SOUTH AFRICA MAINSTREAM RENEWABLE POWER MIERDAM (PTY) LTD

Proposed Construction of a 75MW Solar Photovoltaic (PV) Plant on Mierdam Farm near Prieska, Northern Cape Province of South Africa

Draft Environmental Assessment Report for the Amendment of an Environmental Authorisation

DEA Ref. No.:12/12/20/2320/2

NEAS Ref No.: DEA/EIA/AMEND/0000033/2012

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Revision Number:	1
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Signature:	
For:	SiVEST Environmental Division

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

- act as the Independent Environmental Assessment Practitioners in this application for the proposed construction of a Solar Photovoltaic (PV) Plant on Mierdam Farm near Prieska, Northern Cape Province of South Africa.
- do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the Environmental Impact Assessment Regulations, 2010;
- do not have and will not have any vested interest in the proposed activity proceeding;
- have no, and will not engage in, conflicting interests in the undertaking of the activity; and
- will provide the competent authority with access to all information at our disposal regarding the application, whether such information is favourable to the applicant or not.

SOUTH AFRICA MAINSTREAM RENEWABLE POWER MIERDAM (PTY) LTD

PROPOSED CONSTRUCTION OF A 75MW SOLAR PHOTOVOLTAIC (PV) PLANT ON MIERDAM FARM NEAR PRIESKA, NORTHERN CAPE PROVINCE OF SOUTH AFRICA

DRAFT ENVIRONMENTAL ASSESSMENT REPORT FOR THE AMENDMENT OF AN ENVIRONMENTAL AUTHORISATION

Executive Summary

South Africa Mainstream Renewable Power Mierdam (Pty) Ltd (hereafter referred to as Mainstream) obtained an Environmental Authorisation (EA) for the construction of a 40MW Solar Photovoltaic (PV) Facility on Mierdam Farm near Prieska in the Northern Cape Province (DEA Reference 12/12/20/2320/2) on 06 September 2012.

Originally, Mainstream proposed a 40MW PV facility in order to allow the electricity generated at the facility to be fed directly into an existing 66kV power line traversing the site. Subsequently, Eskom advised that the electricity generated at the proposed PV facility would need to be fed into Kronos Substation via a new power line. As such, it is no longer required that the electricity output of the facility be limited to 40MW and Mainstream are proposing to increase the output to 75MW - the maximum capacity set by the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP).

In terms of section 39 of the Environmental Impact Assessment (EIA) Regulations promulgated on 18 June 2010, the holder of an EA can apply to the relevant competent authority for an amendment of the EA. As such, SiVEST (the independent environmental assessment practitioner) submitted an application for an amendment of the EA to the Department of Environmental Affairs (DEA) on 08 October 2012. In response, the DEA issued a letter dated 02 November 2012 advising SiVEST that, despite the disturbance footprint not extending outside the already-approved development area, the proposed increase in the output of the PV facility is a substantive amendment. SiVEST was requested to assess the impacts associated with the proposed increase and submit an assessment report to the DEA for decision-making. It was also required that a public participation process, as referred to in section 54 of the EIA Regulations, be conducted to ensure that all Interested and/or Affected Parties (I&APs) are informed of the proposed amendment and given the opportunity to comment.

SiVEST on behalf of the applicant is therefore applying for amendment to the EA and has prepared this environmental assessment report in accordance with the request from the DEA

dated 02 November 2012. This environmental assessment report is an amendment to the final EIR dated (16 May 2012) and it serves to address the following in respect to the amendment:

- Assess the impacts associated with the proposed increase in the output of the PV facility;
- Indicate the revised site layout, confirm the new footprint of the facility and include a certified copy of the environmental authorisation;
- Conduct a Public Participation Process as referred to in Regulation 54 to bring the proposed amendment to the attention of potential Interested and Affected Parties and allow them an opportunity to comment in terms of regulation 41(3)(a) of the Environmental Impact Assessment Regulations, 2010;
- Consult with various stakeholders and submit their comments, where possible. These include but are not limited to the following:
    - Siyathemba Local Municipality
    - Pixley ka Seme District Municipality
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    - Department of Agriculture Forestry and Fisheries (DAFF)
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In terms of Regulation 56 of the EIA Regulations (2010), an opportunity is provided for registered Interested and Affected Parties (I&APs) to submit written comment on the above-mentioned amendment application. The environmental assessment report was made available for public review from Tuesday 05 February 2013 until Wednesday 06 March 2013.

The proposed project involves the construction of a 75MW solar photovoltaic (PV) plant to be located within the approved PV field alternative 2 site, which has already been assessed by the various specialists and was granted an EA. Site alternatives have not been investigated as part of

the amendment application as an assessment of alternatives was not requested by the DEA. In addition, a detailed assessment of alternatives was undertaken in the EIA phase. The DEA requested that a revised layout be included in the assessment report and this is provided below.

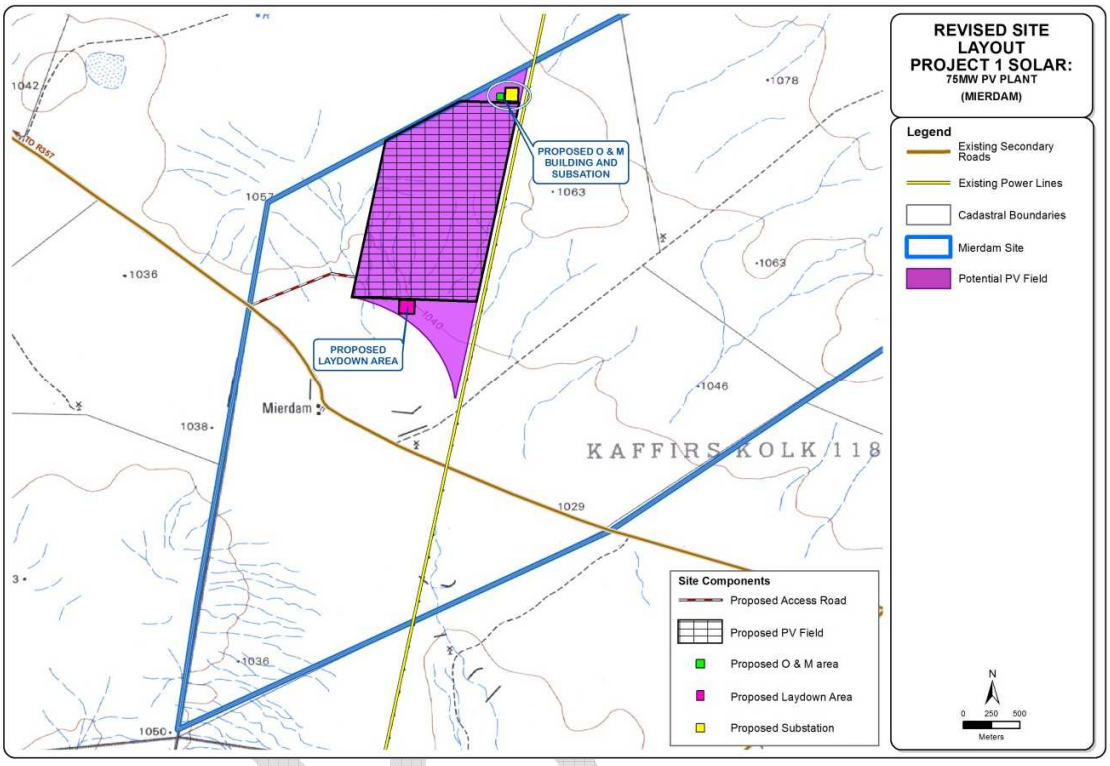

Figure i: Revised site layout

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

Several specialist studies were revised as part of the assessment of the proposed increase. These include:

- 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 through of the more sensitive areas on the site should be undertaken to search for and rescue any plants of botanical or ecological significance and to ensure the PV layout avoids any rare mammal breeding sites. ▪ 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 limit the physical impact of the proposed PV arrays on the drainage lines. ▪ It is advisable that walk through by the surface water specialist be undertaken prior to finalising the exact layout of the panels within the PV field, ▪ 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. The study 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 field. 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 Field. 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 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. .
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 layout 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 and a farmstead. All of the identified sites are located outside the PV layout. They are classed as having high significance on a regional level.	▪ Sensitive heritage resource areas are to be excluded as no-go areas and 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 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. ▪ Inform neighbouring landowners beforehand of any

	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-	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 amended to address the potential impacts relating to the proposed development of a 75MW PV facility. 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. A summary of the impact ratings provided by the specialists are provided in Table ii – iv below.

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

Environmental Aspect	Environmental Impacts	Impact Rating	Impact Rating with

		without Mitigation	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 iv: 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)

It is the opinion of the EAP that the output of the proposed solar PV facility should be allowed to be increased from 40MW to 75MW provided that the recommended mitigation measures are implemented.

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Glossary of Terms

Archaeological resources: This includes:

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

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

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

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

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

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: The consequences 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
ATNS	Air Traffic Navigation Services
C&RR	Comments and Response Report
CPV	Concentrating Photovoltaic
BID	Background Information Document
DAFF	Department of Agriculture Forestry and Fisheries
DEA	Department of Environmental Affairs
DEIR	Draft Environmental Impact Report
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
FEIR	Final Environmental Impact Report
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_{AC}	Megawatt Alternating Current
MWp	Megawatt peak

NCDTEC	Northern Cape Department of Tourism, Environment and Conservation
NCDTRPW	Northern Cape Department of Transport, Roads and Public Works
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
REIPPPP	Renewable Energy Independent Power Producer Procurement Programme
REFIT	Renewable Energy Feed-In Tariff
SACAA	South African Civil Aviation Authority
SAHRA	South African Heritage Resources Agency
SANBI	South African National Biodiversity Institute
SANRAL	South African National Roads Agency Limited
SAWS	South African Weather Service
SIA	Social Impact Assessment
SKA	Square Kilometre Array
WESSA	Wildlife and Environment Society of South Africa

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1 INTRODUCTION

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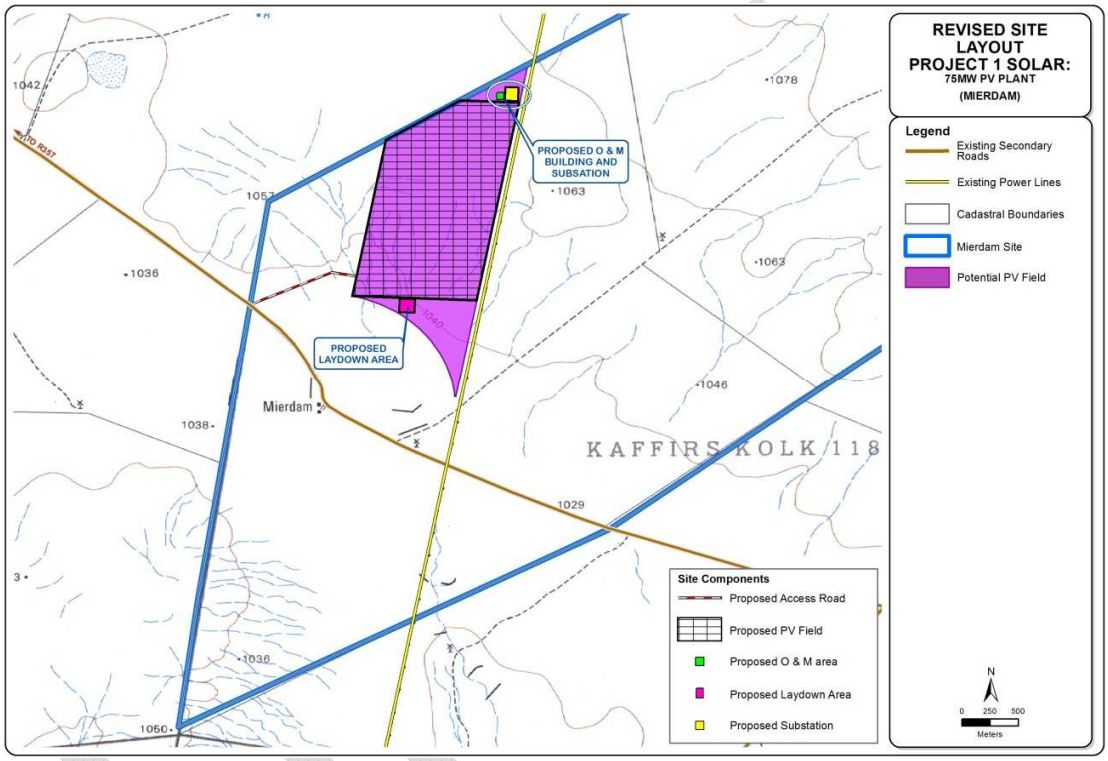

Figure 1: Revised site layout

This proposed PV facility forms one component of the overall solar PV facilities that Mainstream are proposing to develop on both Mierdam Farm and Platsjambok Farm (Figure 2). In addition to this proposed 75MW PV facility on Mierdam farm, two 75MW solar PV facilities are being proposed on Platsjambok farm and have been granted EA. The DEA reference numbers for these approved PV solar facilities are as follows:

- **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

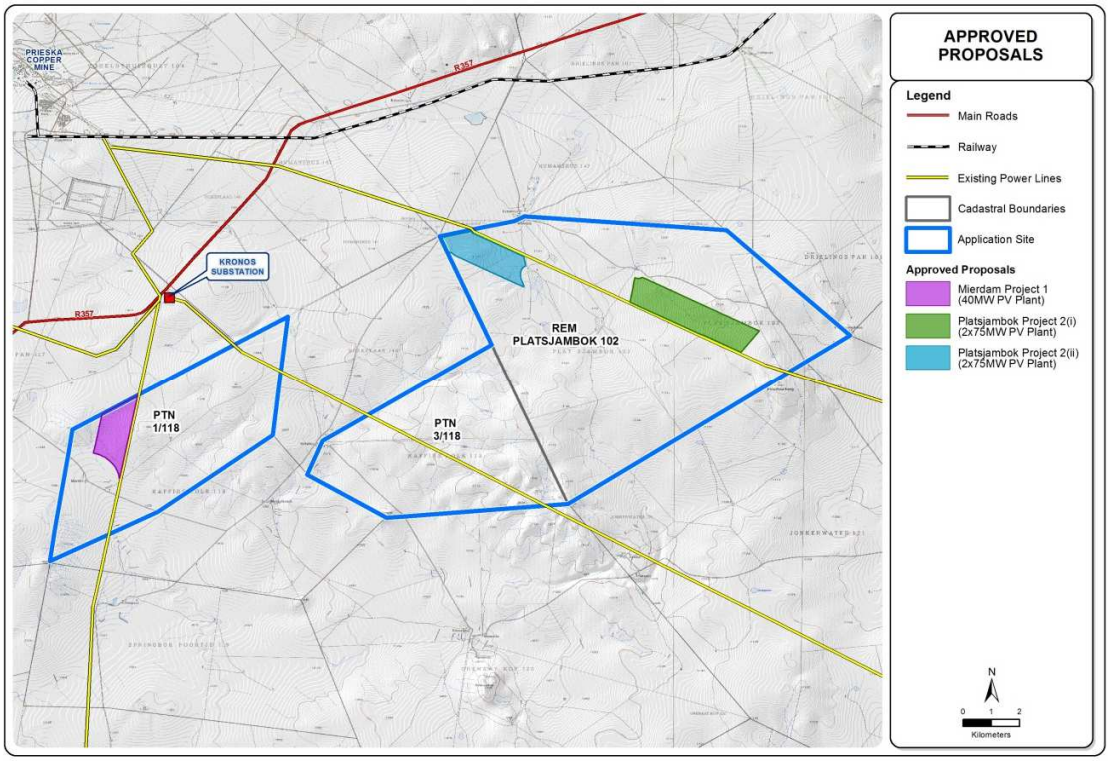

Figure 2: Approved solar projects on Mierdam and Platsjambok Farm

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 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 environmental assessment report for the amendment application 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 revised specialist studies, public participation including key stakeholder consultation and the assessment report
- Chapter 3 elaborates on the assumptions and limitations pertaining to the amendment application process for the proposed development.
- Chapter 4 provides explanation to the need and desirability of the proposed project by highlighting issues such as security of power supply; local employment as well as regional and local income profile.
- Chapter 5 gives detailed technical descriptions of the PV power plant.
- 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 are also summarised.
- Chapter 7 describes the Public Participation Process (PPP) undertaken as part of the amendment application.
- Chapter 8 documents the findings of the specialist studies and associated potential impacts of the proposed 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 provides a description of the environmental monitoring and auditing process to be undertaken for the proposed PV power plant.
- Chapter 12 presents a checklist that ensures that the report has been compiled according to the requirements of the World Bank Standards and Equator Principles.
- Chapter 13 summarises the findings and recommendations per specialist study and provides the overall conclusion.
- Chapter 14 lists references indicated in the motivation for amendment to the EA.

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
Rebecca Thomas – SiVEST	Senior Environmental Scientist
Andrea Gibb – SiVEST	Environmental Assessment Practitioner

Name and Organisation	Role
Liesl Koch (employed by SiVEST at the time of undertaking the study)	Biodiversity (Flora and Fauna)
Paul da Cruz (employed by SiVEST at the time of undertaking the study)	Surface water, Visual, Avifauna
Kurt Barichievy – SiVEST	Soils and Agricultural Potential
Johnny Van Schalkwyk	Heritage
Nonka Byker (employed by MasterQ at the time of undertaking the study)	Social
Sean Smith – MasterQ	
An Kritzinger	Economic
Bernard Casey – Mainstream	Geotechnical
Kerry Schwartz – SiVEST	GIS and Mapping

Please refer to Appendix 3 for CV's of each team member and Appendix 9 for their declarations of interest that were also included in the FEIR.

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

The holder of the application, in terms of Regulation 39 of the EIA Regulations 2012 GN R 543, may at any time apply to the relevant Competent Authority for the amendment of the Authorisation. In a letter dated 02 November 2012, the DEA advised that this application will be considered as a substantive amendment by the Department. This application therefore follows the procedure as outlined in Regulation 39 to 42 of the EIA Regulations 2012 GN R 543.

The following Schedules of the Government Notice No. R. 544 - 546 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**	**Description in Project Context**
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*	A new power line (either 66kV or 132kV) would need to be constructed to connect the proposed facility with the existing Kronos Substation. The proposed power line would be located outside an urban area.
	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.	The proposed PV field and associated infrastructure may be established within a watercourse or within 32 metres from a watercourse as several ephemeral drainage lines traverse the proposed site.
	Activity 22	The construction of a road outside urban areas	A gravel road with a width of between 6m and 10m would

		i) with a reserve wider than 13.5 metres *ii) where no reserve exists where the road is wider than 8 metres*	need to be constructed to provide access to the proposed PV Field.
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.	The proposed PV plant would generate more than 20 megawatts, as it would have a maximum output of 75 megawatts.
	Activity 15	Physical alteration of undeveloped, vacant or derelict land for residential, retail, commercial, recreational, industrial or institutional use where the total area to be transformed is 20 hectares or more.	The proposed development site is predominantly vacant and the entire area to be transformed is approximately 192 hectares.
Government Notice R546 (18 June 2010)	Activity 13	1) The clearance of an area of 1 hectare or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation, In Northern Cape	The proposed development site is characterised by vacant land that is dominated by natural vegetation used for grazing. Vegetation clearing would take place over a portion of the approximate 192 hectare buildable area during the construction phase. 75% of this cleared area may constitute indigenous vegetation.

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 or requires 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 PV facility 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) during the EIA phase of the project, 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.

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] "**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.

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.

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 EIA phase of the project.

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 plant was positioned closer to the existing electromagnetic disturbance created by the power lines that traverse the proposed development site.

Additional comments were received from the SKA on 26 November 2012 after the Public Participation Process for the amendment application was initiated. In addition, the South African SKA Project Office (SASPO) undertook a high-level impact assessment of the proposed PV facility on Mierdam farm on SKA stations located nearest to the proposed site. All correspondence from the SKA is included in Appendix 5D.

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: Labour and Working Conditions
    - Performance Standard 3: Pollution Prevention and Abatement
    - Performance Standard 4: Community Health, Safety and Security
    - Performance Standard 5: Land Acquisition and Involuntary Resettlement
    - Performance Standard 6: Biodiversity Conservation and Sustainable Natural Resource Management
    - Performance Standard 7: Indigenous Peoples
    - Performance Standard 8: Cultural Heritage
- International Finance Corporation – World Bank Guidelines, General EHS Guidelines 2007.

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

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

1.5 Key Development Strategies and Guidelines

1.5.1 Integrated Development Plans

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

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

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

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

The site falls within the Northern Cape District Management Area 07 (NCDMA) of the Pixley ka Seme District Municipality. According to the District IDP 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.

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

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.

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) processes in South Africa and Eskom**,** June 2010 (http://www.eskom.co.za/live/content.php?Item_ID=14324).

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

- Country Process

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

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

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

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. 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

This EA amendment application and environmental assessment report was undertaken in accordance with the EIA 2010 Regulations listed 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 Revised Specialist Studies

The following specialist studies have been revised to address the substantive amendment being proposed to increase in the output of the solar PV facility from 40MW to 75MW:

- 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 Public Participation

The public participation process for the amendment application included the following and was undertaken in accordance with Regulation 54 of the EIA Regulations (2010):

- Placement of site notices informing I&APs of the EA amendment application required in order to increase the output of the proposed PV facility from 40MW to 75MW (21 November 2012);
- Written correspondence notifying all identified I&APs of the EA amendment application required in order to increase the output of the proposed PV facility from 40MW to 75MW (16 November 2012);
- Placement of advertisements notifying the general public of the EA amendment application required in order to increase the output of the proposed PV facility from 40MW to 75MW (16 November 2012);
- Making the amendment assessment report available for a public review for a period of 30 days (05 February 2013 – 06 March 2013).

All comments received on the proposed amendment and environmental assessment report have been incorporated into a Comments and Response Report which is included as Appendix 5E.

Full details and significant outcomes of the public participation process are discussed further in Chapter 7 of this report.

2.3 Key Stakeholder Consultation

Consultation with relevant key stakeholders was also undertaken as requested by the DEA in their letter dated 02 November 2012 in order to provide them with the details associated with the amendment application and to provide them with the opportunity to comment of the proposed increase in the output of the Mierdam PV facility.

As requested, SiVEST has attempted to obtain comments from the following key stakeholders:

- Siyathemba Local Municipality
- Pixley ka Seme District Municipality
- Department of Water Affairs (DWA)
- Department of Agriculture Forestry and Fisheries (DAFF)
- Northern Cape Department of Environmental and Nature Conservation (NCDENC)
- South African National Roads Agency Limited (SANRAL)
- Northern Cape Department of Transport, Roads and Public Works (NCDTRPW)
- South African Heritage Resource Agency (SAHRA)
- Northern Cape Department of Heritage
- Eskom Holdings SOC Limited
- Square Kilometre Array (SKA)
- South African Civil Aviation Authority (SACAA)
- Air Traffic Navigation Services (ATNS)
- Transnet Freight Rail
- Telkom
- Endangered Wildlife Trust (EWT)
- Wildlife and Environment Society of South Africa (WESSA)
- Birdlife South Africa

All comments received to date are included in Appendix 5D. In addition, proof that the key stakeholders have been notified of the proposed amendment is included in Appendix 5G.

2.4 Amendment Application Environmental Assessment Report

The purpose of this environmental assessment report is to:

- Identify and address any environmental impacts associated with the substantive change from a 40MW PV plant to a 75MW PV plant;
- Provide details of the revised site layout and confirm the footprint of the facility;
- Report on identified impacts and determine the significance of the impacts; and

- Formulate any new mitigation measures associated with the increase in output from a 40MW PV plant to a 75MW PV plant.

3 ASSUMPTIONS AND LIMITATIONS

- It is assumed that 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.
- The figures quoted from the project proponent are based on best estimates. As bidding criteria changes and as the project develops, the actual submitted figures may increase or decrease. All efforts have been made to ensure this information is as correct as possible at the time of compiling this report.

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. 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 country is opting for the use of renewable energy technologies, which is fast becoming an important energy option for South Africa. This is supported by the *White Paper on Renewable Energy,* which sets out to promote and implement renewable energy in South Africa and the *White Paper on Energy Policy of the Republic of South Africa*, which prioritises the need to stimulate the development of renewable energy sources.

It is within this context that Mainstream plan to increase the output of the photovoltaic plant proposed to be established near Prieska, Northern Cape Province. Increasing the output of the proposed PV facility will not only produce more electricity through renewable energy technologies, but will also increase the contribution of the project to stabilise electricity and reducing load shedding.

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 led to reductions in demand pressure. 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 this assessment 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.

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).

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. Increasing the output of the proposed PV facility will therefore contribute more 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 operational phase.

5 TECHNICAL PROJECT DESCRIPTION

At this stage, it is estimated that the proposed project will encompass the installation of a solar PV field and their associated components, in order to generate electricity that is to be fed into the existing Eskom grid via a new 132kV power line, which will lead to Kronos Substation. The total power generation capacity limit will be 75 Megawatts (MW_{AC}). The voltage of the connection lines from the PV plant substation to the grid will be 132kV.

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

5.1 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 75 MW_{AC}.

The project will consist of two components:

- PV Power Plant (solar field – panels and inverters)
- Associated infrastructure (substation, lay down areas, O&M buildings, ancillary structures and roads)

The PV Power plant will consist of the following infrastructure:

- Solar field (fixed PV)
- Buildings

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

5.1.1 Solar field

The smallest unit of a PV installation is a cell. A number of cells form a module, and finally a number of modules form the arrays (Figure 3). Modules are arranged into strings that form the

solar field. Modules are arranged in section sizes of approximately 40m x 5m called tables and are installed on racks which are made of aluminium or steel.

All the arrays are wired to inverters that convert direct current (DC) into alternating current (AC) that can be stepped up and fed into the national grid system.

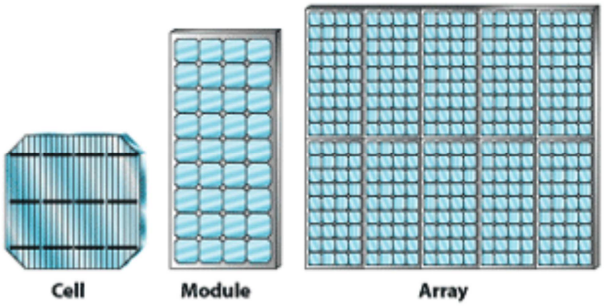

Figure 3: Illustration of a PV installation

The proposed development will fit within the approved site (alternative 2) for the PV facility, which has an area of approximately 192 ha. Within this site approximately 320 000 photovoltaic (PV) panels will be installed. Some clearing/ grading of the area might be required as there is limited tall vegetation on the site which will need to be removed. The cleared areas will however be rehabilitated as per the requirements of the EMPr.

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. Arrays usually reach up to between 5m and 10m above ground level.

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.

The solar field and building infrastructure will be located within the approved PV field (alternative 2), which has already been assessed by the various specialists and was granted an EA. The revised layout is indicated in Figure 4 below.

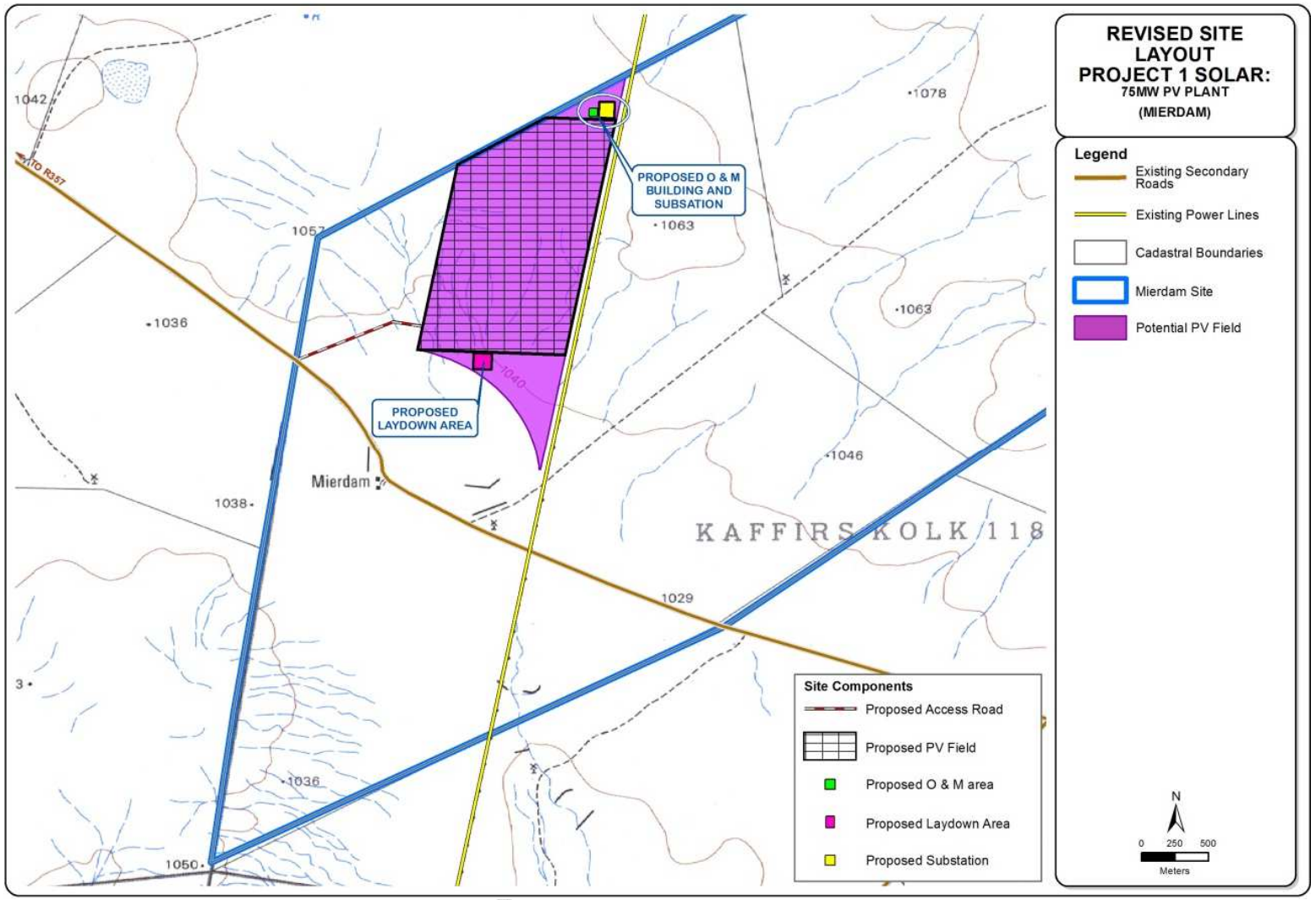

Figure 4: Revised site layout

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 5). 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.

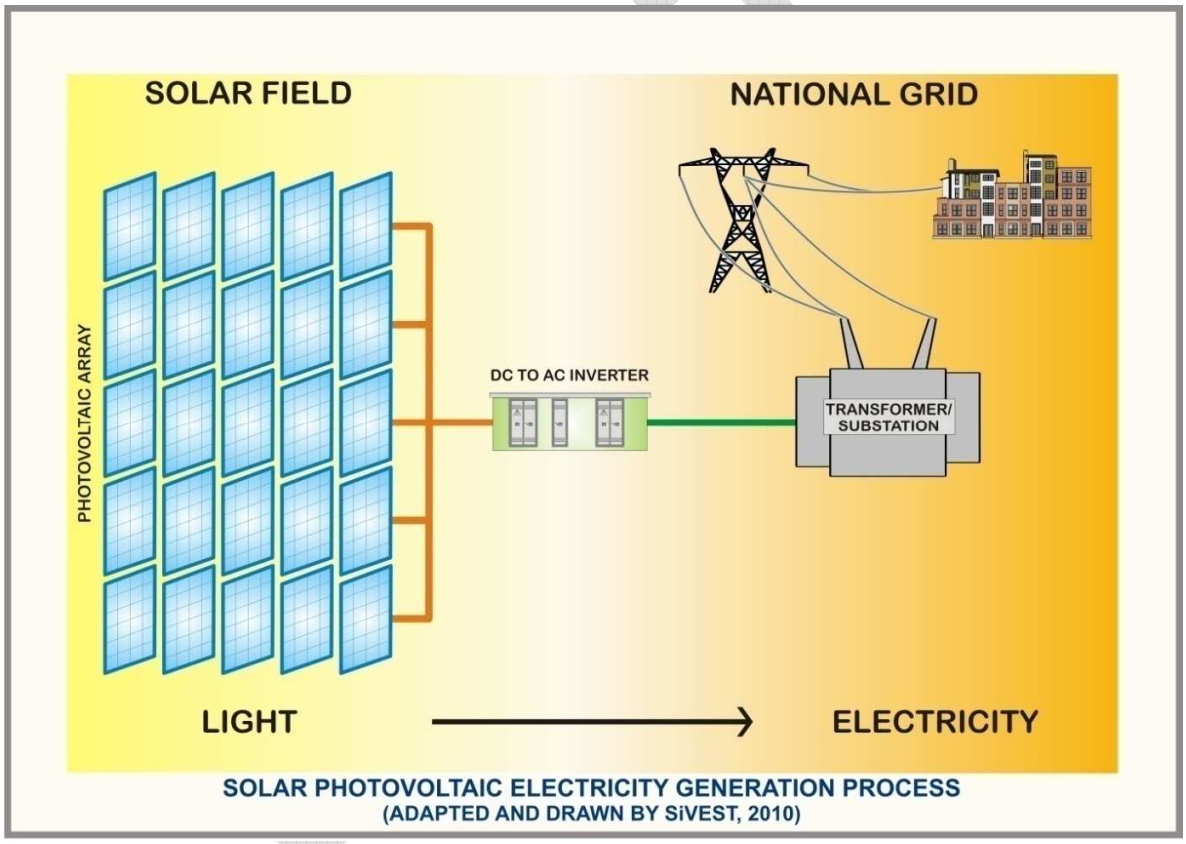

Figure 5: PV process

The solar facility connection to the national grid will be via an onsite transformer unit. The intention is to connect into the 400kV Eskom transmission substation, located approximately 4km to the north of the site. A transformer unit of 132/ 400kV design at Kronos will facilitate this feed in. The project applicant has engaged with Eskom to formalise this grid application and the agreement will form part of the PPA.

For the 75MW AC facility, between 75 and 93 inverters will be required, depending on DC oversizing. Inverters, like the substation transformers, also contain oil. Bunds will be constructed to ensure that any oil spills are suitably attenuated and not released into the environment.

The distribution substation will be approximately 90m x 120m in size and will be located in close proximity to the existing power line. The substation will be securely fenced and will be operated by Eskom.

Two 200m wide corridors were assessed 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 66kV 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 an existing 400kV 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**).

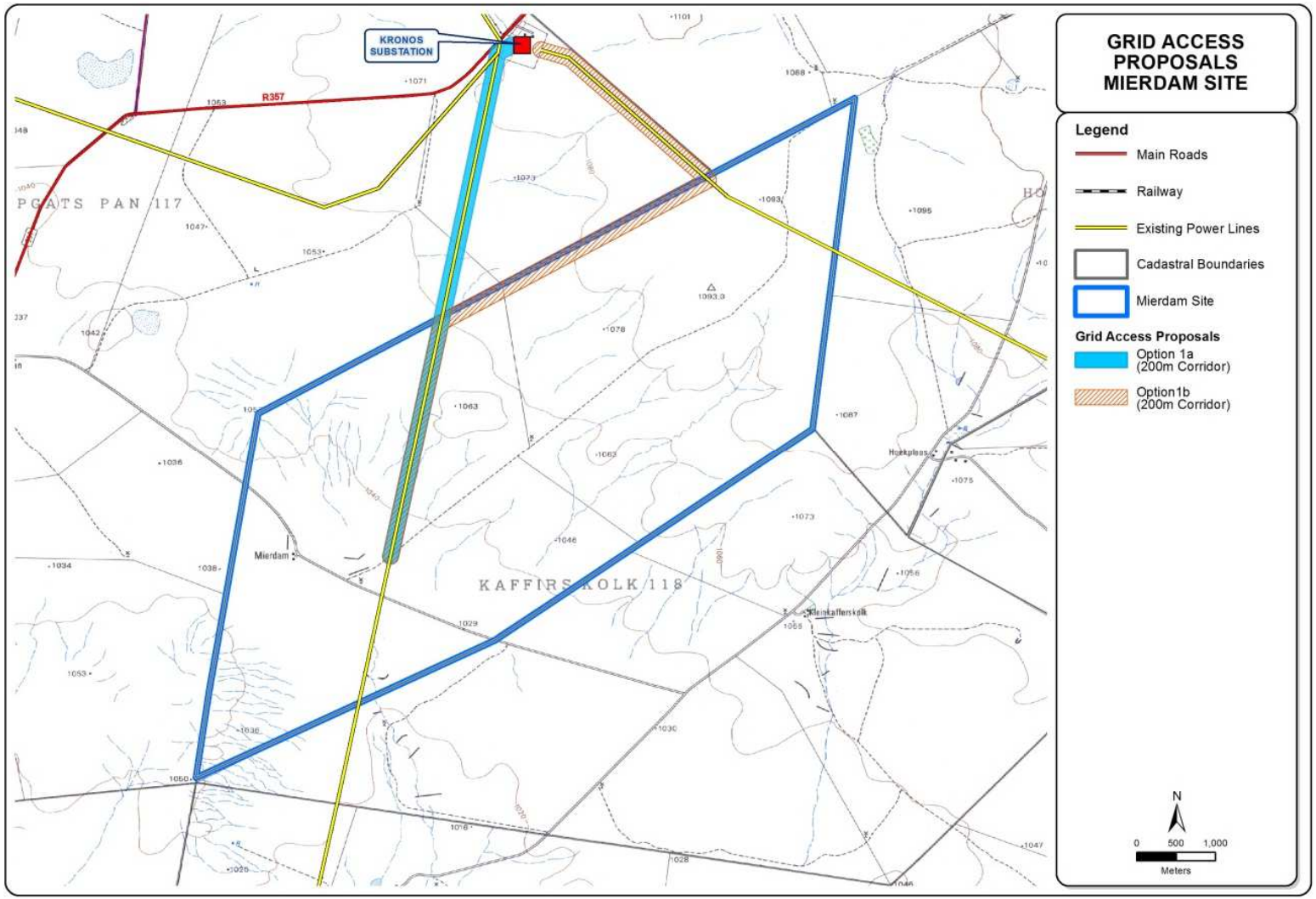

Figure 6: Grid access Proposals

Constructing the new power line along either corridor 1a or corridor 1b was approved by the DEA and granted an EA on 06 September 2012. These alternatives were assessed as part of the EIA for the proposed construction of a 40MW PV facility and no further assessment is therefore required.

- 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 REIPPPP requirements.

- Roads

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

- Fencing

For various reasons (security, public protection and lawful requirements), the plant will be secured by enclosing it with security fencing. Access points will be managed and monitored by a full time security company. The actual choice of fencing is yet to be determined, but may be a fully electrified option, or a full height palisade or even a hybrid of the two.

- Temporary work areas / activities during construction

A lay down area of a maximum of 10 000m², adjacent to the site or access route will be required. This will be temporary in nature. Associated with this will be a contractors site offices which will require a maximum of 5 000m².

- Panel maintenance

The panels will require cleaning and dust will accumulate on them affecting their productivity. Cleaning will take place once every quarter (providing job creation). Water will be trucked in from the collection point along the existing Alkantpan pipeline near Copperton.

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 in the Northern Cape Province 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)

In addition, the proposed new power line will traverse the following land portion:

- Portion 4 of the Farm Klipgats Pan 117, Prieska

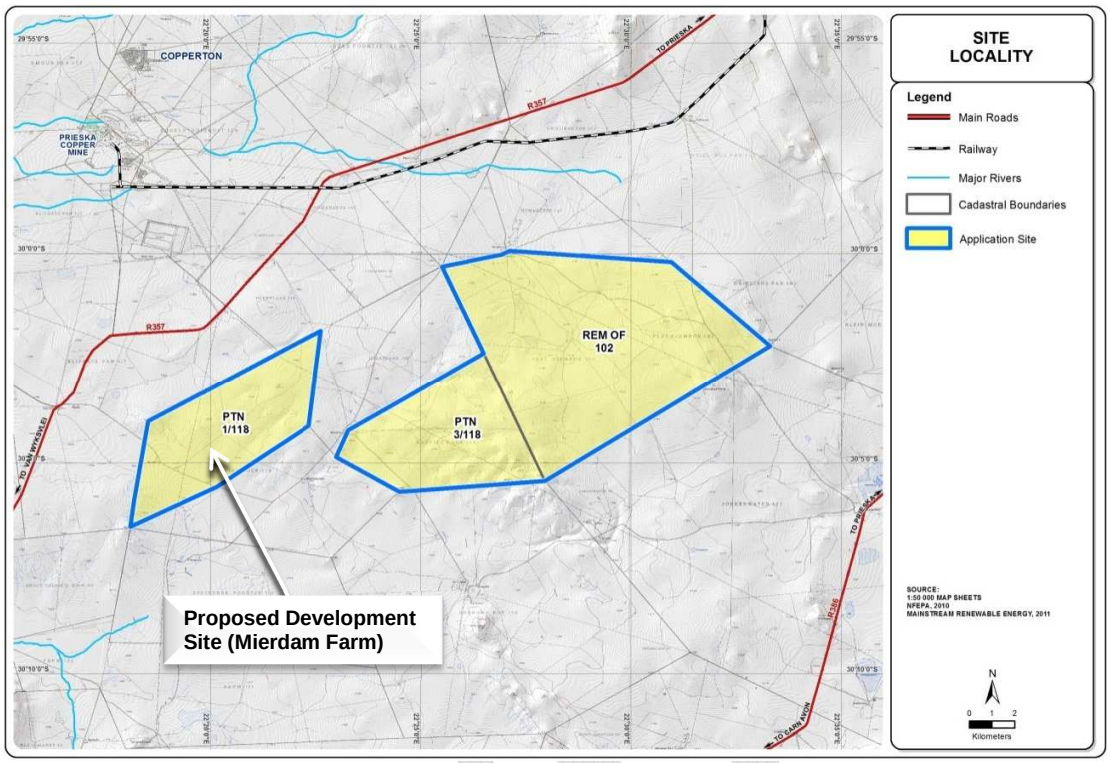

Figure 7: Site locality map

The study area is situated approximately 45km south-west of Prieska and is 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 of Kimberley).

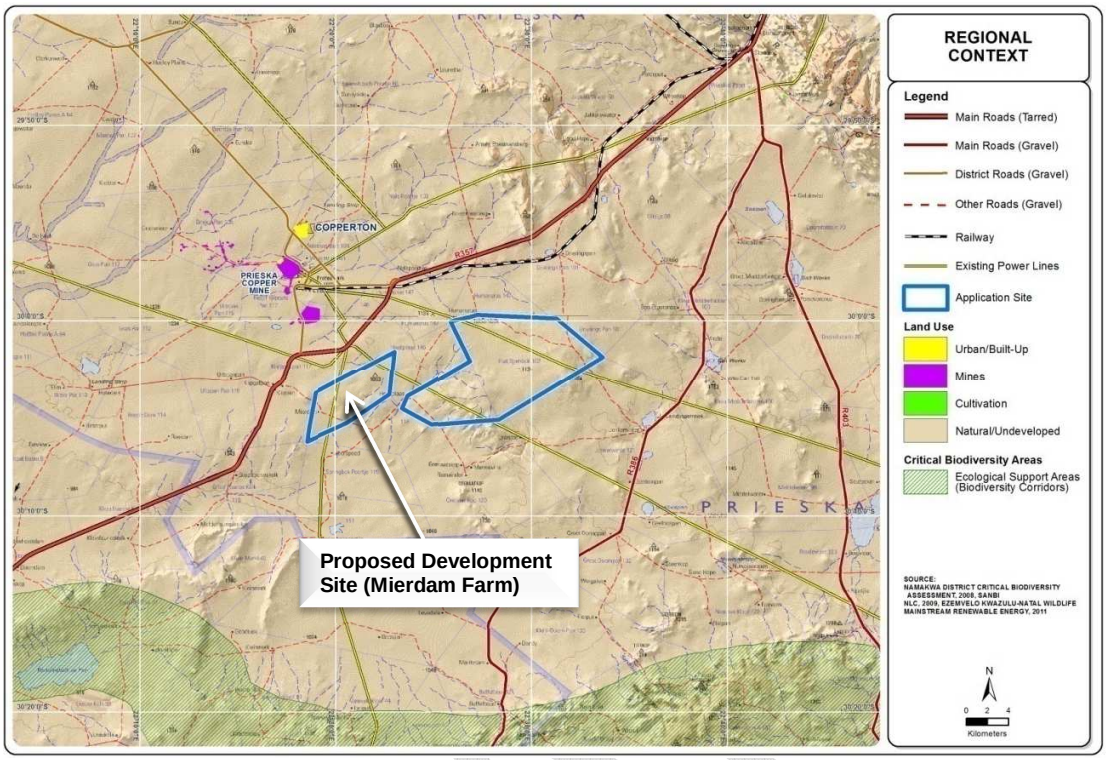

Figure 8: Regional locality map

6.2 Study Area Description

The site proposed for the development (Mierdam farm) is approximately 2855.042 ha in size of which a smaller area (approximately 192 ha) 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.

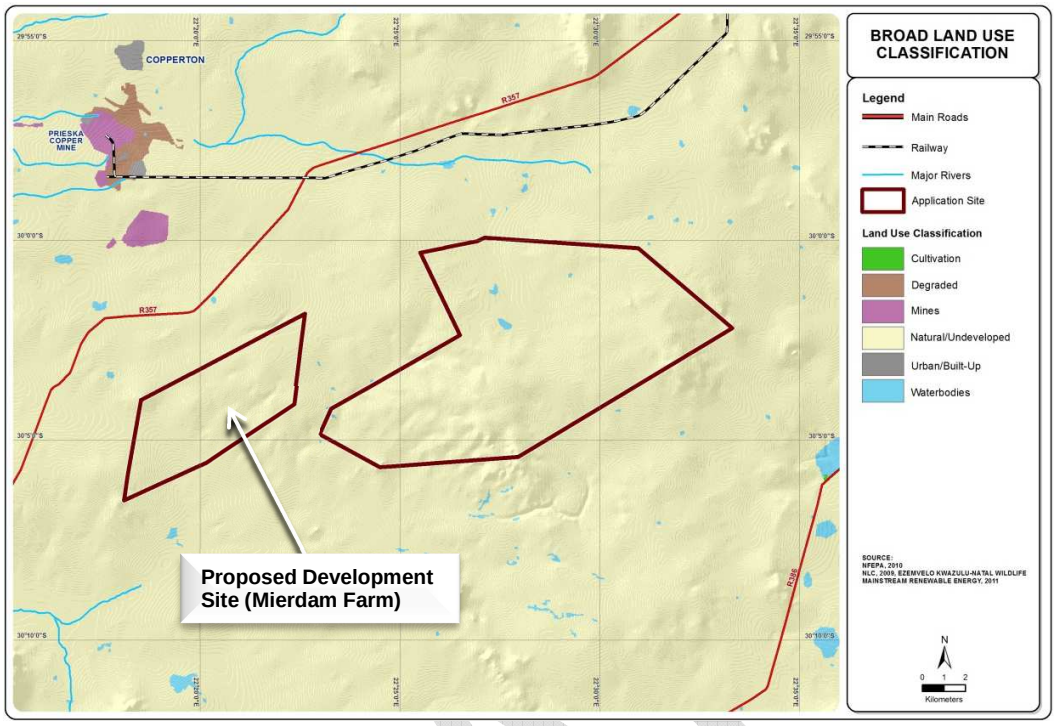

Figure 9: Land use of the study area

The topography within and surrounding the site is characterised by generally flat land with an average gradient of less than 10%, as well as some slightly more undulating relief (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.

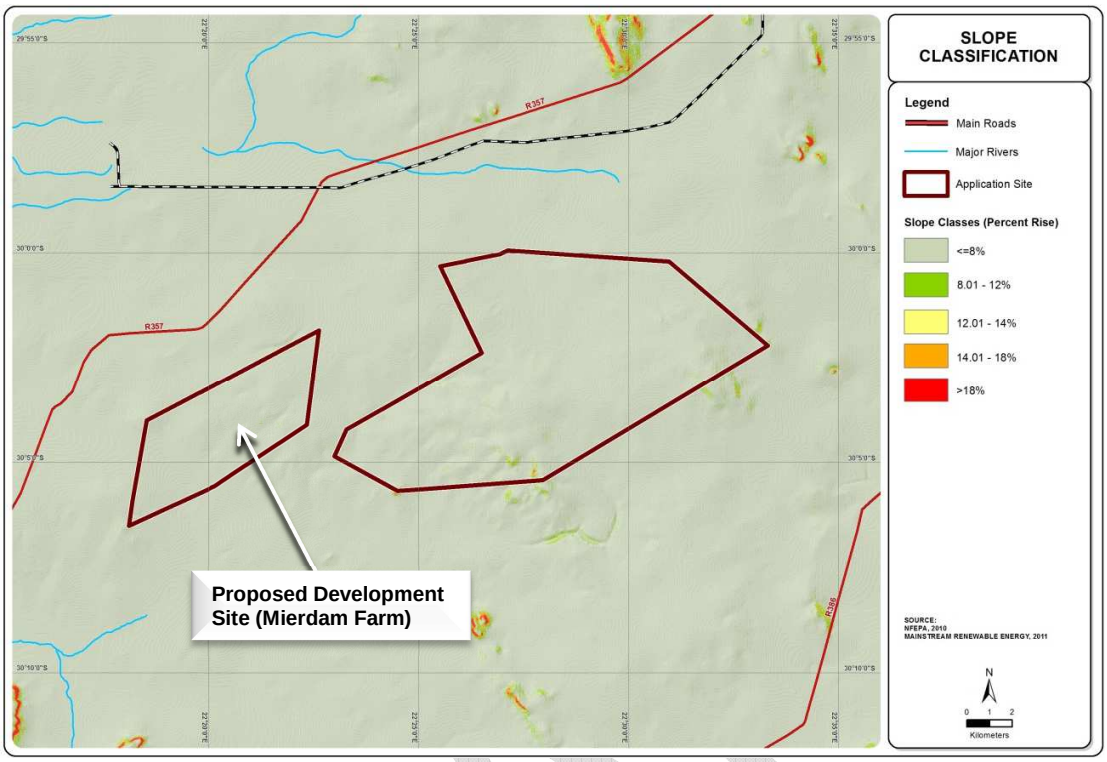

Figure 10: Slope of the study area

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 experiences hot days and cold nights with the average summer temperature of approximately 33ºC and the average winter night time temperatures of approximately 1ºC (Table 3).

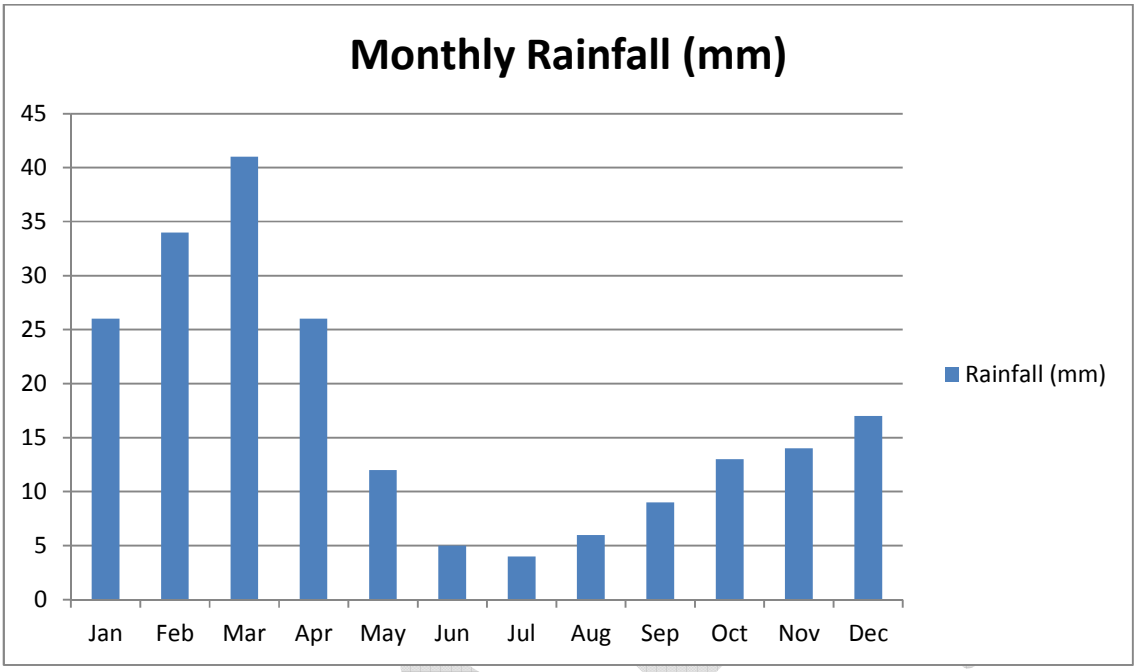

Figure 11: Mean Monthly Rainfall Graph for Prieska (Source: South Africa's Rain Atlas)

Table 3: 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 materials including 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 Platsjambok farm to the east of the development site.

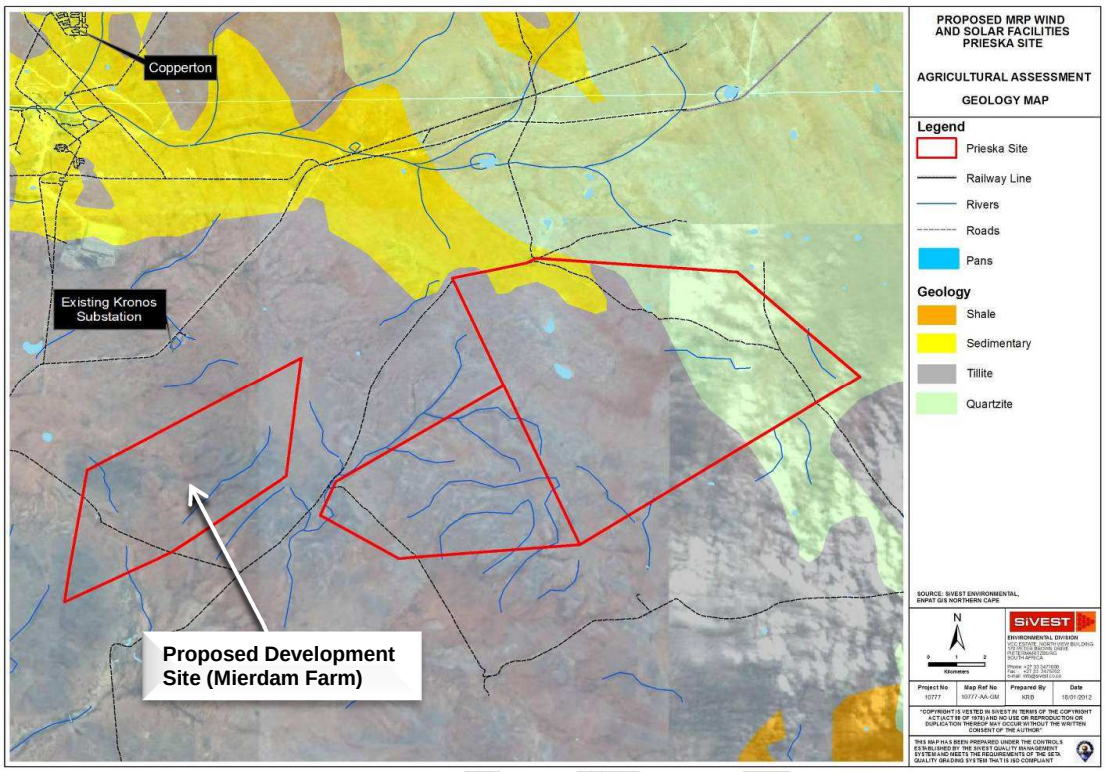

Figure 12: Geological map

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 plains 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.

- 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 type on the site is described as Bushmanland Basin Shrubland. It falls 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).

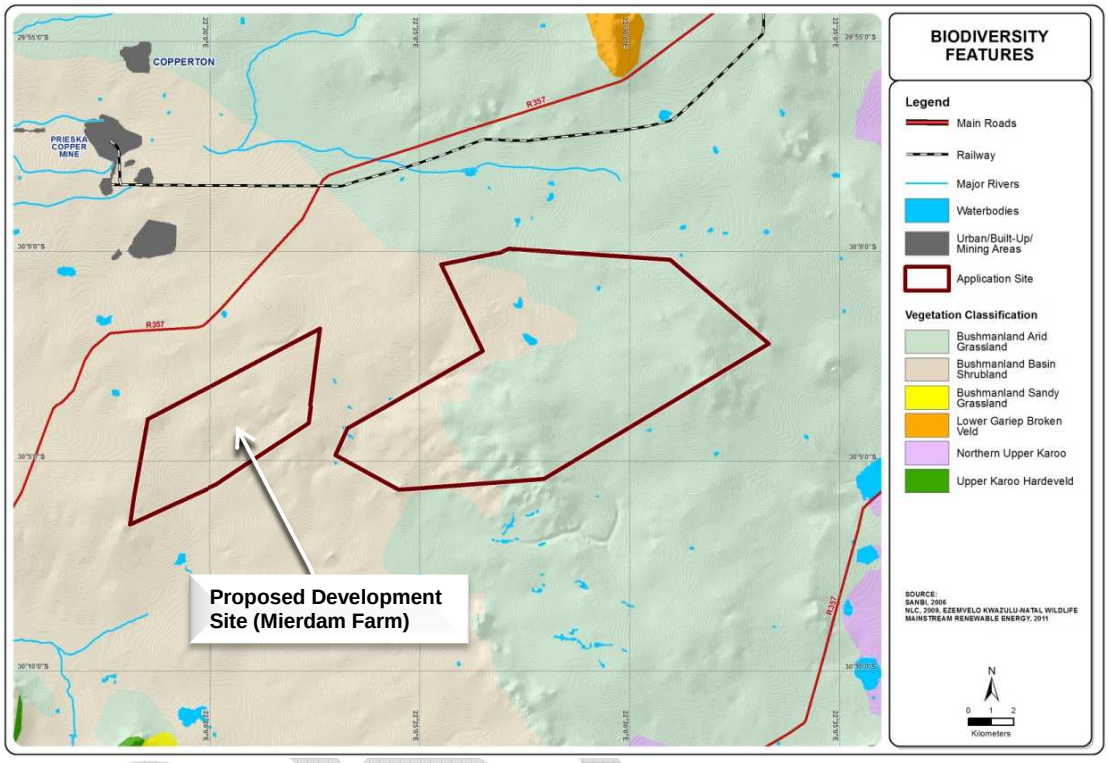

Figure 16: Vegetation of the study area

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 Threatened are 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 comprises of 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 Threatened are 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 against predators (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 4: 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 5 highlights 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 5: 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*
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*	X						

Common Name	*Scientific Name*	Habitat Type in which Species was Recorded						
		Karoo Plains	Sandy Scrubveld	Grassy Pans	Quertzite Ridges	Farmsteads	Feedlots	Human Infrastr.
	serpentarius							
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 capicola*					X		
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			

Common Name	*Scientific Name*	Habitat Type in which Species was Recorded						
		Karoo Plains	Sandy Scrubveld	Grassy Pans	Quertzite Ridges	Farmsteads	Feedlots	Human Infrastr.
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		
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		

Common Name	*Scientific Name*	Habitat Type in which Species was Recorded						
		Karoo Plains	Sandy Scrubveld	Grassy Pans	Quertzite Ridges	Farmsteads	Feedlots	Human Infrastr.
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	
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:

- Secretary bird

- 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 6**:** 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 neighbouring farm Platsjambok (**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.

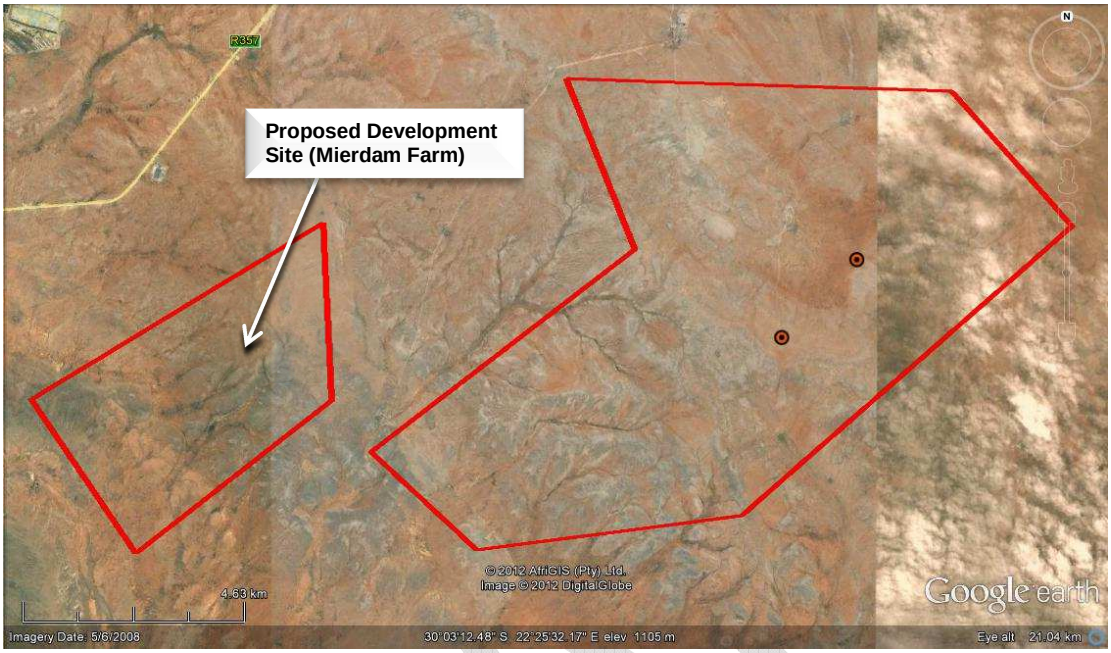

Figure 21: Bat species and activity detected during vehicle monitoring on site, showing very low levels of activity. Orange circles indicate where Egyptian free-tailed bats (*Tadaridaaegyptiaca*) were detected.

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 vegetation type 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.

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 an agricultural 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 23). 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. Drinking water for the animals is sourced from groundwater resources.

Figure 23: 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 24). 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 25).

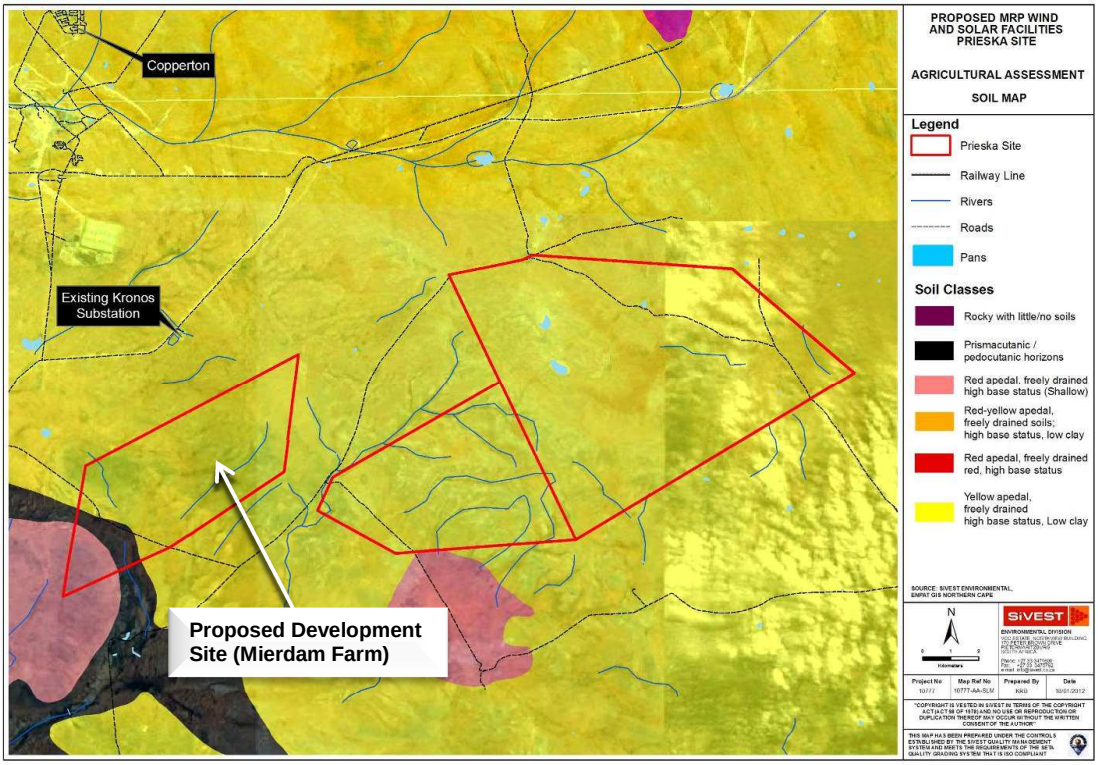

Figure 24: Broad soil type map

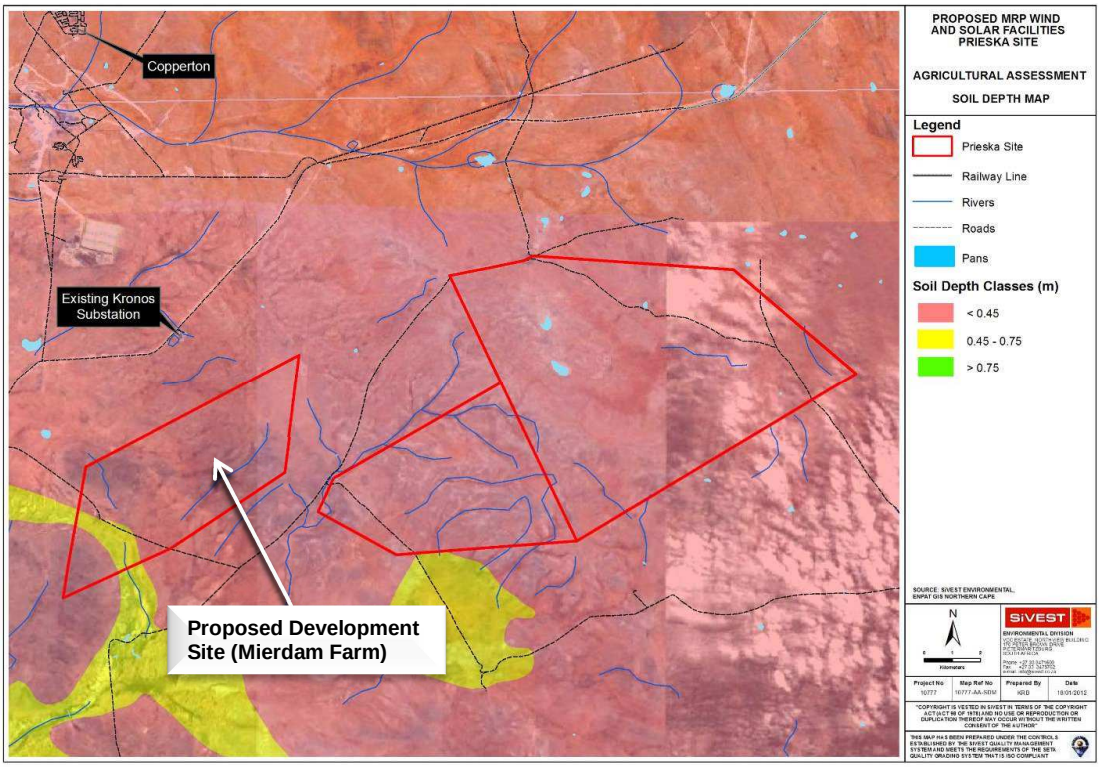

Figure 25: Soil depth map

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 28) mainly due to the shallow effective rooting depth.

- Soil Survey and Field Characteristics

Due to the size of the site (2855.042 ha) 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 26). 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 26). 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 27). 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.

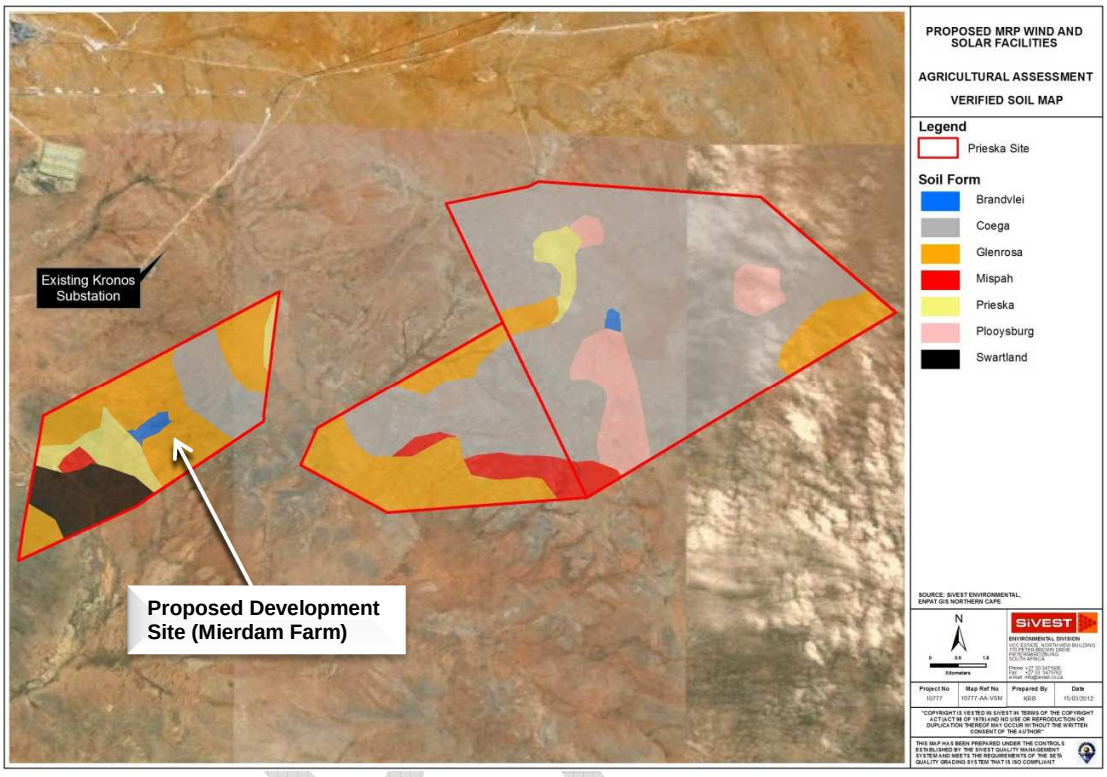

Figure 26: Verified Soil Map for the Prieska Sites

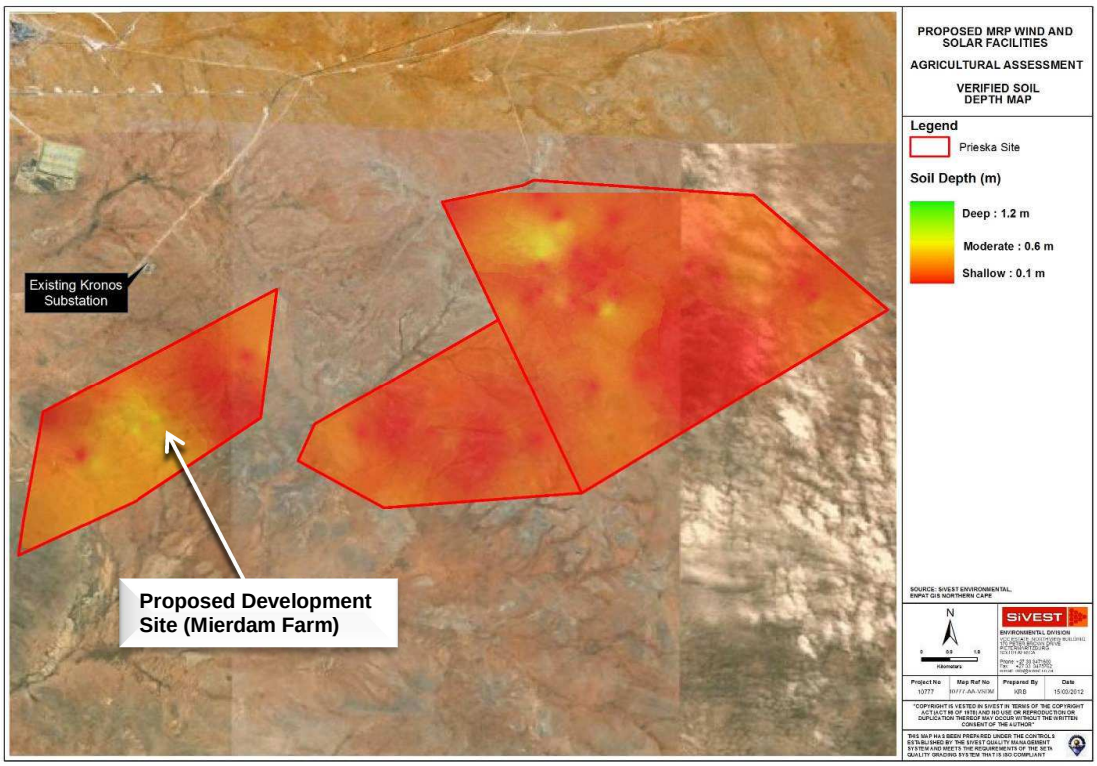

Figure 27: Verified Soil Depth Map

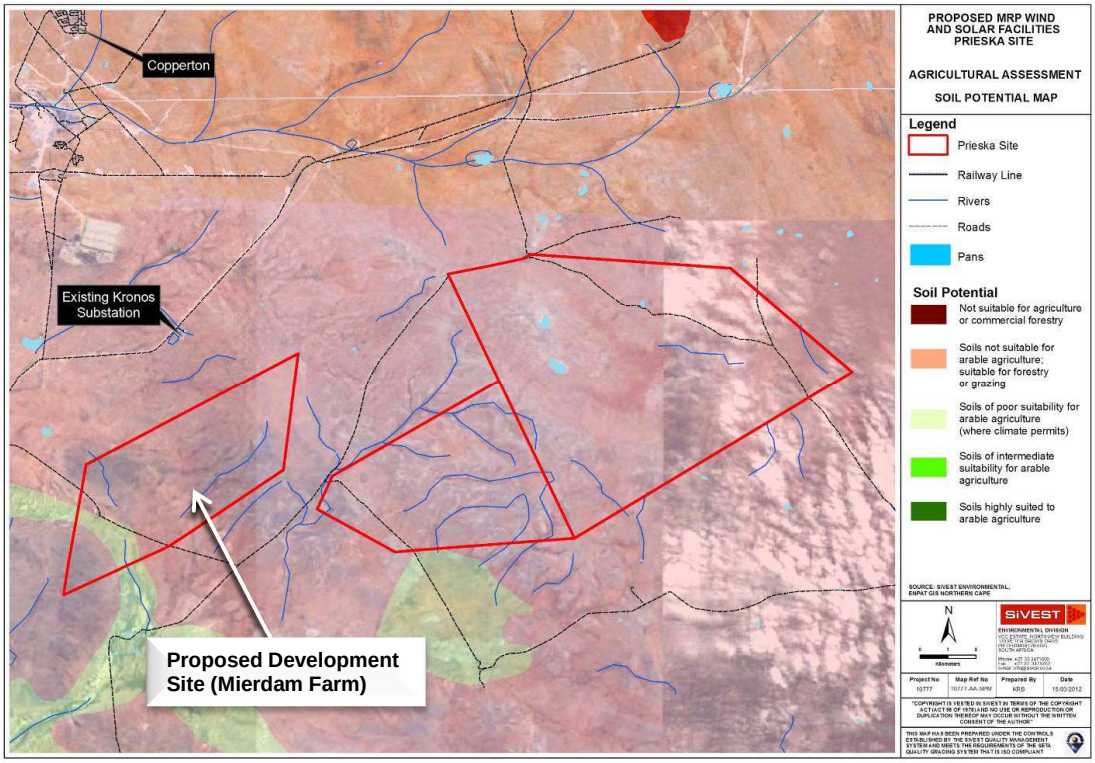

Figure 28: Soil Potential Map

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 29. 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 is not 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.

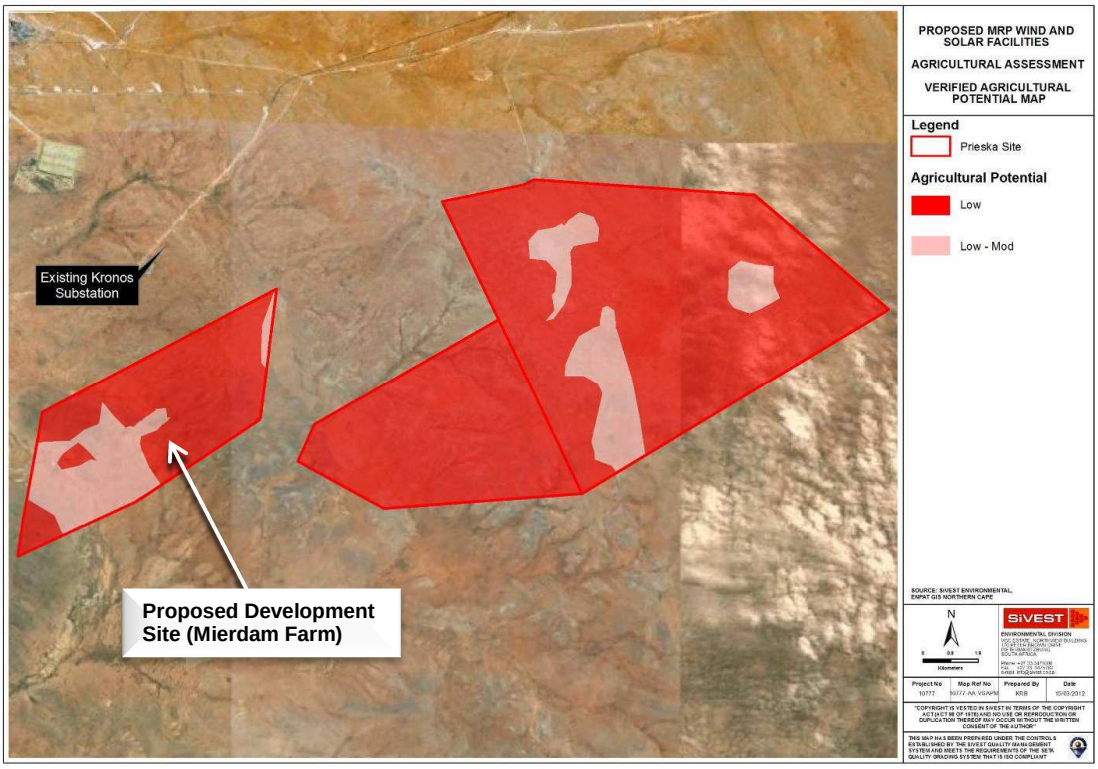

Figure 29: Agricultural Potential Map

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 landscape has retained a 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 and 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 field 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.

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.

Although, the area is not typically visited as part of leisure tourism trips, 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 30: 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.

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.

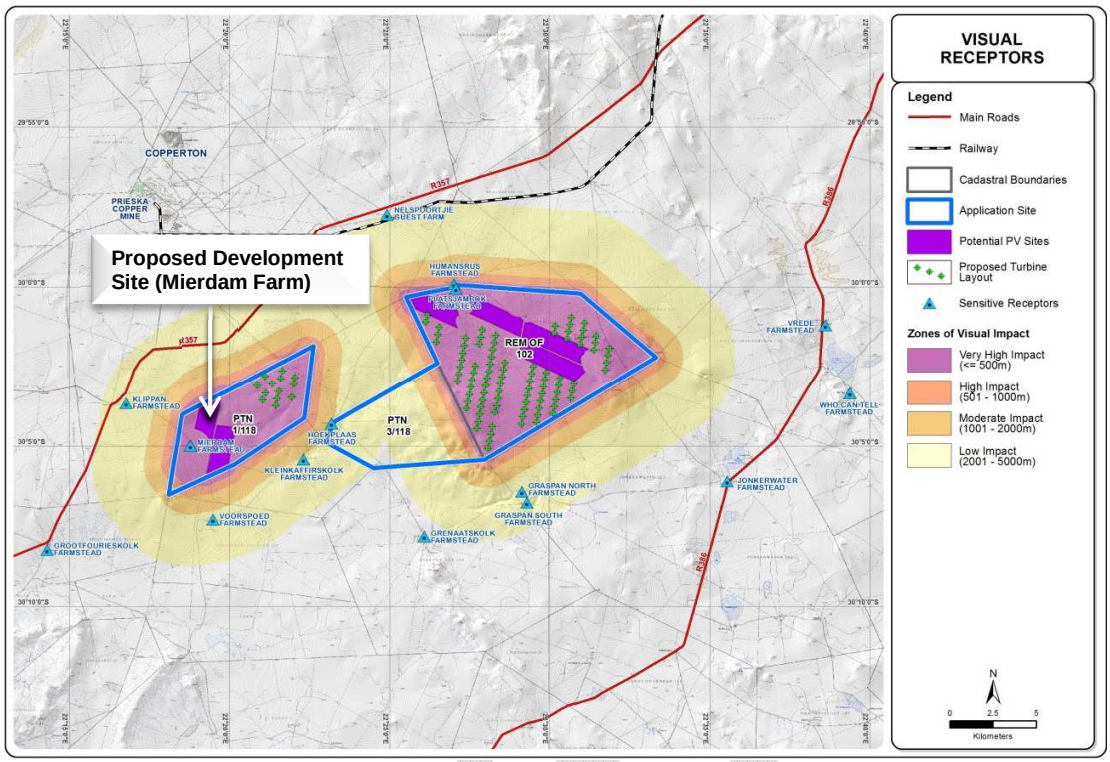

Figure 31: Map showing location of receptor locations in the study area

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 Geotechnical Assessment was conducted by Mainstream and 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 relatively easier to excavate.

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 19th century 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 practiced 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 20th 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:

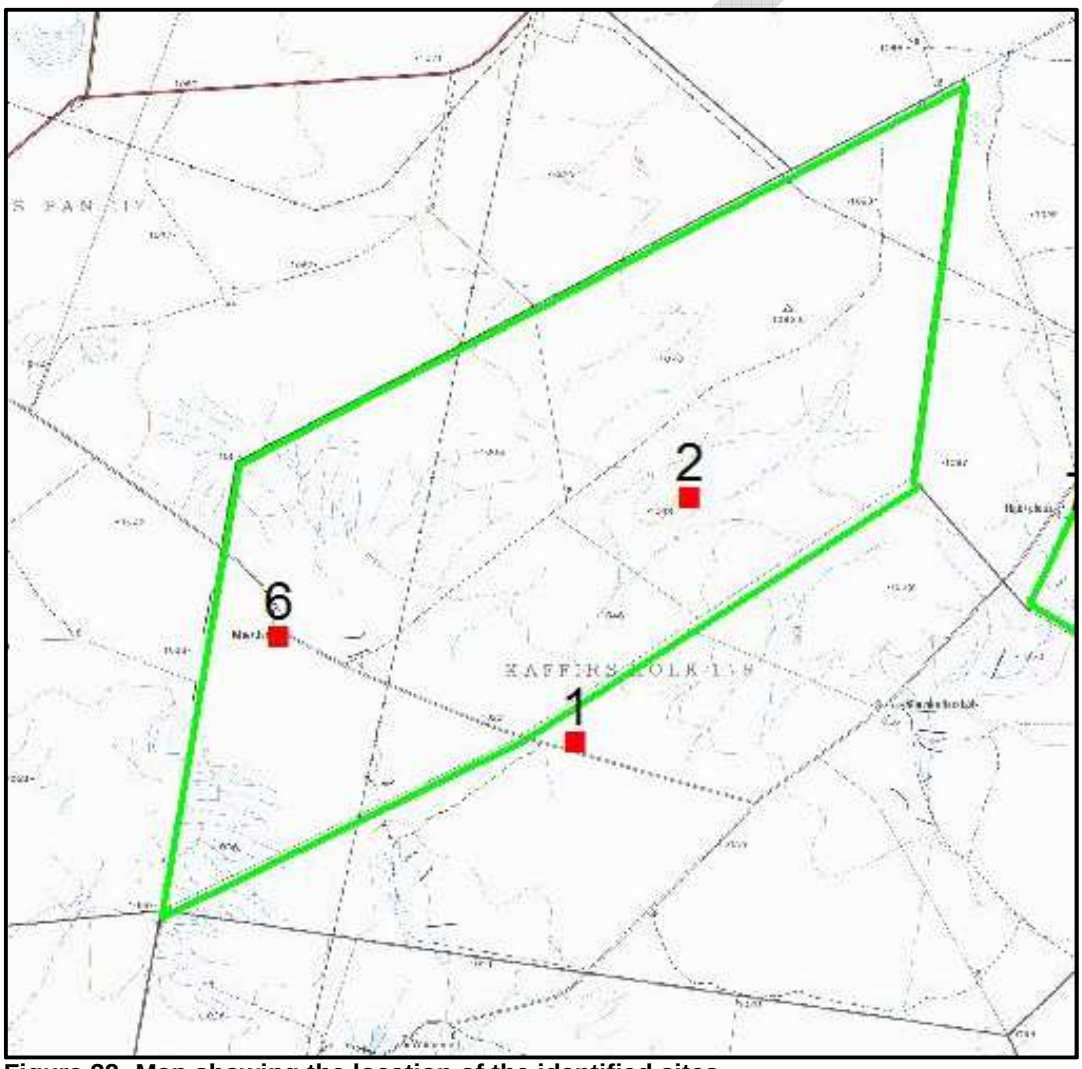

Figure 32: Map showing the location of the identified sites

Archaeological Sites

Table 7: Archaeological sites Identified on the proposed site

Location	No. 1 No. 2	S 30.09346 S 30.07039	E 22.34082 E 22.35148
Description			
Stone tools were identified to occur specifically in areas where there are outcrops or low hills and most commonly date to the Middle Stone Age, although one site also included material that can be dated to the Later Stone Age. None of the sites can be classified as quarry sites or factory sites and no indication of human settlement was found. Because of their location the sites are viewed to be lookout points where people watched for game. The material used for the production of the tools is hardened shale, chalcedony and quartzite and the tools include retouched flakes, blades and scrapers. One hammer stone was found with the LSA material. The density of the tool scatters varies between 1 artifact per 1m² to 10 artifacts per 1 m². None of these areas are bigger than 20 x 20 metres.			
Significance	High on a regional level – Grade III		
Mitigation			
There must be hundreds of similar occurrences in the larger region. As they are all surface finds, their significance is judged to be low. However, as very little is known about the Stone Age occupation of the larger region, studying of these sites might contribute to a better understanding of the prehistory of the region. As first option it is therefore recommended that these areas are avoided if possible. If that is not possible, it is recommended that systematic surface collections are made and that this material is housed at a museum. This can only be done under a permit from SAHRA.			

Figure 33: The material identified on the various Stone Age sites

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 windmills 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 8: Farmsteads Identified on the proposed site

Location	No. 6	S 30.08356	E 22.31290
The Mierdam farmstead dates to the 1940s, but burned down during the 1970s. Only one of the outbuildings remained, but has since been renovated and altered to some extent .It is rectangular, built with bricks, have a corrugated iron roof and wooden window frames.			
Significance	High on a regional level – Grade III		
Mitigation			
This building, although older than 60 years, is not viewed to have high significance. It is also unlikely that it will be impacted on by the proposed development and as a result no mitigation is necessary.			

Figure 34: Farmstead on Mierdam Farm

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. The site is 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.

Table9: 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 forestry industries 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 Coloured and they mostly speak Afrikaans in the form of 'Kaapse Taal' (a creolised dialect of Afrikaans) and 'Pure Afrikaans' (formal Afrikaans).

7 SUMMARY OF THE PUBLIC PARTICIPATION PROCESS

Upon receipt of DEA's request for additional information for the amendment to the EA, the Public Participation Process (PPP) was initiated and ran parallel to the amendment application process in accordance with Regulation 54 of the EIA Regulations (2010). All I&APs registered on the EIA process database were notified of the amendment application as well as the availability of the draft environmental assessment report for the EA amendment. The draft environmental assessment report was made available for public review at various public venues, on SiVEST's website (www.sivest.co.za/downloads) or on CD (upon written request).

Comments received from I&APs during the review period will be incorporated in the Comments and Responses Report (C&RR) and comments that related to a specific environmental issue were forwarded to the environmental specialists for a response, where necessary.

The PPP for the amendment application was initiated on the 16th of November 2012. The stages that formed part of the public participation process to date are reflected in Figure 35 below:

Figure 35: Public Participation Process to date

All I&APs registered on the EIA process database were notified of the amendment application and additional members of the public who wished to be registered on the database as an I&AP were able to do so via telephone, fax, email, or post.

On-going consultation with key stakeholders (e.g. local authorities, relevant government departments, local business etc.) and identified I&APs ensured that I&APs were kept informed regarding the amendment application process. Networking with I&APs will effectively continue throughout the amendment application process until the final environmental assessment report is submitted to the DEA. Where required, stakeholders and I&APs were engaged on an individual basis.

The stages of the public participation process that will be conducted for the remainder of the amendment application process are indicated in the Figure 36 below.

Figure 36: Public Participation Process going forward

During the revision of the environmental studies, consultation was undertaken with individuals, businesses, institutions and organisations, and the following sectors of society have been identified and were afforded the opportunity to comment (the full stakeholder database list is also included in Annexure 5F of the environmental assessment report):

- Siyathemba Local Municipality
- Pixley ka Seme District Municipality
- Department of Water Affairs (DWA)
- Department of Agriculture Forestry and Fisheries (DAFF)
- Northern Cape Department of Environmental and Nature Conservation (NCDENC)
- South African National Roads Agency Limited (SANRAL)
- Northern Cape Department of Transport, Roads and Public Works (NCDTRPW)
- South African Heritage Resource Agency (SAHRA)
- Northern Cape Department of Heritage
- Eskom Holdings SOC Limited
- Square Kilometre Array (SKA)
- South African Civil Aviation Authority (SACAA)
- Air Traffic Navigation Services (ATNS)
- Transnet Freight Rail
- Telkom
- Endangered Wildlife Trust (EWT)
- Wildlife and Environment Society of South Africa (WESSA)
- Birdlife South Africa

7.1 Consultation and Public Involvement

Through the consultation process, issues for inclusion within the environmental assessment report were identified and confirmed. Telephonic discussions and one-on-one consultation was undertaken as necessary.

7.1.1 Identifying stakeholders and announcing the opportunity to participate

In order to identify additional I&APs and invite I&APs registered on the EIA process database to participate, use was made of:

- Print media – to advertise the start of the amendment application process and invite I&APs to register.
    - *Die Echo* (English and Afrikaans)
- E-mail – I&APs registered on the EIA process database were sent an electronic copy of the amendment application notification letter as well as the registration and comment form.
- Site notices – placed at the boundaries of Mierdam farm (Proofs included in Appendix 5A)
- Referrals

A database of I&APs was compiled and is included in Appendix 5F.

7.2 Notification to Interested and Affected Parties

Communication with I&APs was by telephone, faxes and email in order to obtain the necessary background information to compile this environmental assessment report. The advertising process was followed in terms of Section 54 of the EIA Regulations published in Government Notice No. R.543 in Government Gazette No. 33306 of 18 June 2010, in terms of Section 24(5) of the NEMA, as amended.

Annexure 5 includes all proof of notification to Interested and Affected Parties:

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

As stakeholders responded to the advertisements, they were added to the database and sent letters of invitation to participate in the amendment application.

7.2.1 Site Notices

Site notices (size as per regulations) were placed at the boundary of the proposed site, i.e. Mierdam farm. Refer to Appendix 5A.

7.2.2 Advertisements

In accordance with the requirements of the EIA Regulations, the project was announced in a local newspaper (Annexure 5C). The newspaper in which the BA process advertisement was placed is:

Table 10: Newspaper Advertisement

Newspaper	Language	Publication date
Die Echo	English and Afrikaans	16 November 2012

7.3 Comments and Response Report

Issues, comments and concerns raised during the public participation process have been captured in the Comments and Response Report (C&RR) – Appendix 5E. The 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. A separate section will be added to the C&RR for inclusion in the final environmental assessment report, in order to reflect comments received from I&APs which specifically relate to the draft environmental assessment report.

7.4 Public Comments on Draft Environmental Assessment Report

The draft environmental assessment report will be made available for public review prior to submission to DEA, the competent authority. The availability of the draft environmental assessment report was advertised in the following print media:

- *Die Echo* (in English and Afrikaans)

As per the EIA Regulations, the report was out for public review and comment for a 30 day comment period. The comment period is from Tuesday 05 February 2013 until Wednesday 06 March 2013 (end of business day). Written notice was given to all registered I&APs as well as all key stakeholders on the database that the draft environmental assessment report was available for public review.

Electronic copies (CD) of the report were also made available and were distributed on written request. The report was made available at the following venue

Table 11: Venues where the draft environmental assessment report was publically available

Venue	Address	Hours	Contact Details
Prieska Library	Steward Street, Prieska	Mondays – Fridays 09h00 – 17h00	053 353 5300 x 305
Alfa Library	Alfa Street, Prieska	Mondays – Fridays 09h00 – 17h00	053 353 5300 x 307

7.5 Public Meeting

As explained above, the increased capacity would fit within the approved PV field (alternative 2) site and, it is unlikely to result in any additional significant negative environmental impacts. As such, a focused public participation process was undertaken in accordance with Regulation 54 of the EIA Regulations (2010). For the above reason and due to the lack of attendance at the public meeting held during the EIA, no additional public meetings were held.

7.6 Public Comments on Final Environmental Assessment Report

Once the final environmental assessment report is submitted to the DEA, the public are welcome to once again make comment on the report. The report will be available on the SiVEST website (http://www.sivest.co.za/Download.aspx then browse to the folder '*10777 Mierdam PV Amendment Application'*). These comments must however be submitted directly to the DEA and a copy of such comments must be copied to SiVEST.

8 SPECIALIST STUDIES

The following specialist studies were updated and revised in order to address the impacts associated with the proposed 75MW PV plant, as opposed to the originally authorised 40MW PV plant:

- 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

The findings of these revised studies are presented below.

8.1 Biodiversity

The site is very uniform in nature with very few distinct sensitive areas. 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. The sensitivity map below should be viewed in conjunction with the surface water specialist input which details surface water features in more detail.

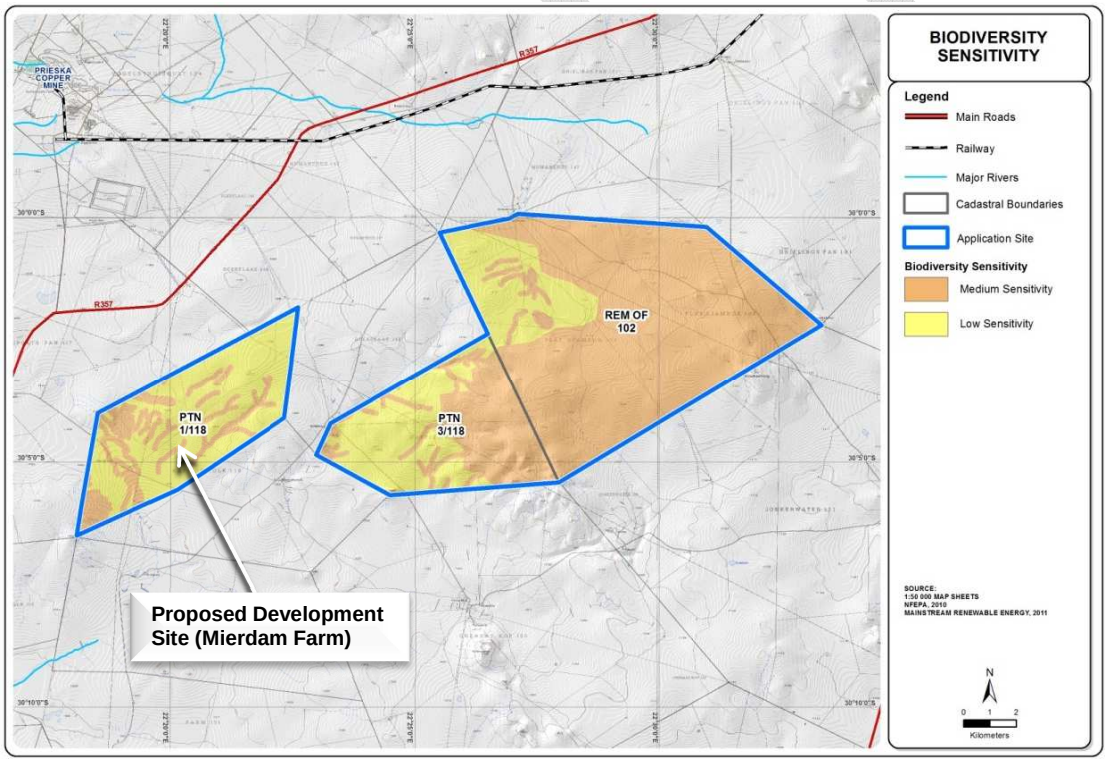

Figure 37: Biodiversity Sensitivity

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.

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 site being located in the western part of the farm. Thus none of the PV infrastructure is located in areas of particular sensitivity and thus relocating the infrastructure would appear to be unnecessary.

The proposed solar plant is 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* 2009 showed preliminary results that 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), 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 Bird Life 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 (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 Bird Life International (Bird Life 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 on the neighbouring Platsjambok farm.

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 (Bird Life 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 Bird Life 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 (Bird Life 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 Secretary bird 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 amendment application. 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 features should 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.

The alignment of roads was not specified at the time of undertaking the surface water assessment, therefore it was not possible to individually assess the impact of roads on the drainage lines within 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 plant

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 layout are discussed below.

8.2.5 Implications of the proposed final PV layout and Infrastructure

Analysis of the 1:50 000 maps indicate that the site has ephemeral drainage lines running through it. Although the PV layout is not considered to be a fatal flaw from a surface water perspective, it is recommended that if possible the layout of the PV panels be altered slightly to limit the physical impact of the proposed PV arrays on the drainage lines. In order to ensure this, it is advisable that a walk through by the surface water specialist be undertaken prior to finalising the exact layout of the panels within the PV field,
. The detailed stormwater design should also 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 the 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 field. The photovoltaic (PV) plant will have a maximum capacity of 75MW and cover an area of approximately 192 ha on Portion 1 of Mierdam. If grazing is not permitted within the PV Field approximately 7% 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.
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 38**).

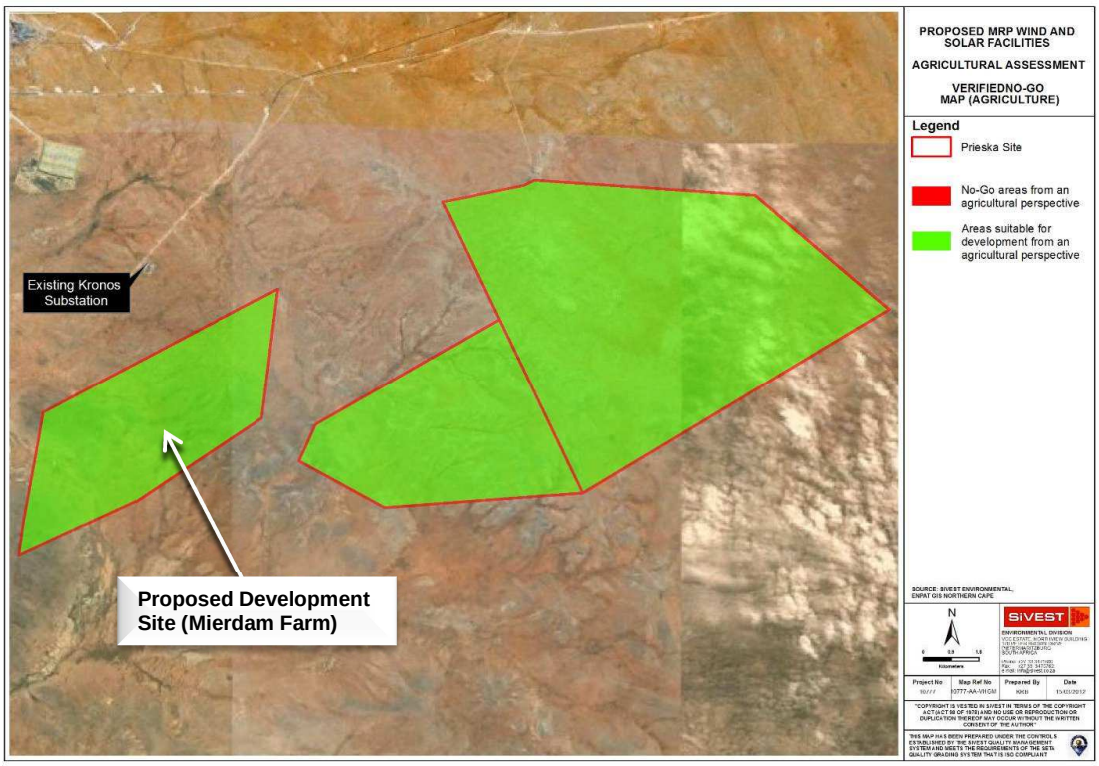

Figure 38: No Go Area Map from an Agricultural Perspective

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 field as undertaken later in this report.

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

Table 12: 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 15 static 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 field, 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 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 1½ 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.

Receptor Location	Visual Contrast	Visual Intrusion created?
Klippan	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 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**	The site 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 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 feature on the northern horizon, 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 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.**
Vrugbaar	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.

The only location likely to be subject to a visual impact would be the Humansrus Farmstead, which is owned / occupied by a landowner of the site who would be likely to financially benefit from the proposed development, so it is thought that it would be highly unlikely that the inhabitants would be sensitive to the proposed PV plant 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 (1a and 1b) were assessed during the EIA phase and either alternative has been approved by the DEA to provide grid access to the Mierdam Farm.

Importantly from a visual impact perspective, both the proposed alignments *run parallel to existing power lines.* The alignments would either 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.

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 13: 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-economic impacts that could be expected as a result of the project are discussed 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

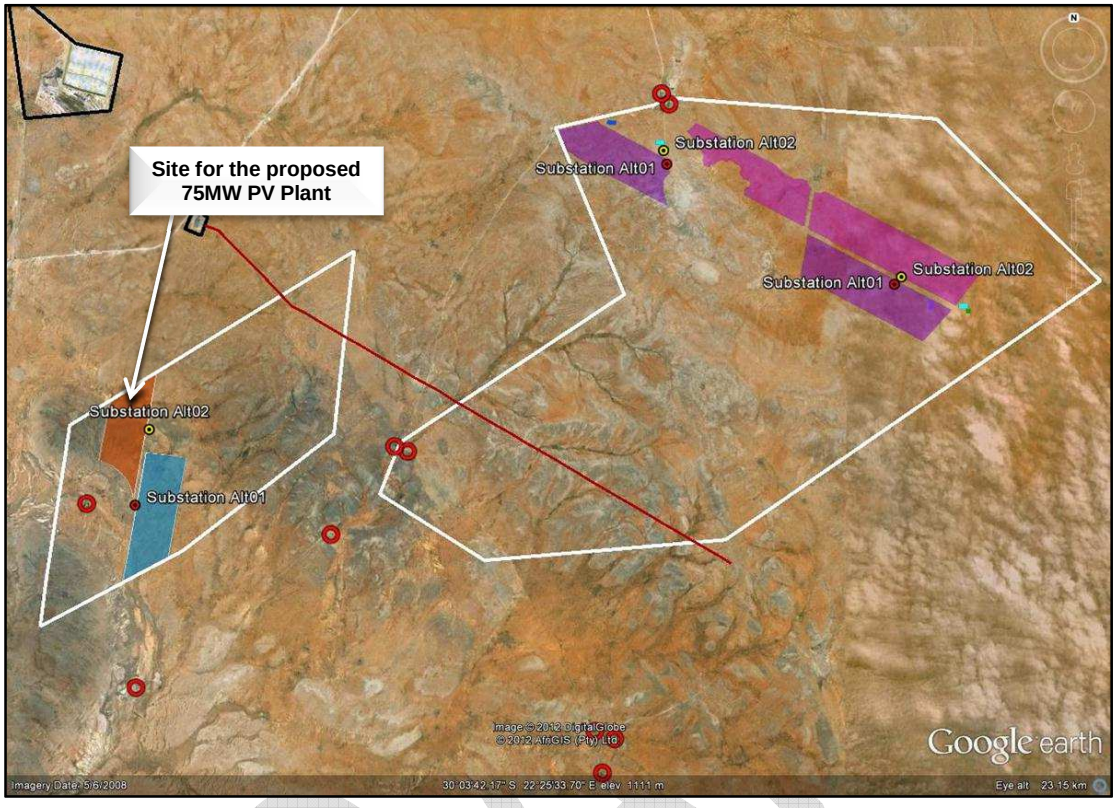

Figure 39: Buildable area and other infrastructure in relation to social sensitive areas (the red rings are indicative of socially sensitive areas)

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.

- o Influx of construction workers

Table 14 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 14**:** 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.

The construction period is expected to last between 13-24 months. On a construction period of 13 months, the total number of people on site per month is expected to be in the region of 70 people. 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 followed, the sudden influx of approximately 650 people at the peak of construction will result in a temporary population increase of approximately 5.8%, 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 13 – 24 months), the 75MW solar plant is expected to create around 1050 jobs within the local area, with 400 sourced locally (38%), 525 or 50% sourced on a national level and 125 or 12% from abroad. The direct increase in local production could be close to R 51m per annum for the four year period.

    - Economic Multiplier Effects

It is estimated that additional temporary jobs in the local economy could be around 7 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 R1.4m due to supply linkages with the construction of the Prieska solar plant. The induced effect of income spending by local workers directly and indirectly employed through the solar plant could result in an additional R3m output generated for the local economy and an associated 10 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 92 jobs and R22m per annum respectively with an additional R4m in output and close to 14 jobs expected to result to be induced nationally 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 plant on local and national employment and output levels is expected to last four years and can be summarised as follows:

Table 15: Total annual impact of the solar facility on local and national employment

Type of impact	Local employment (nr of jobs)	Local output: Gross	% of local Siyathema [(1)]	% of local Siyathema [(1)] output	Employment SA (incl local)	Output SA (incl local) Gross	% of SA employment (total=8.2m	% of SA output (total =

		value added (Rm)	employment (3 276 jobs in 2010)	(R656m in 2010)	(nr of jobs)	value added (Rm)	formal jobs in 2010)	R2412bn in 2010)
Direct impact	400	51	12.2%	7.8%	1 050	51	0.01%	0.002%
Indirect impact	7	2	0.2%	0.3%	99	24	-	-
Induced impact	10	3	0.3%	0.5%	24	7	-	-
Total impact	**417**	**56**	**13.0%**	**8.6%**	**1 173**	**82**	**0.01%**	**0.003%**

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

Table 16: 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	= 590 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	= 33%
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	= 28%

Table 17: 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	= 410 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	= 23%
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	= 20%

- 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. As far as could be determined there are 13 guesthouses/B&Bs, 1 hotel and 1 guest farm in Prieska and surrounds. 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.

- o 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.

- o 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.

- o 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, 55 permanent jobs are expected to be created mainly locally sourced jobs (49). The solar plant could in addition be expected to add an additional R 21m 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 5m to the local economy and around R6m to the broader national economy resulting in an additional 11 local jobs and 12 national jobs.

In addition, R4m in local output and close to 12 local jobs could be induced from spending of local salaries and wages directly or indirectly earned during construction. In the broader national economy an additional R1m and 4 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 plant on local and national employment and output levels can be summarised as follows:

Table 18: 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	49	21 (excluding profits)	1.5%	3.2%	55	130 including profits	-	-
Indirect impact	11	5	0.3%	0.7%	23	11	-	-
Induced impact	12	4	0.3%	0.7%	16	5	-	-
Total impact	**72**	**30**	**2.2%**	**4.6%**	**94**	**146**	**-**	**-**

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

Number of jobs created for local people by the PV plant	**= 72 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	**= 3.6%**
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	**= 3.5%**

- 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

Additional Central Government Tax Revenue

For the PV plant an additional R38m (26% of R146m value added) of central tax revenue could be expected.

Net Income to Local Government

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

Social funds for the enterprise development fund and social economic development fund will be approximately R 2m and R6m of 5% retained profits per annum, i.e. a total of close to R 8m per annum or 1.2% 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.

All actual contributions and commitments will be firmed up as this project is bid under the REIPPPP. Hence, these possible revenue flows may change.

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 kilometre respectively.

The solar plant is assumed to take about 3ha per MW, i.e. given the 75MW planned, about 192 ha or 1.92 square km of agricultural land could potentially be lost due to the solar plant. As such, approximately 7% of the total land area covered by the Mierdam site will be lost, which is relatively inconsequential within the context of the relatively large farm properties and very low density of rural settlement across the wider area. Agricultural output could hence decline with approximately R21 321 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 favorite 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 Assessment 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 21.

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 20: 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 21: 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

IMPACT TABLE FORMAT		
Duration	A brief description of the amount of time the proposed activity is likely to take to its completion	
Cumulative effect	A brief description of whether the impact will be exacerbated as a result of the proposed activity	
Intensity/magnitude	A brief description of whether the impact has the ability to alter the functionality or quality of a system permanently or temporarily	
Significance Rating	A brief description of the importance of an impact which in turn dictates the level of mitigation required	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	4	1
Probability	4	1
Reversibility	4	1
Irreplaceable loss	4	1
Duration	4	1
Cumulative effect	4	1
Intensity/magnitude	4	1
Significance rating	-96 (high negative)	-6 (low negative)
Mitigation measures	Outline/explain the mitigation measures to be undertaken to ameliorate the impacts that are likely to arise from the proposed activity. Describe how the mitigation measures have reduced/enhanced the impact with relevance to the impact criteria used in analyzing the significance. These measures will be detailed in the EMPr.	

9.2 Environmental Impact Assessment

9.2.1 Construction Phase Impacts

- Construction - Biodiversity

Table 22: 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.
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.

IMPACT TABLE		
	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. ▪ 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 23: 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.

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	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 24: 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)	
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	**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 section 10.2.	

Table 25: Rating of impacts related to destruction of foraging habitat for bats

IMPACT TABLE	
Environmental Parameter	Destruction of foraging habitat

IMPACT TABLE		
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.	
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:** Low negative 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

- Construction – Surface Water

Table 26: Rating of impacts related to surface water features

IMPACT TABLE		
Environmental Parameter	Surface Water Impacts	
Issue/Impact/Environmental Effect/Nature	The construction of 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)

IMPACT TABLE	
Mitigation measures	▪ Refer to section 10.2.

- Construction – Agricultural Potential and Soils

Table 27: 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)

IMPACT TABLE	
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: o Clearing activities should be kept to a minimum (road and PV site footprint). o In the unlikely event that heavy rains are expected activities should be put on hold to reduce the risk of erosion. o 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

- Construction – Visual

Table 28: 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	▪ 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.	

- Construction – Heritage

Table 29: 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

IMPACT TABLE		
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 30: 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
Irreplaceable loss of resources	Complete loss of resources
Duration	Permanent
Cumulative effect	High

IMPACT TABLE		
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 31: 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

IMPACT TABLE		
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.	

- Construction – Socio-economic

Table 32: Rating of impacts related to employment and output creation

IMPACT TABLE	
Environmental Parameter	Employment and output creation in the construction phase
Issue/Impact/Environmental Effect/Nature	The creation of local jobs and income during the construction of the PV plant
Extent	400 local jobs and R51m towards local production per annum for 4 years.
Probability	High
Reversibility	N/A
Irreplaceable loss of resources	N/A
Duration	2 years

IMPACT TABLE		
Cumulative effect	An additional 17 jobs and R5m in local output per annum due to indirect and induced effects during construction. Total impact = 13% of local employment and 9% of local output)	
Intensity/magnitude	High	
Significance Rating	High	
	Pre-mitigation impact rating	**Post mitigation impact rating**
Extent	3	4
Probability	4	4
Reversibility	N/A	N/A
Irreplaceable loss	N/A	N/A
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 33: 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 focuses 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

IMPACT TABLE	
	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 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

IMPACT TABLE		
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 34: 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 in 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 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

IMPACT TABLE		
	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)
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.

9.2.2 Operational Phase Impacts

- Operation – Biodiversity

Table 35: 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	
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

IMPACT TABLE		
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 36: 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).
Reversibility	The impact is partly reversible but more intense mitigation measures are required.
Irreplaceable loss of resources	The impact will result in marginal loss of resources
Duration	The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 50 years)
Cumulative effect	The impact would result in minor cumulative effects
Intensity/magnitude	Impact alters the quality, use and integrity of the system/component but system/ component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).
Significance Rating	**Prior to mitigation measures:** There will be a negative low impact i.e. the anticipated impact

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

Table 37: 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)

IMPACT TABLE		
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)
Mitigation measures	▪ Refer to section10.2.	

- Operation – Surface Water

Table 38: 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)

IMPACT TABLE		
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.	

- Operation – Agricultural Potential and Soils

Table 39: 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

IMPACT TABLE		
	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
Duration	3	3
Cumulative effect	1	1
Intensity/magnitude	1	1
Significance rating	-12 (low negative)	-12 (low negative)
Mitigation measures	▪ No viable recommendations.	

- Operation – Visual

Table 40: 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)

IMPACT TABLE		
Intensity/magnitude	Low (1)	
Significance Rating	**Low Negative Impact**	
	Pre-mitigation impact rating	**Post mitigation impact rating**
Extent	2	2
Probability	4	4
Reversibility	2	2
Irreplaceable loss	2	2
Duration	3	3
Cumulative effect	2	2
Intensity/magnitude	1	1
Significance rating	-15 (low negative)	-15 (low negative)
Mitigation measures	▪ Refer to section 10.2.	

- Operation – Heritage

Table 41: 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

IMPACT TABLE		
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 42: 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

IMPACT TABLE		
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 43: 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

IMPACT TABLE		
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.	

- Operation – Socio-economic

Table 44: 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	49 local jobs and R21m 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 23 jobs and R9m in local production due to

IMPACT TABLE		
	backward linkages and spending multipliers. Total impact = 2.0% of local employment and 5% of local output.	
Intensity/magnitude	Medium	
Significance Rating	Medium	
	Pre-mitigation impact rating	**Post mitigation impact rating**
Extent	1	2
Probability	4	4
Reversibility	N/A	N/A
Irreplaceable loss	N/A	N/A
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 45: 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 R38m Net increase in local government income due to increase in property taxes
Probability	High
Reversibility	N/A
Irreplaceable loss of resources	N/A
Duration	As long as the PV Plant is in operation

IMPACT TABLE		
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	N/A	N/A
Irreplaceable loss	N/A	N/A
Duration	3	3
Cumulative effect	4	4
Intensity/magnitude	1	1
Significance rating	14 (low positive)	14 (low positive)
Mitigation measures	▪ None	

Table 46: 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 is expected to be paid out as a community dividend as part of a community development fund.
Extent	Total social funds for 75 MW solar plant: R 8m per annum, 1% of local production
Probability	Medium
Reversibility	N/A
Irreplaceable loss of resources	N/A
Duration	As long as the PV Plant is in operation

IMPACT TABLE		
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	2	3
Significance rating	18 (low positive)	36 (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 47: 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 R25 000 in output and no jobs lost per annum
Probability	Low
Reversibility	High
Irreplaceable loss of resources	Low
Duration	As long as the PV Plant is in operation
Cumulative effect	Low

IMPACT TABLE		
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 48: 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
Duration	As long as the PV Plant is in operation
Cumulative effect	Low
Intensity/magnitude	Low
Significance Rating	Low

IMPACT TABLE		
	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	-9 (low negative)	-9 (low negative)
Mitigation measures	▪ None	

Table 49: 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	
Cumulative effect	Low	
Intensity/magnitude	Low	
Significance Rating	Low	
	Pre-mitigation impact rating	**Post mitigation impact rating**
Extent	1	1
Probability	1	1

IMPACT TABLE		
Reversibility	2	2
Irreplaceable loss	1	1
Duration	3	3
Cumulative effect	1	1
Intensity/magnitude	1	1
Significance rating	-9 (low negative)	-9 (low negative)
Mitigation measures	▪ None	

Table 50: 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 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

IMPACT TABLE		
	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	-28 (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.	

9.2.3 Decommissioning Phase Impacts

- Decommissioning – Biodiversity

Table 51: 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).

IMPACT TABLE FORMAT		
Reversibility	The impact is partly reversible but more intense mitigation measures are required.	
Irreplaceable loss of resources	The impact will result in marginal loss of resources	
Duration	The impact and its effects will 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	2
Irreplaceable loss	2	1
Duration	1	1
Cumulative effect	1	1
Intensity/magnitude	1	1
Significance rating	+8 (low positive)	+8 (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.	

IMPACT TABLE FORMAT	
	▪ Constant removal of alien invasive species in and around plant.

Table 52: 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.	
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**

IMPACT TABLE FORMAT		
Extent	1	1
Probability	2	2
Reversibility	1	1
Irreplaceable loss	2	1
Duration	1	1
Cumulative effect	3	3
Intensity/magnitude	1	1
Significance rating	+10 (low positive)	+10 (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).	

- Decommissioning – Surface Water

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

- Decommissioning – Agricultural Potential and Soils

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

- Decommissioning – Visual

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

- Decommissioning – Heritage

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

- 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 53: 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 are anticipated.
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 often

	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:

- o A walk through of the more sensitive areas on the site should be undertaken to search for and rescue any plants of botanical or ecological significance and to ensure the PV layout avoids any rare mammal breeding sites.

- Construction site specific mitigation measures

The following mitigation measures are recommended for the study area:

- o An on-site ecologist should be present when excavation takes place to ensure that any uncovered species are protected from destruction.
- o Demarcation of sensitive areas prior to construction activities starting.
- o Appropriate construction methods should be used in sensitive areas.
- o Intensive environmental audits (frequently in sensitive areas) should be undertaken by an independent party during the construction period.
- o A copy of the Environmental Assessment 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.
- o 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 should be undertaken as soon as possible after construction in sensitive areas.
- Only vegetation within the development site 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.
- Rehabilitation should be with correct locally indigenous species.
- A monitoring programme should be implemented to ensure that rehabilitation efforts are successful and to ensure that risks such as erosion and the edge effect are avoided.
- The area should be constantly maintained to ensure re-colonisation of floral species.
- Alien species that may jeopardise the proliferation of indigenous species should be regularly removed.

- 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

- 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.
  - 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.

- 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.

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

- 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 ECO 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 do 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

- New and existing local businesses should be linked to the supply chain of the PV Plant.

Corporate Social Investment

- The most effective community structures should be used 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

- 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 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
- 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 7.

12 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 54 below indicates that all applicable performance standards have been complied with.

The performance standards which have not been addressed at this stage as indicated in Table 54 below will be addressed at a later stage when the proponent has reached financial closure.

Therefore, the compliance level is partially compliant at this stage. It is important to note that the project proponent is committed to achieving compliance with the EPs.

The coding key is as follows:

Compliance level			
Clear			
Not assessed/determined	Not compliant	Partially compliant	Compliant

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

Table 54: 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	Refer to Appendix 10

	course as part of the development planning for the project.	
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	Refer to Appendix 10

	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.	
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**

13 EVALUATION AND RECOMMENDATIONS

Table 55 summarises the key recommendations for the environmental issues identified in the amendment application. 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 assessment must be included within an Environmental Management Programme (EMPr). The EMPr should form part of the contract with the contractors appointed to construct and maintain the proposed PV facility. 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 as Appendix 7 of this environmental assessment report.

It is also recommended that the process of communication and consultation with the community representatives be maintained during the construction phase associated with the proposed project.

13.1 Summary of Findings

Table 55: 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 through of the more sensitive areas on the site should be undertaken to search for and rescue any plants of botanical or ecological significance and to ensure the PV layout avoids any rare mammal breeding sites. ▪ 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	The PV layout should be altered slightly to limit the physical impact of the proposed PV arrays on the drainage lines. ▪ It is advisable that walk through by the surface water specialist be undertaken prior to finalising the exact layout of the panels within the PV field, ▪ No power line towers should be located within any

	significant impacts on surface water features and therefore the mitigation measures (provided) will need to be adhered to.	surface water feature.
Agricultural Potential and Soils	The site is not classified as high potential nor is it a unique dry land agricultural resource. The study 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 field. 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 Field. 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. .
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 layout and the key observation locations. The thick vegetation that surrounds	▪ None.

	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 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 and a farmstead. All of the identified sites are located outside the PV layout. They are classed as having high significance on a regional level.	▪ Sensitive heritage resource areas are to be excluded as no-go areas and 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.	▪ Address all social issues identified by engaging social specialists where necessary or by ensuring that ECO used during construction have the

	In certain instances the implementation of mitigation 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	necessary knowledge and skills to identify social problems and address these 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".

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

Key

LOW NEGATIVE	-6 to -28	**LOW POSITIVE**	6 to 28
MEDIUM NEGATIVE	-29 to -50	**MEDIUM POSITIVE**	29 to 50
HIGH NEGATIVE	-51 to -73	**HIGHPOSITIVE**	51 to 73

Table 56: 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 57: 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 58: 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)

13.2 Conclusion

The findings of the specialist studies undertaken and revised for this amendment application provide an assessment of both the benefits and potential negative impacts anticipated as a result of the proposed 75MW PV facility. The findings conclude that there are no environmental fatal flaws that should prevent the proposed project from proceeding and the surrounding environment would be able to accommodate the increased capacity with minimal additional adverse impacts. 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 assessment that the proposed facility will result in limited potential negative impacts and certain positive impacts.

Further to the above, it was demonstrated in the environmental assessment report that a detailed public participation process was followed during the amendment application process, which conforms to the public consultation requirements as required by the DEA in their letter dated 02 November 2012 and as stipulated in the EIA Regulations. In addition, all issues raised by I&APs were captured in the environmental assessment report and where possible, mitigation measures provided in the EMPr to address these concerns.

We are therefore of the view that:

- The negative environmental impacts of the 75MW PV facility are expected to be similar in extent to those already mentioned in the Final Environmental Impact Assessment Report (FEIR) for the proposed 40MW PV Facility as the increased capacity will fit within the already assessed and approved site.
- 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 75MW PV facility can be mitigated to acceptable levels

It is trusted that this environmental assessment report provides the reviewing authority with adequate information to make an informed decision regarding the proposed project.

It is the opinion of the EAP that the proposed 75MW PV facility should be allowed to proceed provided that the recommended mitigation measures are implemented.

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