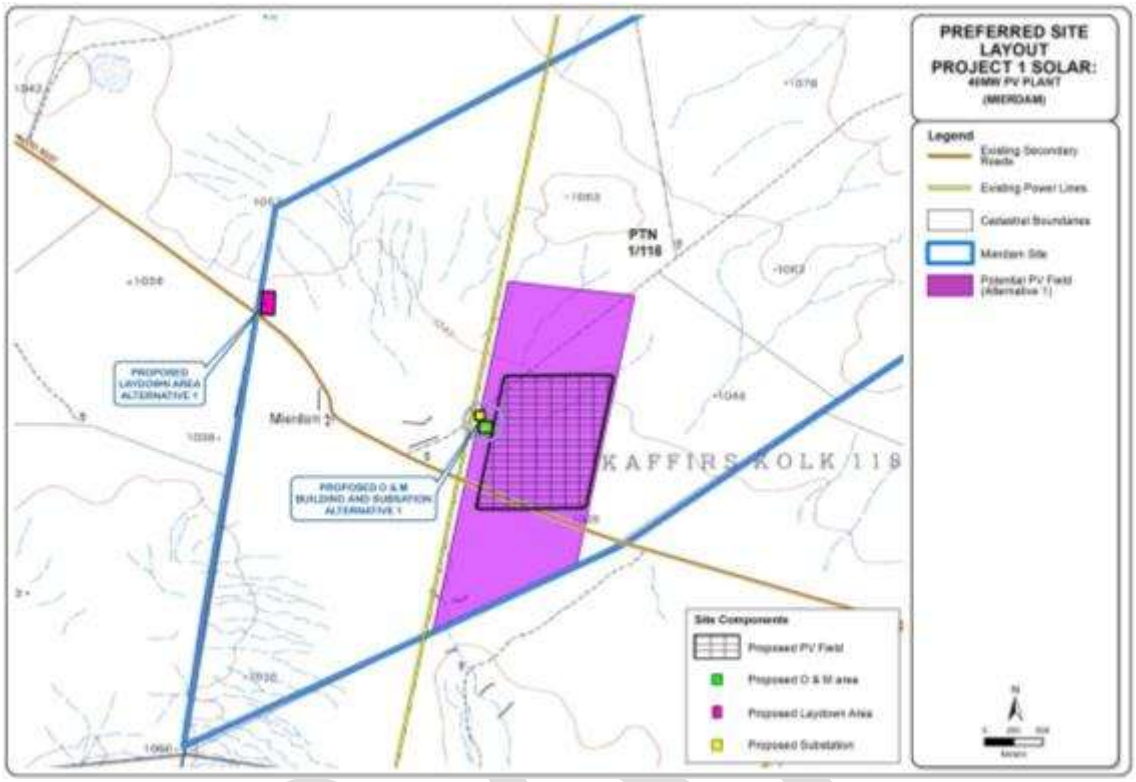

Figure 41: Preferred Site Layout

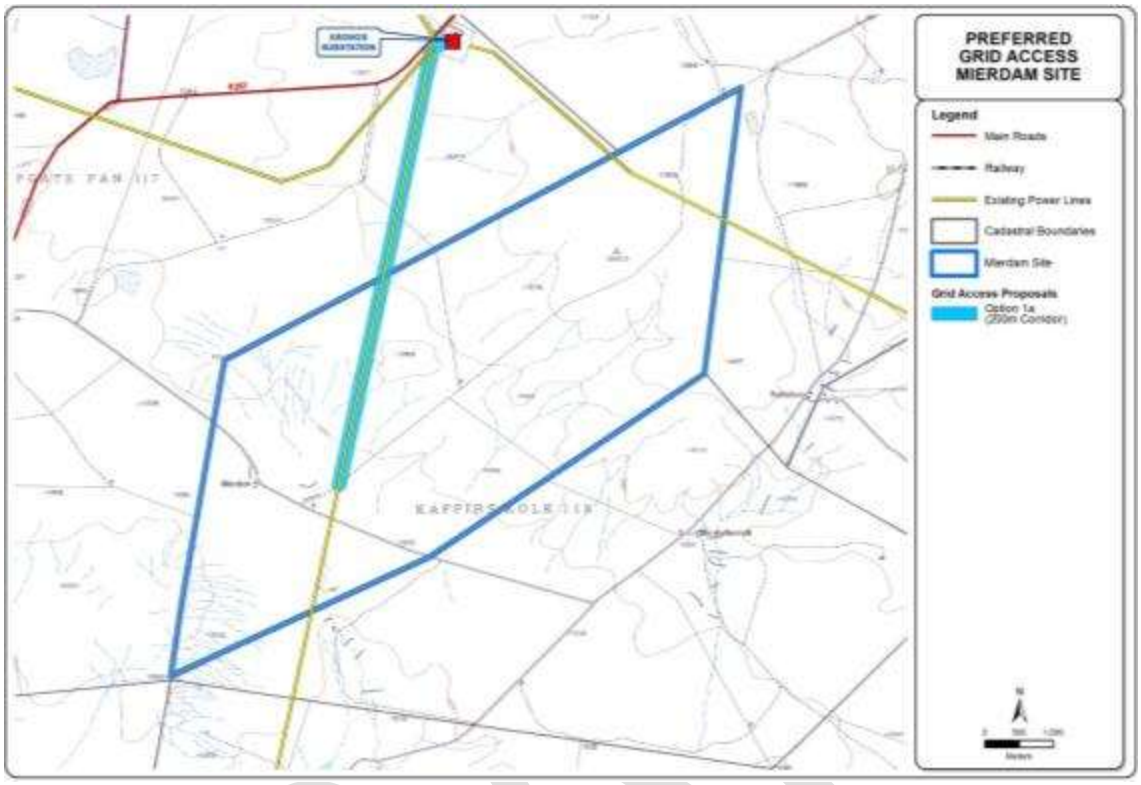

Figure 42: Preferred Grid Access

Below is a map of the sensitivity mapping overlayed with the layout indicating how the layout has been dictated by the sensitivity mapping.

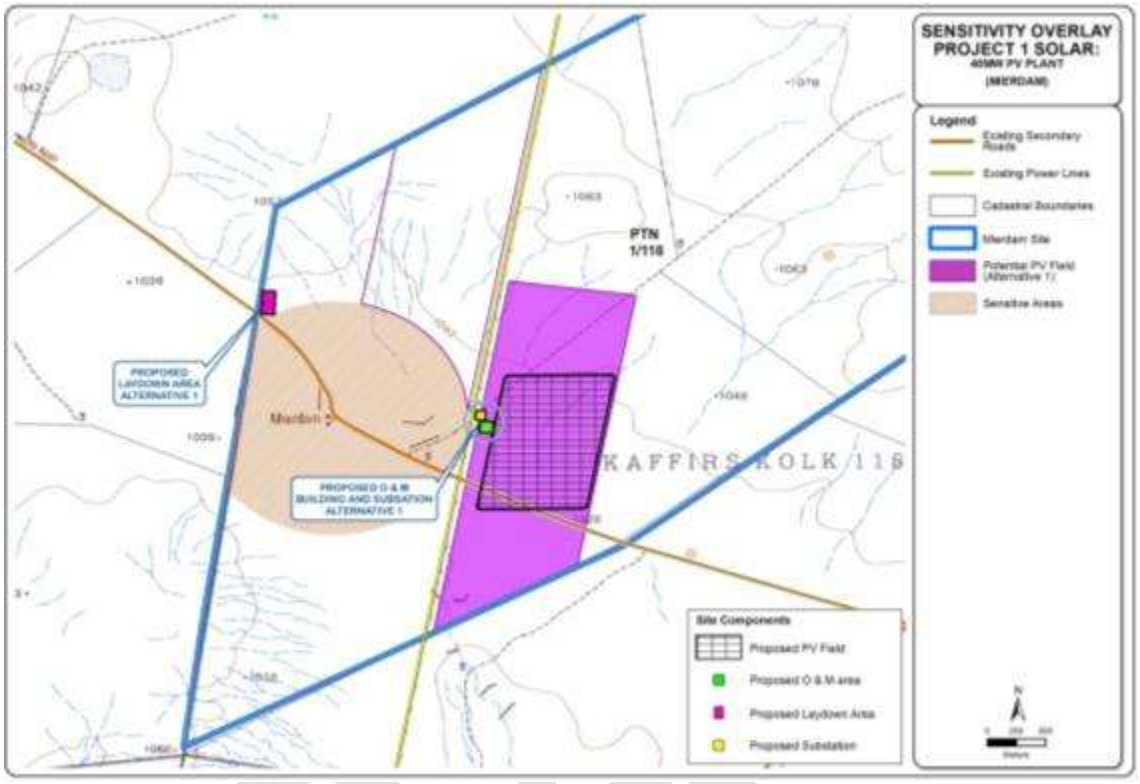

Figure 43: Sensitivity Overlay – 40MW PV Plant on Mierdam Farm

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 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.

It was determined during the EIA that the proposed plant will result in limited potential negative impacts and certain positive 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 PV Plant 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.

15 REFERENCES

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