Final EIA Report **14/12/16/3/3/2/614**

PROPOSED RENEWABLE ENERGY GENERATION PROJECT ON THE FARM RHODES No. 269, KURUMAN RD, JOE MOROLONG LOCAL MUNICIPALITY, JOHN TAOLO GAETSEWE DISTRICT MUNICIPALITY, NORTHERN CAPE PROVINCE

Short name: RHODES 1 SOLAR PARK

September 2014

Commissioned by: Mira Energy(Pty) Ltd
Document version 2.0 – Final

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Purpose with Passion

Proposed Renewable Energy Generation Project on the Farm Rhodes No. 269, Kuruman RD, Joe Morolong Local Municipality, John Taolo Gaetsewe District Municipality, Northern Cape Province Short name: Rhodes 1 Solar Park

September 2014

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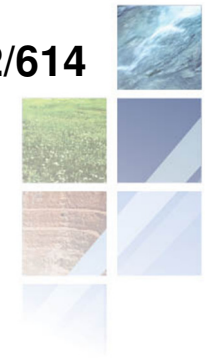

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PROJECT MAIN FEATURES

Project main features - according to the EIA guidelines
Summary of information included in the report

General site information

Site location	
Farm	**RHODES 269 KURUMAN RD**
Portion	**(Portion 0)**
Surveyor-general 21 digit site	C04100000000026900001
Local Municipality	Joe Morolong
District Municipality	John Taolo Gaetsewe
Province	Northern Cape

Property details	
Extent	1810.8314 hectares
Land Owner	HAUMAN FAMILIE TRUST
Diagram deed number	G30/1947
Title deed number	T3472/2013
Registration date	20131030
Current land use	Farming

Site data(planned footprint)	
Alternative Location 1 Geo-graphical co-ordinates	Latitude: 27° 08' 30" S Longitude: 22° 58' 00" E
Alternative Location 2 Geo-graphical co-ordinates	Latitude: 27° 08' 40" S Longitude: 22° 57' 20" E
Altitude	1030 to 1045 m a.m.s.l.
Ground slope	flat

Adjacent farm portions	
Farm **Portion** Surveyor-general 21 digit site Land Owners Diagram deed number Title deed number Registration date Extent Current land use	**EAST 270 KURUMAN RD** **Remainder Portion** C04100000000027000000 PRETORIUS JACOBUS NICOLAAS PRETORIUS HELETTA ROSIA G25/1954 T791/2002 20020402 964.2695 hectares Farming
Farm **Portion** Surveyor-general 21 digit site Land Owners Diagram deed number Title deed number Registration date Extent Current land use	**EAST 270 KURUMAN RD** **Portion 1** C04100000000027000001 SISHEN IRON ORE COMPANY PTY LTD T479/1958 T1998/2004 20040624 42.8266 hectares Mining
Farm **Portion** Surveyor-general 21 digit site	**EAST 270 KURUMAN RD** **(Portion 2)** C04100000000027000002

Land Owner	PRETORIUS JACOBUS NICOLAAS&HELETTA ROSIA
Diagram deed number	T993/1972
Title deed number	T3469/2013
Registration date	20131030
Extent	856.5320 hectares
Current land use	Farming
Farm	**GASESA 272 KURUMAN RD**
Portion	**(Portion 1)**
Surveyor-general 21 digit site	C04100000000027200001
Land Owner	TSINENG COMMUNAL PROPERTY ASSOCIATION
Diagram deed number	T145/1931
Title deed number	T175/2010
Registration date	20100203
Extent	966.9795
Current land use	Farming
Farm	**MATLIPANI 222 KURUMAN RD**
Portion	**(Portion 0)**
Surveyor-general 21 digit site	C04100000000022200000
Land Owner	VAN DER WESTHUIZEN ADRIAAN JOCOBUS
Diagram deed number	G12/1929
Title deed number	T1771/1976
Registration date	19761207
Extent	1037.3005 hectares
Current land use	Farming
Farm	**BOWDEN 223 KURUMAN RD**
Portion	**Reminder Portion**
Surveyor-general 21 digit site	C04100000000022300000
Land Owners	MOSHAWENG PLAASLIKE MUNISIPALITEIT
Diagram deed number	G2/1929
Title deed number	T3317/2008
Registration date	20080930
Extent	1214.7893 hectares
Current land use	Farming
Farm	**DIKGATHLONG 268 KURUMAN RD**
Portion	**Remainder Portion**
Surveyor-general 21 digit site	C04100000000026800000
Land Owner	STOLS HESTER MAGDALENA GERTRUIDA
Diagram deed number	G4/1924
Title deed number	T403/1992
Registration date	19920330
Extent	1971.3583 hectares
Current land use	Farming
Farm	**N'ÇHWANING 267 KURUMAN RD**
Portion	**Remainder Portion**
Surveyor-general 21 digit site	C04100000000026700000
Land Owner	REYNECKE ENGELA ELIZABETH
Diagram deed number	G12/1940
Title deed number	T1492/1970
Registration date	19701210
Extent	1574.2678
Current land use	Farming
Farm	**GLORIA 266 KURUMAN RD**
Portion	**(Portion 1)**
Surveyor-general 21 digit site	C04100000000026600001
Land Owner	ASSMANG LTD
Diagram deed number	T291/1941
Title deed number	T506/1966

Registration date	19660804
Extent	2000.0001 hectares
Current land use	mining

PV power plant design specifications and connection to the Eskom grid

Project data	
Project name	**RHODES 1 SOLAR PARK**
Technology	**Photovoltaic power plant**
Number of Phases	**1**
Maximum generating capacity at the delivery point	**up to 75 MW**
Type of PV modules	Thin-film or Mono/Polycrystalline
Type of mounting system	fixed or horizontal single-axis trackers (SAT)
Average annual energy production (up to)(*)	up to 160GWh/year with fixed mounting system up to 190GWh/year with trackers
Load factor (*)	0.223 with fixed mounting system 0.251 with trackers
Full net equivalent hours (EOH) (*)	1950h/year (Wh/Wp/y) with fixed mounting systems 2200 h/year (Wh/Wp/y) with trackers
(*) calculated by PVSYST, simulation professional tool	

Technical specifications	
Installed power capacity - AC side	**up to 75 MW**
Installed power capacity - DC side	**up to 86.25 MWp**
Number of PV modules	up to 638,900 thin film modules of 135 Wp up to 287,500 mono/polycrystalline modules of 300 Wp
Number of structures (PV arrays)	up to 24,570 fixed structures up to 15,130 1-axis horizontal trackers (SAT)
Minimum structure height above ground level	1.0 m
Maximum structure height above ground level	3.1 m

Other information	
Fenced area	up to 210 ha
Footprint	up to 210 ha
PV power plant lifetime	25 - 30 years
Construction camp (temporary)	10 ha
Construction timeframe	up to 15 months

Connection to the Eskom grid (**)
The connection to the Eskom grid will be done according to the Eskom connection solution which may require: (i) one small on-site high voltage substation with high-voltage power transformers, stepping up the voltage to the voltage of the Eskom's grid, a control building and one busbar with metering and protection devices (also called "switching station"); (ii) one or two high voltage power line(s), for the connection to the Eskom grid. The Rhodes 1 Solar Park may be connected either: a) to **Eskom "Hotazel - Heuningvlei" 132 kV power line**, running through the project site: the Eskom 132 kV power line to loop in and out of 132 kV busbar of new on-site substation via two new sections of 132 kV line ±100m long (***alternative connection 1 - preferred***); b) to the **Eskom Hotazel substation**, 7 km south of the project site, via a new 132 kV power line approximately 7.2 km long and running parallel to the existing Eskom "Hotazel - Heuningvlei" 132 kV power line (***alternative connection 2***); or c) to the new **Eskom Umtu substation**, 8 km south-west of the project site, via a new 132 kV power line approximately 10.2 km long and running parallel to the existing Eskom "Hotazel - Heuningvlei" 132 kV power line (for 5.7 km) and to the Eskom "Hotazel - Umtu" 132 kV power line (for 4.5 km) (***alternative connection 3***). The connection solution may also entail intervention on the Eskom's grid.
(**) Environmental Authorization is applied for, for alternatives 2 and 3 (Basic Assessment)

Water requirements	
Water consumptions	See paragraph 4.2.5 - water requirements

Site maps and GIS information

Status quo information - site	***ESRI shapefiles***
Site	Farm Rhodes 269 Kuruman RD, adjacent farm portions
Building and other structures	Boreholes
Agricultural field	Not applicable
Natural and endangered vegetation areas	Vegetation and sensitivity map, Gamagara Spruit, Kuruman Spruit
Cultural historical sites and elements	Not applicable
Contours with height references	2m contours
Slope analysis	2m contours
High potential agricultural areas	Not applicable
Eskom's substation(s) / power line(s)	Eskom Hotazel-Heuningvlei 132 kV power line, Eskom Hotazel-Umtu 132 kV power line, Eskom Umtu substation, Eskom Hotazel substation, Eskom Hotazel - Klipkop power line
Mines	Gloria mine, Hotazel mine, Kalagadi Manganese mine, N' Çhwaning mine

Development proposal maps	***ESRI shapefiles***
Project site	Farm Rhodes 269 Kuruman RD
Access road and internal roads	access road, internal roads
Position of solar facilities	PV arrays
Permanent laydown area footprint	Alternative Location 1, Alternative Location 2
Construction period laydown footprint	Construction camp
River, stream, drainage crossing	Not applicable
Substation and transformers	on-site HV substation
Connection routes	new sections of 132 kV power line, corridors route 1, corridors route 2
Buildings	MV stations, control building, warehouses

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Annexure M Consents and Approvals

ABBREVIATIONS AND ACRONYMS

AGES	Africa Geo-Environmental and Engineering Consultants (Pty) Ltd
BID	Background Information Document
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CSP	Concentrating Solar Power
DEA	Department of Environmental Affairs
DEAT	Department of Environmental Affairs and Tourism
DENC	Northern Cape Department of Environment and Nature Conservation
DoE	Department of Energy
DWA	Department of Water Affairs
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EIR	Environment Impact Assessment Report
EMP	Environmental Management Plan
ESS	Environmental Scoping Study
FIT	Feed in Tariffs
GHG	Green House Gases
GIS	Geographic Information Systems
GN	Government Notice
GWh	Giga Watt hour
I&AP	Interested and Affected Party
IDP	Integrated Development Plan
IEM	Integrated Environmental Management
IPP	Independent Power Producer
kV	kilovolt
MW	Mega Watt
MWp	Mega Watt peak
Mira Energy	Mira Energy (Pty) Ltd (applicant)
NEMA	National Environmental Management Act - Act no. 107 of 1998
NERSA	National Energy Regulator of South Africa
NHRA	National Heritage Resources Act - Act no. 25 of 1999
NWA	National Water Act - Act no. 36 of 1998
PoS	Plan of Study
Property	Farm Rhodes269
Project	Rhodes 1 Solar Park
Project company	Mira Energy (Pty) Ltd (applicant)
Project site	Farm Rhodes 269, Kuruman RD
PV	Photovoltaic
REFIT	Renewable Energy Feed-in Tariffs
RFP	Request For Qualification and Proposals For New Generation Capacity under the IPP Procurement Programme
SAHRA	South African Heritage Resources Agency
SANRAL	South African National Roads Agency Limited
SANS	South African National Standard
UPS	Uninterruptible Power Supply

1. INTRODUCTION

Mira Energy (Pty) Ltd (Reg. No. 2012/016683/07) is proposing the development of a **renewable solar energy facility** (with associated infrastructure and structures) in a key strategic location in terms of the connection to the Eskom grid and in terms of the favourable solar irradiation.

The proposed site is the **Farm Rhodes 269, Kuruman RD,** located in the **Joe Morolong Local Municipality, John Taolo Gaetsewe District Municipality, Northern Cape Province**, 7 km North of Hotazel and 50 km North of Kathu.

Site location: Farm Rhodes 269, Kuruman RD
Surveyor-general 21 digit site code:

C	**0**	**4**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**6**	**9**	**0**	**0**	**0**	**0**	**0**

The project is called **RHODES 1 SOLAR PARK** and it envisages the establishment of a **Photovoltaic (PV) Power Plant having a maximum generation capacity of 75 MW**.

The chosen property is located in an area with several manganese mines under operation and/or under construction, including the **Hotazel mine, Kalagadi Manganese mine and Assmang mines**. **The proposed solar park will help the Eskom grid to meet the high energy demand related to mining activities conducted in the area. Furthermore, being a renewable energy plant which doesn't generate CO_2 emissions - it will help to compensate for the CO_2 emissions arising from these mining activities.**

The PV power plant will have a **footprint up to 210 ha**, to be located on the southern side of the Farm Rhodes 269 (1,810.8314 ha in extent).

Two alternative development areas are proposed and discussed in this EIA Report:

a) **Alternative Location 1 (preferred location):** on the south-eastern side of the property, East of the 132 kV power line crossing the project site (Eskom "Hotazel - Heuningvlei" 132 kV power line);

b) **Alternative Location 2 (alternative location):** on the southern side of the property, parallel to the southern boundary of the farm, West and East of the Eskom "Hotazel - Heuningvlei" 132 kV power line.

The ***alternative connection 1*** resulted to be the **preferred development area**, being the best one from the ecological point of view; indeed the proposed footprint (210 ha) was optimized in order to include the *low to medium* ecological sensitivity areas located East of the Eskom 132 kV power line. This location is also preferred by the current landowner of the property.

The Rhodes 1 Solar Park will participate to the Renewable Energy Independent Power Producer (REIPP) Procurement Programme, issued on 3 August 2011 by the Department of Energy (DoE).

In order to develop the facility, Mira Energy must conduct an Environmental Impact Assessment (EIA) and acquire environmental authorization from the National Department of Environmental Affairs (DEA), in consultation with the *Northern Cape Department of Environment and Nature Conservation (DENC)*, in terms of the EIA Regulations (2010) published in terms of Section 24(2) and 24D of the National Environmental Management Act (NEMA, Act No. 107 of 1998).

The project has been registered with the **DEA application reference number 14/12/16/3/3/2/614.**

The Scoping Phase was conducted for two solar parks to be developed on Rhodes 269:

a) Rhodes 1 Solar Park, proposed by Mira Energy, and
b) Rhodes 2 Solar Park, proposed by Palus Energy.

Subsequently **Palus Energy withdrew the application for the Rhodes 2 Solar Park**, which was registered with the DEA application reference number 14/12/16/3/3/2/615.

Therefore, **the current EIA is conducted only for the Rhodes 1 Solar Park**.

Rhodes 1 Solar Park may be connected either:

a) to the **Eskom "Hotazel - Heuningvlei" 132 kV power line**, running through the project site: the Eskom 132 kV power line will loop in and out of the 132 kV busbar of the new on-site substation via two new sections of 132 kV line approximately 100 m long (***alternative connection 1 - preferred***);
b) to the **Eskom Hotazel substation**, 7 km south of the project site, via a new 132 kV power line approximately 7.2 km long and running parallel to the existing Eskom "Hotazel - Heuningvlei" 132 kV power line (***alternative connection 2***); or
c) to the new **Eskom Umtu substation**, 8 km south-west of the project site, via a new 132 kV power line approximately 10.2 km long and running parallel to the existing Eskom "Hotazel - Heuningvlei" 132 kV power line (for 5.7 km) and to the Eskom "Hotazel - Umtu" 132 kV power line (for 4.5 km) (***alternative connection 3***).

The ***alternative connection 1*** is the **preferred connection solution**, as confirmed by Eskom in the **Cost Estimate Letter issued on 12 May 2014** (Eskom Ref. IPP 112442854), enclosed to this EIA Report as Annexure M.

With regard to **alternative connections 2 and 3**, whereby a new 132 kV power line may be constructed outside the project site, **a separate Basic Assessment is currently being conducted by AGES** (the applicant is Mira Energy).

Eskom is the entity which assesses the connection solution included and described in this Final EIA Report. Eskom also coordinated the necessary liaising between Mira Energy, Eskom Transmission, Eskom Distribution and Eskom Land & Rights Department.

It is important to highlight that all or part of the infrastructure required for the connection may be owned and/or operated by Eskom Distribution, this will depend on the Eskom grid code in relation to the IPPs (Independent Power Producers) and on the Connection Agreement to be finalized prior to or simultaneously with the conclusion of the PPA (Power Purchase Agreement) in respect of the options of retaining ownership of the connection works once completed.

The independent Environmental Assessment Practitioners (EAPs) which have been appointed for the undertaking of the detailed environmental studies in compliance with the 2010 EIA Regulations are **AGES (Pty) Ltd.**

With the aim of identifying and assessing all potential environmental impacts related to the development as well as suggesting possible mitigation measures and alternatives, AGES has appointed specialist sub-consultants to compile detailed reports and to study the activities necessary for the assessment of the specific impacts related to their field of expertise.

AGES and the other specialist consultants are in a position of independency from Mira Energy; therefore they are not subsidiaries or affiliated to the latter. AGES and the specialist consultants have no secondary interest connected with the development of this project or of other projects which may originate from the authorization of the project.

The characteristics, the technology and the extent of the Rhodes 1 Solar Park are defined and evaluated in this Final EIA Report and its annexures.

2. MOTIVATION AND RATIONALE OF THE RHODES 1 SOLAR PARK IN LIGHT OF THE IPP PROCURMENT PROGRAMME REQUIREMENTS

2.1. THE CHOICE OF THE NORTHERN CAPE PROVINCE AND OF THE SITE LOCATION

The Rhodes 1 Solar Park will be located in the Northern Cape Province. The Northern Cape Province has been identified by Mira Energy as an ideal macro area for establishing of a solar PV plant on the basis of several important considerations:

- solar resource is exceptionally high: the *global horizontal irradiation* of the site is 2,126 kWh/m^2/year;
- there are several green projects currently under development in the Northern Cape, because of the high solar resources and the availability of desolate lands with low ecological and agricultural value;
- The Northern Cape Province, Local Municipalities and Communities are eager to continue establishing an eco-green image in consideration of the burden of CO_2 emissions they have to bear.

In addition to these very favourable characteristics in terms of desirability of renewable solar energy projects in the Northern Cape Province, the site of the Rhodes 1 Solar Park has been chosen by Mira Energy on the grounds of several considerations, in particular:

- **the high need for electricity supply to the area, due to the presence of several manganese mines under operation and under construction, including the Hotazel mine, Kalagadi Manganese mine and Assmang mines;**
- the availability of several connection alternatives, due to the presence of Eskom "Hotazel - Heuningvlei" 132 kV power line, which crosses the project site, and of the Eskom Hotazel and Umtu substations, 7 km South and 8 km South-West of the project site respectively;
- the flatness of the proposed project site;
- the low to medium ecological sensitivity and the low agricultural value of the proposed development area.

The proposed solar park will help the Eskom grid to meet the high energy demand related to the mining activities conducted in the area (Hotazel mine, Kalagadi Manganese mine and Assmang mines). Furthermore, being a renewable energy plant which doesn't generate CO_2 emissions - it will help to compensate the CO_2 emissions arising from these mining activities.

Furthermore, in the light of the IPP procurement Programme requirements, the **Rhodes 1 Solar Park** has been developed according to the following main characteristics:

- the installed capacity is within the "eligible capacity" defined by the rules of the RFP (from 1 MW to 75 MW);
- the construction phase will last approximately15 months and the PV plant will be able to begin its commercial operation before the end of 2020.

With specific reference to Rhodes 1 Solar Park, Eskom has indicated that the project does not interfere with Eskom's present and future developments and do not affect the voltage in the area negatively. Eskom, as an interested and affected party, recognized the positive outcome of the project in terms of the possibility of meeting the local growth of the energy consumption that is expected.

2.2. NEED AND DESIRABILITY OF THE PROPOSED PROJECT

South Africa currently relies principally on fossil fuels (coal and oil) for the generation of electricity. At the present date, Eskom generates approximately 95% of the electricity used in South Africa. On the other hand, South Africa has a largely unexploited potential in renewable energy resources such as solar, wind, biomass and hydro-electricity to produce electricity as opposed to other energy types (fuel or coal).
South Africa's electricity supply still heavily relies upon coal power plants, whereas the current number of renewable energy power plants is very limited. In the last few years, the demand for electricity in South Africa has been growing at a rate approximately 3% per annum.

These factors, if coupled with the rapid advancement in community development, have determined the growing consciousness of the significance of environmental impacts, climate change and the need for sustainable development. The use of renewable energy technologies is a sustainable way in which to meet future energy requirements. The development of clean, green and renewable energy has been qualified as a priority by the Government of South Africa with a target goal for 2013 of 10,000 GWh, as planned in the Integrated Resource Plan 1 (IRP1) and with the Kyoto Protocol.Subsequently the Department of Energy of South Africa (DoE) decided to undertake a detailed process to determine South Africa's 20-year electricity plan, called Integrated Resources Plan 2010-2030 (**IRP 2010**).

The IRP1 (2009) and the IRP 2010 (2011) outline the Government's vision, policy and strategy in matter of the use of energy resources and the current status of energy policies in South Africa. In particular, the IRP 2010 highlights the necessity of commissioning 1200 MW with solar PV technology by the end of 2015.

In order to achieve this goal, the DoE recently announced a renewable energy IPP (Independent Power Producers) Procurement Programme. **The IPP Procurement Programme, issued on 3 August 2011, envisages the commissioning of 3725 MW of renewable projects (1450 MW with solar photovoltaic technology) capable of beginning commercial operation before end 2020.** Therefore, the development of photovoltaic power plants will represent a key feature in the fulfilment of the proposed target goal and the reduction of CO_2 emissions.

The purpose of the Rhodes 1 Solar Park is to add new capacity for the generation of renewable electric energy to the national electricity supply in compliance with the IPP Procurement Programme and in order to meet the "sustainable growth" of the Northern Cape Province.

The use of solar radiation for power generation is considered as a non-consumptive use and a renewable natural resource which does not produce greenhouse gas emissions. The generation of renewable energy will contribute to the growth of South Africa's electricity market, which has been primarily dominated up to this date by coal-based power generation. With specific reference to photovoltaic energy, and the proposed project, it is important to consider that South Africa has one of the highest levels of solar radiation in the world.

The selected property is located in an area with several mines under operation and under construction, including the **Hotazel, Kalagadi Manganese and Assmang mines**. **The proposed solar park will help the Eskom grid to meet the high energy demand related to the mining activities conducted in the area.**

The reasons for the location of the project in the selected area include the following:

- low requirement for municipal services;
- compliance with national and provincial energy policies and strategies;
- no impact on people health and wellbeing;
- no waste and noise;
- no impact on air quality;
- compatibility with the ecosystem and the surrounding landscape;
- likelihood of social and economic development of marginalized, rural communities; and
- attraction of environmentally aware (green) tourists to the area.

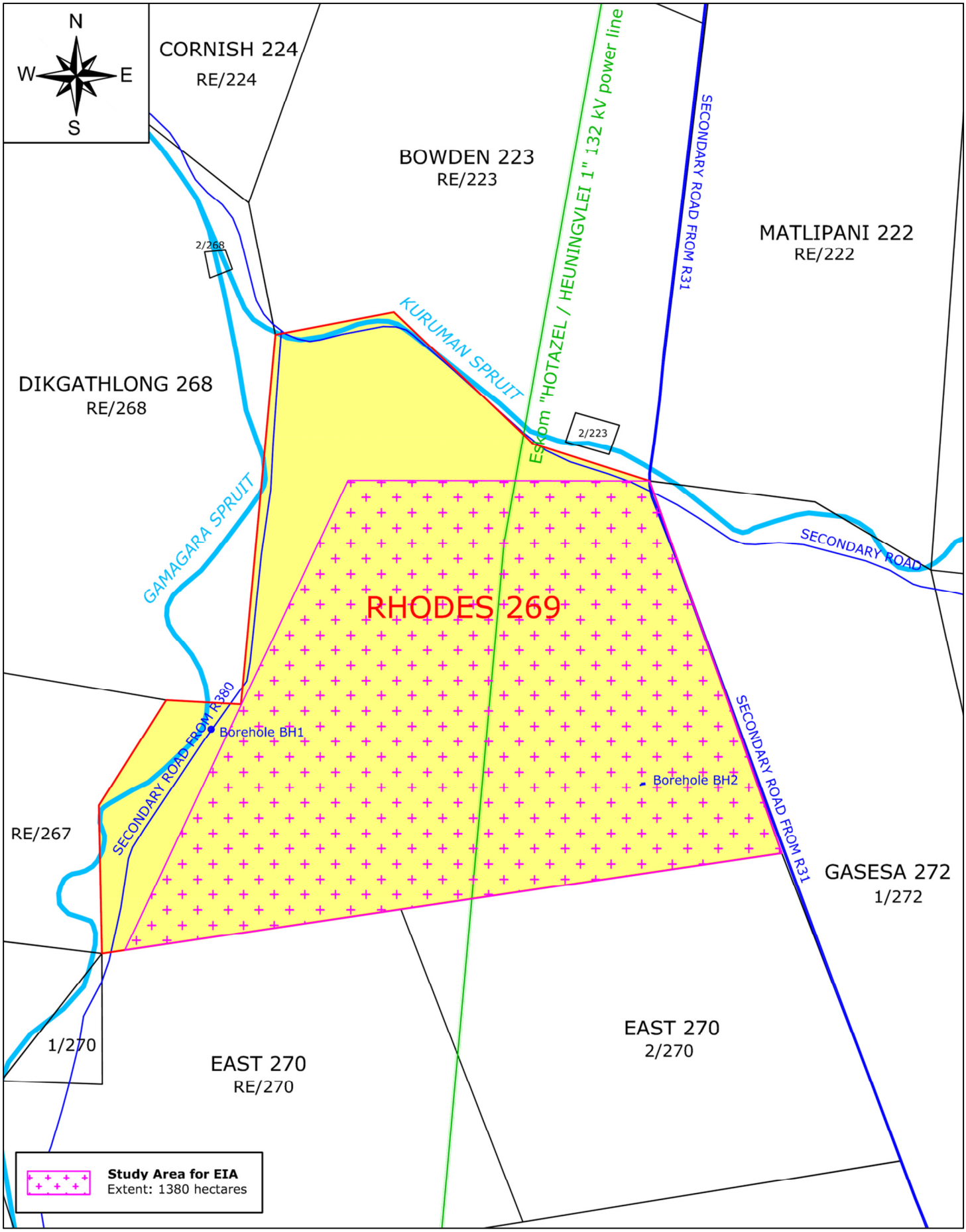


Figure 1: Locality map of the project site and study area for EIA

3. AUTHORITIES, LEGAL CONTEXT AND ADMINISTRATIVE REQUIREMENTS

The legislative and regulatory framework of reference for the solar power plant project includes statutory and non-statutory instruments by which National, Provincial and Local authorities exercise control throughout the development of the same project.

The development and the environmental assessment process of a solar power plant project involve various authorities dealing with the different issues related to the project (economic, social, cultural, biophysical etc.).

3.1. REGULATORY AUTHORITIES

3.1.1. National Authorities

At national level, the main regulatory authorities and agencies are:

- *Department of Energy (DoE):* the Department is competent and responsible for all policies related to energy, including renewable energy. Solar energy is contemplated and disciplined under the White Paper for Renewable Energy and the Department constantly conducts research activities in this respect;
- *Department of Environmental Affairs (DEA):* the Department is competent and responsible for all environmental policies and is the controlling authority under the terms of NEMA and EIA Regulations. The DEA is also the competent authority for the proposed project, and is entrusted with granting the relevant environmental authorisation;
- *National Energy Regulator of South Africa (NERSA):* the Regulator is competent and responsible for regulating all aspects dealing with the electricity sector and, in particular, issues the licence for independent power producers;
- *South African Heritage Resources Agency (SAHRA):* the Agency is responsible for the protection and the survey, in association with provincial authorities of listed or proclaimed sites, such as urban conservation areas, nature reserves and proclaimed scenic routes under the terms of the National Heritages Resources Act (Act no. 25 of 1999);
- *South African National Roads Agency Limited (SANRAL):* the Agency is responsible for all National road routes.

3.1.2. Provincial Authorities

At provincial level, the main regulatory authority is the *Northern Cape Department of Environment and Nature Conservation;* this Department is responsible for environmental policies and is the Provincial authority in terms of NEMA and the EIA Regulations. The Department is also the commenting authority for the proposed project.
The project should comply with the *Northern Cape Nature Conservation Act* (Act No. 9 of 2009).

3.1.3. Local Authorities

At a local level, the local and municipal authorities are the principal regulatory authorities responsible for planning, land use and the environment. In the Northern Cape Province, Municipalities and District Municipalities are involved in various aspects of planning and the environment related to solar energy facilities development. The Local Municipality is *Joe Morolong*, which is part of the *John Taolo Gaetsewe District Municipality*.

Under the terms of the Municipal System Act (Act no. 32 of 2000), all municipalities are deemed to go through an Integrated Development Planning (IDP) process in order to devise a five-year strategic development plan for the area of reference. The identification of priority areas for conservation and their positioning within a planning framework of core, buffer, and transition areas is the subject of bioregional planning. Priority areas are individuated and defined with reference to visual and scenic resources and their identification and protection is granted through visual guidelines drafted for the area included in bioregional plans.

Local authorities also provide specific by-laws and policies in order to protect visual and aesthetic resources with reference to urban edge lines, scenic drives, special areas, signage, communication masts etc.

The **Spatial Development Framework (SDF) 2012 of the Joe Morolong Local Municipality** has three main nodes where relatively higher economic activity takes place, namely Vanzylsrus, Hotazel and Blackrock. The proposed solar park is situated near Hotazel and Blackrock. It is stated in the SDF that investment should be focused on these areas to expand the node into a more diverse economic centre. It is mentioned that a replacement economic activity should be found when the mineral resources are depleted for Hotazel and Blackrock. The proposed renewable energy project will contribute towards meeting this goal by introducing new economic activity and job opportunities to the area.

The SDF furthermore outlines Spatial Planning Categories. Spatial Planning Category F involves *Surface infrastructure and Buildings, i.e.* all surface infrastructure and buildings, including roads, railway lines, power lines, communication structures, etc.
The Sub-Category: F.i includes *Renewable Energy Structures*: These include any wind turbine or solar photovoltaic apparatus, or grouping thereof, which captures and converts wind or solar radiation into energy for commercial gain irrespective of whether it feeds onto an electricity grid or not. It includes any appurtenant structure or any test facility which may lead to the generation of energy on a commercial basis.

Development Guidelines for Sub-Category: F.(i) states that "*all surface infrastructure and buildings that are required for sustainable socio-economic development and resource use must be undertaken in accordance with site specific design and planning guidelines. All industry must be regulated and managed in accordance with sustainability standards (e.g. ISO 14001)*".
The East Solar Park will comply with the international standards and regulations for photovoltaic power plants.

The proposed solar park situated nearby Hotazel and Blackrock will aid the Municipality in the upliftment of these areas. It will a sustainable form of land development and will be developed in compliance with the Development Guidelines stipulated under Sub-Category F(i) of the SDF. The proposed solar park will comply with the SDF of the Joe Morolong Local Municipality.

There are also various non-statutory bodies and environmental groups, who are involved in the definition of various aspects of planning and the protection of the environment, which may influence in the development of the proposed project.

3.2. LEGISLATION, REGULATIONS AND GUIDELINES

A review of the relevant legislation involved in the proposed development is detailed in table 1 below.

Table 1: Review of relevant legislation

National Legislation	Sections applicable to the proposed project
Constitution of the Republic of South Africa (Act no. 108 of 1996)	• Bill of Rights (S2) • Rights to freedom of movement and residence (S22) • Environmental Rights (S24) • Property Rights (S25) • Access to information (S32) • Right to just administrative action (S33)
Fencing Act (Act no. 31 of 1963)	• Notice with reference to a boundary fence (S7) • Clearing bush for boundary fencing (S17) • Access to land for purpose of boundary fencing (S18)

Conservation of Agricultural Resources Act (Act no. 43 of 1983)	• Prohibition of the spreading of weeds (S5) • Classification of categories of weeds & invader plants and restrictions in terms of where these species may occur (Regulation 15 of GN R0148) • Requirement and methods to implement control measures for alien and invasive plant species (Regulation 15E of GN R0148)
Environment Conservation Act (Act no. 73 of 1989)	• National Noise Control Regulations (GN R154 dated 10 January 1992)
National Water Act (Act no. 36 of 1998)	• Entrustment of the National Government to the protection of water resources (S3) • Entitlement to use water (S4) - Schedule 1 provides the purposes which entitle a person to use water (reasonable domestic use, domestic gardening, animal watering, fire fighting and recreational use) • Duty of Care to prevent and remedy the effects of water pollution (S19) • Procedures to be followed in the event of an emergency incident which may impact on water resources (S20) • Definition of water use (S21) • Requirements for registration of water use (S26 & S34) • Definition of offences in terms of the Act (S151)
National Forests Act (Act no. 84 of 1998)	• Protected trees
National Environmental Management Act (Act no. 107 of 1998)	• Definition of National environmental principles (S2): strategic environmental management goals and objectives of the government applicable within the entire Republic of South Africa to the actions of all organs of state, which may significantly affect the environment • NEMA EIA Regulations (GN R543, 544, 545, 546, & 547 of 18 June 2010) • Requirement for potential impact on the environment of listed activities to be considered, investigated, assessed and reported on to the competent authority (S24 - Environmental Authorisations) • Duty of Care (S28): requirement that all reasonable measures are taken in order to prevent pollution or degradation from occurring, continuing and recurring, or, where this is not possible, to minimise and rectify pollution or degradation of the environment • Procedures to be followed in the event of an emergency incident which may impact on the environment (S30)
National Heritage Resources Act (Act no. 25 of 1999)	• SAHRA, in consultation with the Minister and the Member of the Executive Council of every province must establish a system of grading places and objects which form part of the national estate (S7) • Provision for the protection of all archaeological objects, paleontological sites and material and meteorites entrusted to the provincial heritage resources authority (S35) • Provision for the conservation and care of cemeteries and graves by SAHRA, where this is not responsibility of any other authority (S36)

	• List of activities which require notification from the developer to the responsible heritage resources authority, with details regarding location, nature, extent of the proposed development (S38) • Requirement for the compilation of a Conservation Management Plan as well as a permit from SAHRA for the presentation of archaeological sites for promotion of tourism (S44)
National Environmental Management: Biodiversity Act (Act no. 10 of 2004)	• Provision for the Member of the Executive Council for Environmental Affairs/Minister to publish a list of threatened ecosystems and in need of protection (S52) • Provision for the Member of the Executive Council for Environmental Affairs/Minister to identify any process or activity which may threaten a listed ecosystem (S53) Provision for the Member of the Executive Council for Environmental Affairs/Minister to publish a list of: critical endangered species, endangered species, vulnerable species and protected species (S56(1) - see Government Gazette 29657 • Three government notices have been published up to the present date: GN R150 (Commencement of Threatened and Protected Species Regulations, 2007), GN R151 (Lists of critically endangered, vulnerable and protected species) and GN R152 (Threatened Protected Species Regulations)
National Environmental Management: Air Quality Act (Act no. 39 of 2004)	• Provision for measures in respect of dust control (S32) • Provision for measures to control noise (S34)
National Environmental Management: Waste Management Act (Act no. 59 of 2008)	• Waste management measures • Regulations and schedules • Listed activities which require a waste licence
Northern Cape Nature Conservation Act (Act No. 9 of 2009)	• Indigenous flora protected under this act • No hunting to take place without a permit
Occupational Health and Safety Act (Act No. 85 of 1993)	• Health and safety of all involved before and after construction must be protected.

Guideline Documents	**Sections applicable to the proposed project**
South African National Standard (SANS) 10328, Methods for environmental noise impact assessments in terms of NEMA no. 107 of 1998	• Impact of noise emanating from a proposed development may have on occupants of surrounding land by determining the rating level • Noise limits are based on the acceptable rating levels of ambient noise contained in SANS 10103
Draft Guidelines for Granting of Exemption Permits for the Conveyance of Abnormal Loads and for other Events on Public Roads	• The Guidelines outline rules and conditions related to transport of abnormal loads and vehicles on public roads and detailed procedures to be followed for the grant of exemption permits

Policies and White Papers	**Sections applicable to the proposed project**
The White Paper on the Energy Policy of the Republic of South Africa (December 1998)	• The White Paper supports investment in renewable energy initiatives, such as the proposed solar power plant project
The White Paper on Renewable Energy (November 2003)	• The White Paper outlines the Government's vision, policy, principles, strategic goals and objectives for the promotion and the implementation of renewable energy in South Africa

Integrated Resource Plan (IRP1) Integrated Resources Plan 2010-2030 (IRP 2010).	• The first Integrated Resource Plan (IRP1) was released in late 2009. Subsequently the DoE decided to undertake a detailed process to determine South Africa's 20-year electricity plan, called Integrated Resources Plan 2010-2030 (IRP 2010). • The IRP1 and the IRP 2010 outline the Government's vision, policy and strategy in matter of the use of energy resources and the current status of energy policies in South Africa. • **In particular, the IRP 2010 highlights the necessity of commissioning 1200 MW with solar PV technology by the end of 2015.**
Request For Qualification and Proposals For New Generation Capacity under the IPP Procurement Programme(3 August 2011)	• The IPP Procurement Programme, issued on 3rd August 2011 by the DoE, envisages the commissioning of **3725 MW** of renewable projects (**1450 MW with Solar photovoltaic technology**) **capable of beginning commercial operation before the end of 2020**.
Equator Principles (July 2006)	• The Equator Principles provide that future developments with total project capital costs of US$10 million or more shall be financed only if socially and environmentally sustainable

3.3. LISTED ACTIVITIES IN TERMS OF NEMA

The "listed activities" in terms of sections 24 and 24D of NEMA involved (or *potentially* involved) in the proposed development are detailed in table 2 below.

Table 2: Listed Activities in terms of sections 24 and 24D of NEMA potentially involved in the proposed development

Relevant notice	Activity No.	Activity Description
R.545, 18 June 2010	**1**	***The construction of facilities or infrastructure for the generation of electricity where the electricity output is 20 megawatts or more:*** The Rhodes 1 Solar Park will be established on the Farm Rhodes 269, Kuruman RD, measuring 1810.8314 hectares and located in the Joe Morolong Local Municipality, John Taolo Gaetsewe District Municipality, Northern Cape Province. The project will consist of construction, operation and maintenance of a Photovoltaic (PV) Power Plant with a generation capacity exceeding 20 MW (up to 75 MW).
R.545, 18 June 2010	**15**	***Physical alteration of undeveloped, vacant or derelict land for, industrial use where the total area to be transformed is 20 hectares or more*** The Photovoltaic Power Plant with associated infrastructure and structures will be constructed and operated on a footprint up to 210 hectares on a farm portion measuring 1810.83 ha. The project will be established on undeveloped land and the proposed activity is regarded as "industrial".
R.544, 18 June 2010	**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 kilovolts but less than 275 kilovolts The connection to the Eskom grid will be done according to the Eskom connection solution, which entails the establishment of one small on-site high voltage substation with one or more high-voltage power transformer(s) stepping up the voltage to the voltage of the Eskom grid (132 kV), a 132 kV busbar with protection an metering devices ("switching station") and a control building. The Rhodes 1 Solar Park may be connected either: a) to the Eskom "**Hotazel - Heuningvlei" 132 kV power line**, running through the project site: the Eskom 132 kV power line will loop in and out of the 132 kV busbar of the new on-site substation **via two new sections of 132 kV line approximately 100 m long** (***alternative connection 1 - preferred***); b) to the **Eskom Hotazel substation**, 7 km south of the project site, via a new 132 kV power line approximately 7.2 km long and running parallel to the existing Eskom "Hotazel - Heuningvlei" 132 kV power line (***alternative connection 2***); or c) to the **new Eskom Umtu substation**, 8 km south-west of the project site, via a new 132 kV power line approximately 10.2 km long and running parallel to the existing Eskom "Hotazel - Heuningvlei" 132 kV power line (for 5.7 km) and to the Eskom "Hotazel - Umtu" 132 kV power line (for 4.5 km) (***alternative connection 3***). The connection may also entail interventions on the Eskom grid according to Eskom's connection requirements/solution.
R.544, 18 June 2010	**22**	***The construction of a road, outside urban areas,*** ***(i) with a reserve wider than 13.5 metres*** Access to the Rhodes 1 Solar Park will be from a local upgraded dirt road starting from the regional road R31, which runs parallel to the eastern boundary of the property. The new section of access road - linking this secondary road to the PV plant footprint - will be 8.0 m wide. During the construction phase, the road reserve may be wider than 13.5 meters in order to allow the transportation of abnormal loads (e.g. the high-voltage step-up transformers of the new on-site high-voltage substation). Internal roads will be maximum 8 m wide with a road reserve maximum 12.0 m wide. At the turning points / intersection points the road reserve may be wider than 13.5 m due to the shape of the intersection / turning points..
R.546, 18 June 2010	**14**	***The clearance of an area of 5 hectares or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation*** ***a) In Northern Cape:all areas outside urban areas.*** The Photovoltaic Power Plant with associated infrastructure and structures will be constructed and operated on a footprint up to 210 hectares on a farm portion measuring 1810.8314 hectares. The required footprint should be cleared from the existing trees.

Activities 11 and 18 of GN R 545 - which were included in the Scoping Report - **are not applied for anymore**, because the proposed development areas (alternative locations 1 and 2) are not affected by any wetland, stream, drainage, pan or water course.
The closest watercourses are the *Kuruman* and *Gamagara Spruits*, which run parallel to the northern and western boundary of the project site, but at a minimum distance of **1.3 km** from the proposed development area (alternative locations 1 and 2).
No infilling or depositing of any material or dredging, excavation, removal or moving of soil will take place in the proximity of the *Kuruman* and *Gamagara Spruits*, considering that the construction activities will be restricted to the proposed PV plant fenced area / footprint.
Therefore **Activities 11 and 18 of GN R544 are NOT APPLICABLE**.

With **alternative connections 2 and 3**, whereby a new 132 kV power line may be constructed outside the project site, **a separate Basic Assessment is currently undergoing by Ages.**

Eskom is the entity which assesses the connection solution included and described in this EIA Report. Eskom also coordinated the necessary liaising between Mira Energy, Eskom Transmission, Eskom Distribution and Eskom Land & Rights Department. Furthermore, a part of the connection infrastructure (the 132 kV busbar of the on-site substation and the new 132 kV power line) may be executed, owned and operated by Eskom.

Final layout and site plans drafted by Mira Energy (enclosed as Annexure A) have been finalized following the inputs received via public participation. All information acquired was analysed in order to determine the proposed final development layout and site plans. Such approach ensures a holistic view of future requirements of the site and that resources are utilised to their full availability in terms of social and environmental sustainability. It must also be pointed out that this application and all other development applications, in the area, are considered together in order to ensure general sustainability in the Local and District Municipal areas.

4. PROJECT DESCRIPTION AND FUNCTIONING

Mira Energy is proposing the establishment of a **solar power plant with a maximum generation capacity at the delivery point up to 75 MW.**
The construction timeframe is estimated to be approximately 15 months, whereas the commissioning date will depend on the IPP Procurement Programme timeframe.

The preferred technical solutions envisage:

- **thin-film PV modules or mono/polycrystalline PV modules,**
- **fixed mounting systems** or **single-axis horizontal trackers (SAT).**

The estimated annual energy production is calculated in approximately:

- **1,950 kWh/kWp/year** (load factor = 0.223), in the case of PV modules mounted on fixed mounting systems; or
- **2,200 kWh/kWp/year** (load factor = 0.251) in the case of PV modules mounted on trackers.

Therefore, the Rhodes 1 Solar Park will generate:

- **160.1GWh per year** in the case of PV modules mounted on fixed systems; or
- **190.1GWh per year** in the case of PV modules mounted on trackers.

The calculation is made by the professional tool "PVSYST" and the simulation is done for 1 MWp (1 "PV field"). The site data (irradiation, temperature, etc.) charged on the database consists of hourly meteo-data registered by NASA satellites (NASA-SSE satellite data 1983-1993, release 6) and the simulation is made for the timeframe of 1 year.
The output (1,950 kWh/kWp/year and 2,200 kWh/kWp/year) is also called “full net equivalent hours”, which represent the average energy injected into the grid per 1 kWp of installed capacity.
The *Global Horizontal Irradiation* of the site is 2,126 kWh/m^2/year (NASA-SSE satellite data, 1983-1993, release 6).

The energy generated by the Rhodes 1 Solar Park will reduce the quantity of pollutants and greenhouse gases emitted into the atmosphere. The reduced amount of CO_2 will be the emissions that would have been generated by a thermal power plant using fossil fuels for producing the same quantity of energy that it is produced by the Rhodes 1 Solar Park.

The quantity of the avoided CO_2 is calculated as follows: the energy produced by the Rhodes 1 Solar Park (up to 160.1 GWh/y or 190.1GWh/y) is multiplied by the Eskom’s average emission factor which is 1.015 t CO_2/MWh (*source*: Energy Research Centre, University of Cape Town. (2009 *Carbon accounting for South Africa*).

This means that, in the case of the Rhodes 1 Solar Park, the **avoided CO_2 emissions** are approximately **192,931 tons of CO_2 per year** in the case of PV modules mounted on fixed mounting systems, or **162,564 tons of CO_2 per year** in the case of PV modules mounted on trackers.

Considering that 1 kg of coal generates approximately 3.7 kWh (supposing a caloric value of 8000 kcal/kg and a coal plant efficiency of 40%), **the coal saved by the Rhodes 1 Solar Park will be approximately 51,373 tons of coal / year** in the case of PV modules mounted on fixed mounting systems, or **43,287 tons of coal / year** in the case of PV modules mounted on trackers.

A detailed description of the characteristic and functioning of the plant and its connection is given in the following paragraphs.

4.1. PROJECT LAYOUT

The layout of the proposed development is the result of a comparative study of various layout alternatives and had been defined in consideration of the results of the specialist studies conducted during the Scoping Phase and attached to this EIA Report.

The PV plant is designed and conceived in order to minimize visual and noise impacts, as well as to operate safely and assuring a high level of reliability, with low water consumption and the need only for easy and quick maintenance and repair for approximately 25-30 years.

The main drives of the proposed layout are:

- to maximize the energy production and the reliability of the PV plant, by choosing proven solar technologies: thin-film or mono/polycrystalline solar modules mounted on single-axis horizontal trackers (SAT) or on fixed mounting systems;
- to develop the PV power plant on the southern and eastern side of the Farm Rhodes269 (1810.8314ha), since this area is flat and has a *low to medium* ecological sensitivity, while two streams(*Gamagara Spruit and Kuruman Spruit*) run along the western and northern boundaries of the property and is characterized by sand dunes to the north west of the farm;
- to include as much as possible in the proposed footprint the low ecological sensitivity areas, in order to reduce the extension of the medium ecological sensitivity areas to be cleared and as consequence the number of protected trees to be removed;
- the proposed footprint has been located at a minimum distance of 50 m from the southern boundary and 150 m from the eastern boundary, so that the distance and the existing vegetation would be able to minimise the potential visual impact of the proposed development to the surrounding properties.

The footprint of the Rhodes 1 Solar Park will be up to 210 ha.

As anticipated in the Chapter 1 - Introduction, two alternative development areas are proposed and discussed in this EIA Report:

a) **Alternative Location 1 (preferred):** on the south-eastern side of the property, East of the 132 kV power line crossing the project site (Eskom “Hotazel - Heuningvlei” 132 kV power line);

b) **Alternative Location 2:** on the southern side of the property, parallel to the southern boundary of the farm, West and East of the Eskom “Hotazel - Heuningvlei” 132 kV power line.

Alternative location 1 is the best one from the ecological point of view, because the proposed fenced area (210 ha) is optimized in order to include the *low to medium* ecological sensitivity areas located East of the Eskom 132 kV power line. On the whole, this development area (210 ha) entails the clearance of 64.5 ha (31%) of *medium to low* sensitivity areas and 145.5 ha (69%) of *medium* sensitivity areas.

Alternative location 2 is the best one in terms of visual impact from the secondary road parallel to the eastern boundary of the property, because of its shape, parallel to the southern boundary of the property. The fenced area (210 ha) excludes the borehole BH2, currently used for the livestock on the property (as requested by the landowner).
Overall, this development area (210 ha) encloses 50.6 ha (24%) of *medium to low* sensitivity areas and 159.4 ha (76%) of *medium* sensitivity areas. It should be noted that the actual footprint would be approximately 205 ha, since 5 ha are affected by the Eskom servitude of the existing 132 kV power line, which may be rebuilt by Eskom parallel to the current corridor. Indeed the layout plan takes into account a possible new Eskom servitude - parallel to the existing one - necessary for the re-built of this 132 kV line.

The *alternative connection 1* resulted to be the preferred development area, being the best one from the ecological point of view. As far as the borehole is concerned, Mira Energy will equip it with an electric pump and will install a water reservoir outside the fenced area, in order to make water available for the animals and other landowner's uses at any time. The maintenance of this borehole and related equipment will be made by Mira Energy for the landowner's benefit.

The two proposed development areas, superimposed to the vegetation and sensitivity map, are indicated in the drawings of the Annexure A:

- RH1SP_00.1_r0 Development area: Alternative Location 1 and Sensitivity Map
- RH1SP_00.2_r0 Development area: Alternative Location 2 and Sensitivity Map

The two proposed layout plans, attached as Annexure A and also shown in Figures 3 and 4 below, were drawn using PV modules mounted on single-axis horizontal trackers; in the case of PV modules mounted on fixed mounting systems, the layout plan does not change, except for the orientation of the PV arrays: east-west instead of north-south.
The required **footprint** - corresponding on the fenced area - **will not exceed 210 ha**, and the maximum height of the structures (PV modules and support frames) will be approximately 3.1 m above the ground level. Therefore the impacts and mitigation measures will remain exactly the same.

The project layout and the other PV plant components are detailed in the following drawings:

- RH1SP_00.3_r1 Connection alternatives
- RH1SP_01_r2 Layout plan on the Alternative Location 1 - PV power plant up to 75 MW
- RH1SP_02_r0 Layout plan on the Alternative Location 2 - PV power plant up to 75 MW
- RH1SP_03_r0 Mounting System – Alternative option 1: fixed mounting systems
- RH1SP_04_r0 Mounting System – Alternative option 2: horizontal single-axis trackers
- RH1SP_05_r0 Medium-voltage stations
- RH1SP_06_r2 Control building and medium-voltage receiving station
- RH1SP_07_r2 On-site high-voltage substation
- RH1SP_08_r0 Warehouse

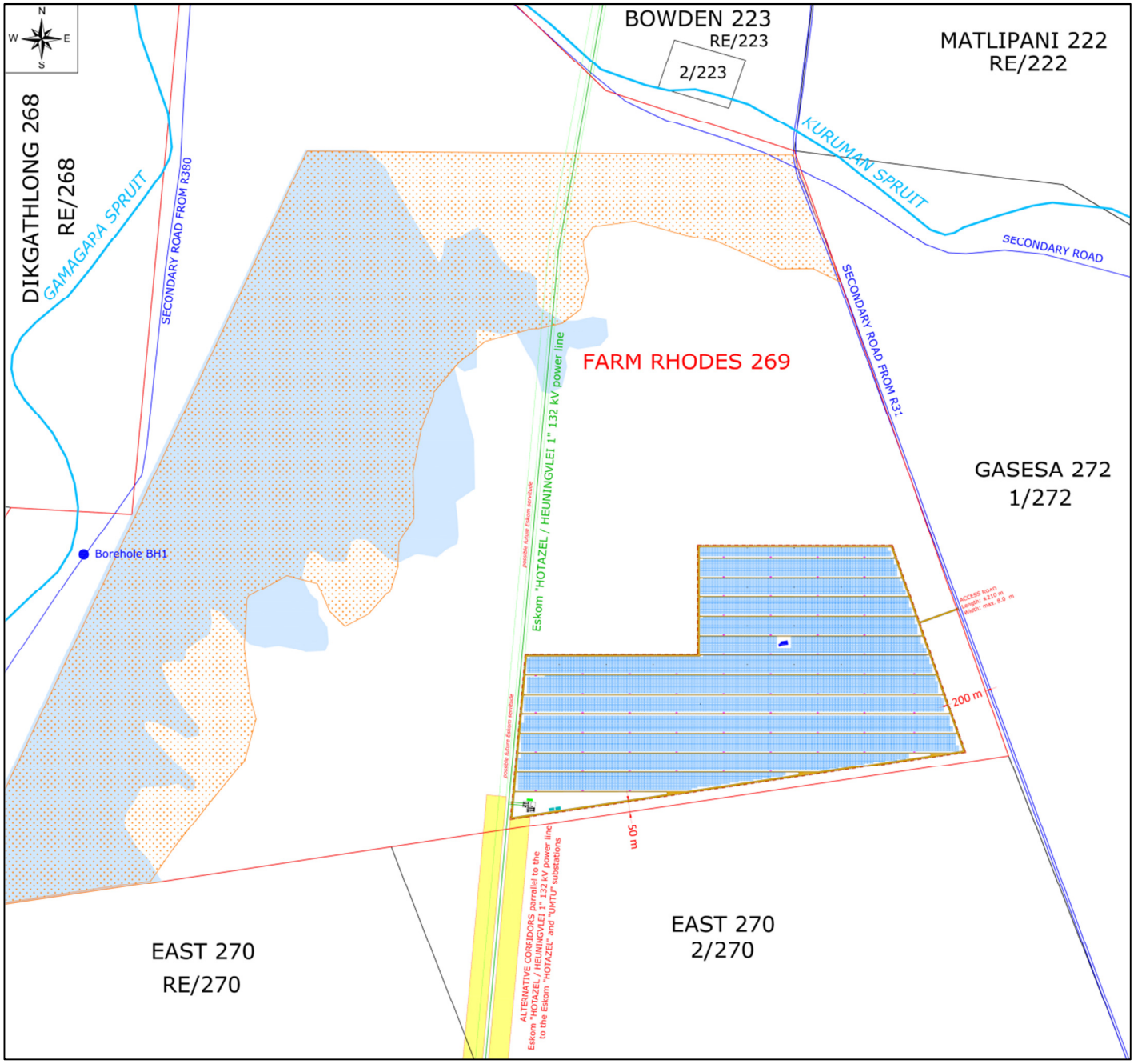
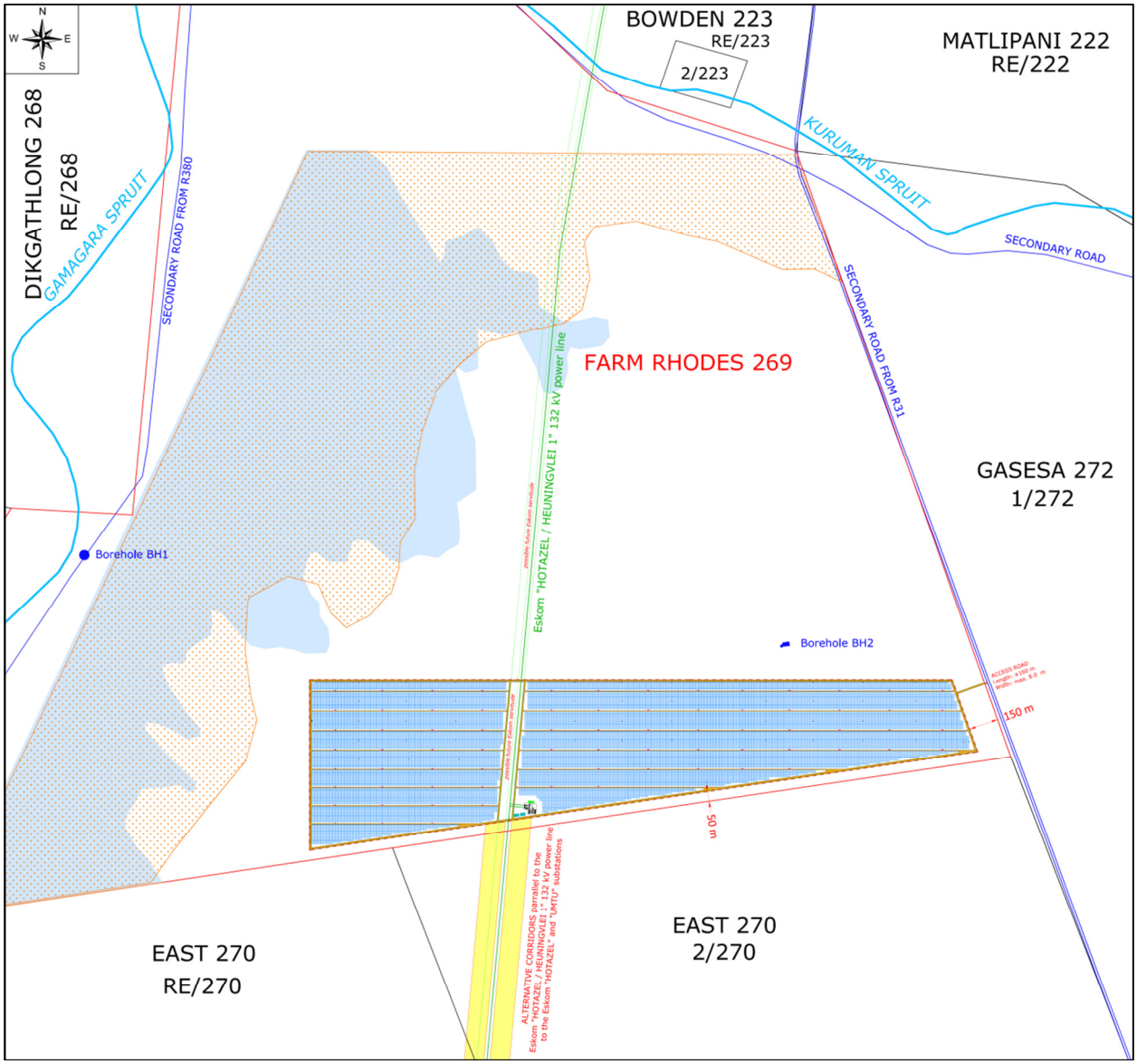


Figure 2: **Layout plan of the Rhodes 1 Solar Park on the Alternative Location 1 (preferred option)**

Footprint (fenced area)
Extent: 210 ha

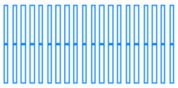
Figure 3: Layout plan of the Rhodes 1 Solar Park on the Alternative Location 2 (alternative option)



Fenced area: 210 ha (including Eskom servitutes)
Actual footprint: 205 ha

Figures 2 and 3- Legend

PROJECT SITE
Farm RHODES 269, Kuruman RD
Joe Morolong Local Municipality
John Taolo Gaetsewe District Municipality
Northern Cape Province
Surveyor-general 21 digit site: C04100000000026900000
Extent: 1810.8314 hectares



PV arrays

Medium voltage stations

High-voltage substation
2 x 40 MVA power transformers

Medium voltage receiving station and control building

Eskom "HOTAZEL / HEUNINGVLEI 1" 132 kV power line
and registered servitude

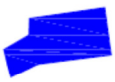
Warehouses

Internal roads

Medium-High Ecological Sensitivity
Sloping terrain along dunes with protected tree species

Land Use Area B of the Geo-technical Study
Undulating topography (sand dunes)

Borehole BH1



Borehole BH2

Alternative corridors to the Eskom "Hotazel" and "Umtu"ubstations

4.2. PRIMARY COMPONENTS

The Photovoltaic (PV) Power Plant together with its connection infrastructures and structures will require the installation of the following equipment:

- Photovoltaic modules (monocrystalline, polycrystalline or thin-film solar modules)
- Mounting systems (fixed or single-axis horizontal trackers) for the PV arrays and related foundations
- Internal cabling and string boxes
- Medium voltage stations, hosting DC/AC inverters and LV/MV power transformers
- Medium voltage receiving station(s)
- Workshop & warehouses
- one small **on-site high-voltage substation** with high-voltage power transformers, stepping up the voltage to the voltage of the Eskom's grid (132 kV) and a 132 kV busbar with metering and protection devices and a control building (also called "**switching station**") - to be located within the PV plant development area
- **two new small sections of 132 kV line** - 100 m long - allowing the **Eskom "Hotazel - Heuningvlei" 132 kV power line** - crossing the project site - to loop in and out of the 132 kV busbar of the new on-site switching station
- Electrical system and UPS (Uninterruptible Power Supply) devices
- Lighting system
- Grounding system
- Access road and internal roads
- Fencing of the site and alarm and video-surveillance system
- Water access point and water extraction on-site borehole(s) point, water supply pipelines, water treatment facilities
- sewage system (*Ballam Waterslot* or *Lilliput* system).

The connection may also entail interventions on the Eskom grid according to Eskom's connection requirements/solution.

During the construction phase, the site may be provided with additional:

- water access point and water extraction on-site borehole(s) point, water supply pipelines, water treatment facilities;
- pre-fabricated buildings;

to be removed at the end of construction.

As *alternative connection solutions*, the Rhodes 1 Solar Park may be connected:

a) to the **Eskom Hotazel substation**, 7 km south of the project site, via a new 132 kV power line approximately 7.2 km long and running parallel to the existing Eskom "Hotazel - Heuningvlei" 132 kV power line (***alternative connection 2***); or

b) to the new **Eskom Umtu substation**, 8 km south-west of the project site, via a new 132 kV power line approximately 10.2 km long and running parallel to the existing Eskom "Hotazel - Heuningvlei" 132 kV power line (for 5.7 km) and to the Eskom "Hotazel - Umtu" 132 kV power line (for 4.5 km) (***alternative connection 3***).

With regard to **alternative connections 2 and 3**, whereby a new 132 kV power line may be constructed outside the project site, **a separate Basic Assessment is currently being conducted by AGES** (the applicant is Mira Energy).

Table 3: Project components

Component	Description / Dimensions
Project site / property	**Farm Rhodes No. 269, Kuruman RD** Joe Morolong Local Municipality John Taolo Gaetsewe District Municipality Northern Cape Province LPI code: C04100000000026900001 Alternative Location 1 (Preferred) - central point: Latitude 27° 08' 30" S Longitude 22° 58' 00" E Alternative Location 2 - central point: Latitude 27° 08' 40" S Longitude 22° 57' 20" E
PV plant footprint (fenced area)	**PV plant footprint: up to 210 ha** Geo-graphical coordinates of the footprint / security fence: **Alternative Location 1** P01 27° 08' 08.5" S, 22° 58' 23.6" E P02 27° 08' 43.0" S, 22° 58' 36.5" E P03 27° 08' 53.0" S, 22° 57' 11.7" E P04 27° 08' 25.7" S, 22° 57' 15.0" E P05 27° 08' 26.2" S, 22° 57' 47.0" E P06 27° 08' 08.0" S, 22° 57' 47.3" E P01 27° 08' 08.5" S, 22° 58' 23.6" E **Alternative Location 2** P01 27° 08' 30.7" S, 22° 58' 33.8" E P02 27° 08' 42.8" S, 22° 58' 38.4" E P03 27° 08' 57.4" S, 22° 56' 34.2" E P04 27° 08' 29.0" S, 22° 56' 34.7" E P01 27° 08' 30.7" S, 22° 58' 33.8" E
New section of access road	**Alternative Location 1 (preferred) - new section of access road** Access from the secondary road starting from the **R31 regional road** Access point: 27° 08' 19.2" S , 22° 58' 35.6" E Gate at the PV plant fence: 27° 08' 21.4" S , 22° 58' 28.4" E Length of the new section of access road: 210 m **Alternative Location 2 - new section of access road** Access from the secondary road starting from the **R31 regional road** Access point: 27° 08' 31.4" S , 22° 58' 40.3" E Gate at the PV plant fence: 27° 08' 33.1" S , 22° 58' 34.7" E Length of the new section of access road: 170 m
Generation capacity	up to 75 MW
Proposed technology	The preferred technical solutions are: **PV solar modules**: thin-film modules or mono-crystalline or polycrystalline modules **Mounting systems:** fixed mounting systems or single-axis horizontal trackers (SAT)
Height of installed panels from ground level	maximum height (highest point of the PV arrays): 3.1 m above the ground level minimum height (lowest point of the PV arrays): 0.7 m above the ground level

Width and length of internal roads	**Alternative Location 1 (preferred)** The main internal road around the security fence is max. 8.0 m wide and approximately 6.7 km long. **Main internal road around the security fence (Alt. 1)** FIR01: 27°08'08.7" S, 22°58'23.4" E FIR02: 27°08'42.8" S, 22°58'36.1" E FIR03: 27°08'52.7" S, 22°57'12.1" E FIR04: 27°08'26.0" S, 22°57'15.3" E FIR05: 27°08'26.4" S, 22°57'47.2" E FIR06: 27°08'08.2" S, 22°57'47.6" E FIR01: 27°08'08.7" S, 22°58'23.4" E Secondary internal roads are 4.0 m wide (max. 5.0 m wide) and max. 19.6 km long **Internal roads (Alt. 1)** East to West IR1: 27°08'10.6" S, 22°58' 23.9" E / IR1: 27°08'10.1" S, 22°57'47.7" E IR2: 27°08'13.9" S, 22°58' 25.1" E / IR2: 27°08'13.3" S, 22°57'47.6" E IR3: 27°08'17.1" S, 22°58' 26.3" E / IR3: 27°08'16.6" S, 22°57'47.6" E IR4: 27°08'20.4" S, 22°58' 27.6" E / IR4: 27°08'19.8" S, 22°57'47.5" E IR5: 27°08'23.6" S, 22°58' 28.8" E / IR5: 27°08'23.0" S, 22°57'47.4" E IR6: 27°08'26.9" S, 22°58' 30.0" E / IR6: 27°08'26.3" S, 22°57'47.4" E IR7: 27°08'30.1" S, 22°58' 31.2" E / IR7: 27°08'29.0" S, 22°57'15.0" E IR8: 27°08'33.4" S, 22°58' 32.5" E / IR8: 27°08'32.2" S, 22°57'14.6" E IR9: 27°08'36.6" S, 22°58' 33.7" E / IR9: 27°08'35.5" S, 22°57'14.2" E IR10: 27°08'39.9" S, 22°58' 34.9" E/ IR10: 27°08'38.7" S, 22°57'13.8" E IR11: 27°08'43.1" S, 22°58' 30.0" E/ IR11: 27°08'42.0" S, 22°57'13.4" E IR12: 27°08'46.0" S, 22°58' 05.4" E/ IR12: 27°08'45.2" S, 22°57'13.1" E IR13: 27°08'48.8" S, 22°57' 41.0" E/ IR13: 27°08'48.4" S, 22°57'12.7" E **Alternative Location 2** The main internal road around the security fence is max. 8.0 m wide and approximately 8.0 km long **Main internal road around the security fence (Alt. 2)** FIR01: 27°08'31.0" S, 22°58'33.6" E FIR02: 27°08'42.6" S, 22°58'37.9" E FIR03: 27°08'57.1" S, 22°56'34.5" E FIR04: 27°08'29.3" S, 22°56'35.0" E FIR01: 27°08'31.0" S, 22°58'33.6" E Secondary internal roads are 4.0 m wide (max. 5.0 m wide) and max. 18.7 km long **Internal roads (Alt. 2)** East to West IR1: 27°08'32.8" S, 22°58' 34.1" E / IR1: 27°08'31.6" S, 22°57'14.6" E IR2: 27°08'36.0" S, 22°58' 35.4" E / IR2: 27°08'34.8" S, 22°57'14.2" E IR3: 27°08'39.2" S, 22°58' 36.6" E / IR3: 27°08'38.1" S, 22°57'13.8" E IR4: 27°08'42.5" S, 22°58' 34.8" E / IR4: 27°08'41.3" S, 22°57'13.7" E IR5: 27°08'45.4" S, 22°58' 10.2" E / IR5: 27°08'44.5" S, 22°57'13.0" E IR6: 27°08'48.1" S, 22°57' 47.5" E / IR6: 27°08'47.5" S, 22°57'12.7" E IR7: 27°08'31.6" S, 22°57' 11.6" E / IR7: 27°08'31.0" S, 22°56'35.1" E

	IR8: 27°08'34.8" S, 22°57' 11.2" E / IR8: 27°08'34.3" S, 22°56'35.0" E IR9: 27°08'38.1" S, 22°57' 10.8" E / IR9: 27°08'37.5" S, 22°56'35.0" E IR10: 27°08'41.3" S, 22°57' 10.4" E/ IR10: 27°08'40.8" S, 22°56'34.9" E IR11: 27°08'44.5" S, 22°57' 10.0" E/ IR11: 27°08'44.0" S, 22°56'34.8" E IR12: 27°08'47.5" S, 22°57' 09.7" E/ IR12: 27°08'47.0" S, 22°56'34.8" E IR13: 27°08'50.5" S, 22°57' 09.3" E/ IR13: 27°08'50.0" S, 22°56'34.7" E IR14: 27°08'53.4" S, 22°57' 02.0" E/ IR14: 27°08'53.0" S, 22°56'34.7" E
Height of Fencing	security fence around the footprint: maximum height: 3.0 meters above the ground level
PV plant High Voltage Substation	**Alternative Location 1** - On-site High-Voltage Substation Substation Fence: 60 m x 60 m Substation Footprint: 0.36 ha Latitude 27° 08' 50.9" S Longitude 22° 57' 15.4" E **Alternative Location 2** - On-site High-Voltage Substation Substation Fence: 60 m x 60 m Substation Footprint: 0.36 ha Latitude 27° 08' 51.0" S Longitude 22° 57' 15.4" E
Loop-in loop-out lines	**Alternative Location 1** two new sections of 132 kV power line Length: 100 m each 01 starting point: 27°08'50.3" S, 22°57'14.2" E 01 ending point: 27°08'50.1" S, 22°57'11.5" E 02 starting point: 27°08'50.7" S, 22°57'14.2" E 02 ending point: 27°08'50.4" S, 22°57'11.5" E **Alternative Location 2** two new sections of 132 kV power line Length: 100 m each 01 starting point: 27°08'50.5" S, 22°57'14.2" E 01 ending point: 27°08'50.3" S, 22°57'11.5" E 02 starting point: 27°08'50.9" S, 22°57'14.1" E 02 ending point: 27°08'50.6" S, 22°57'11.5" E

4.2.1. Project functioning and connection of the solar park to the Eskom grid

Solar energy facilities using PV technology convert sun energy to generate electricity through a process known as the Photovoltaic Effect, which consists of the generation of electrons by photons of sunlight in order to create electrical energy.

The preferred technical solutions are:

- thin-film modules or mono / polycrystalline modules, mounted on:
- fixed mounting systems or mounted on 1-axis horizontal trackers (SAT), which at present represent the best performing options in terms of reliability and costs/efficiency.

The PV technology is in constant and rapid evolution, this means that the final choice of the type of solar modules (thin-film, mono-crystalline or polycrystalline) and mounting system (fixed or tracker) can be taken at the time of the commission date, on the basis of the availability of PV modules and mounting systems, of the worldwide market and of the cost-efficiency curve.

The required footprint - corresponding on the fenced area - will not exceed 210ha, and the maximum height of the structures (PV modules and support frames) will be approximately 3.1 m above the ground level. Therefore the impacts and mitigation measures will not change. For further reference please refer to section 5.2.

The following description is referred to the examples of "thin-film PV modules on fixed mounting systems" and of "mono/polycrystalline modules on single-axis horizontal trackers (SAT)", but the combinations "thin-film PV modules on trackers" and "mono/polycrystalline PV modules on fixed mounting systems" are also possible and feasible.

The required **footprint** (including internal roads) will not exceed **210ha**.

PV modules will be assembled on zinced steel or aluminium frames, to form PV arrays. The metal frames that sustain PV arrays are set to the ground by fixed support poles.

A) In the case of PV modules mounted on fixed mounting systems:

Each mounting frame will host several PV modules along two or more parallel rows consisting of PV modules placed side by side, with the position of the PV arrays northwards and at an optimized tilt. The rows are mounted one on top of the other, with an overall mounting structure height **up to 3.1 meters above ground level**.

Figure 4: Lateral views of PV arrays mounted on fixed mounting systems

Figure 5: Frontal view of PV arrays mounted on fixed mounting systems

For further details, Please refer to the Figures 4 and 5 above and to the drawing of the Annexure A:

- RH1SP_03_r0 *Mounting System – Alternative option 1: fixed mounting systems*

B) In the case of PV modules mounted on single-axis horizontal trackers (SAT):

Each PV array is composed of several PV modules disposed along one or more parallel rows consisting of PV modules placed side by side.
Each tracker is composed by several PV arrays North-South oriented and linked by a horizontal axis, driven by a motor. The horizontal axis allows the rotation of the PV arrays toward the West and East direction, in order to follow the daily sun path.

The maximum mounting structure height will be **up to 3.1 meters above ground level**.

Figure 6: Simulation views of the PV arrays mounted on 1-axis horizontal tracker

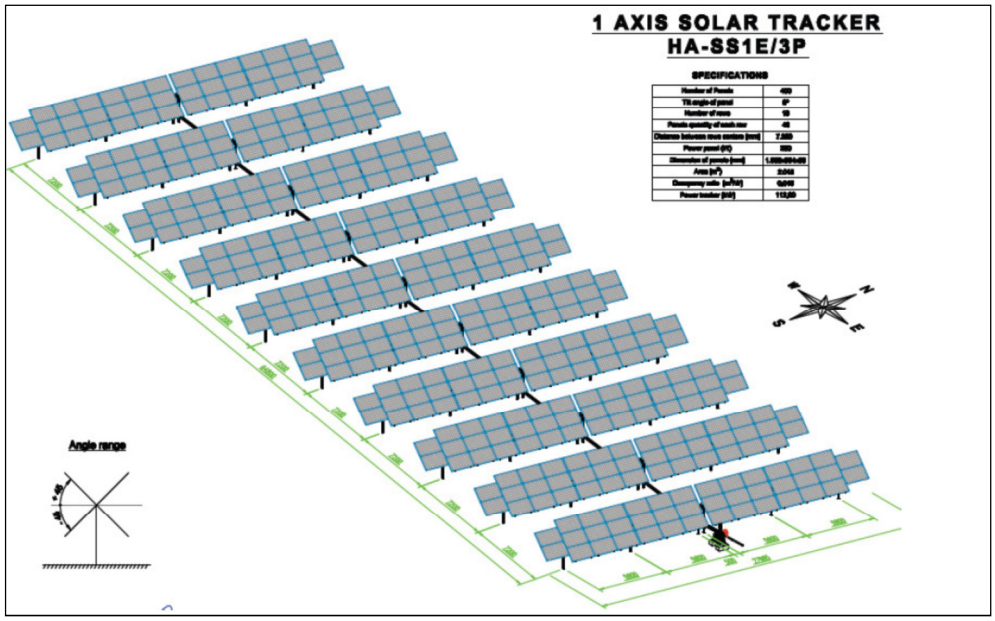


Figure 7: Frontal views of the PV arrays mounted on 1-axis horizontal tracker

For further details, see also the drawing of the Annexure A:

- RH1SP_04_r0*Mounting System – Alternative option 2: horizontal single-axis trackers*

C) In both cases:

PV modules are series-connected outlining PV strings made of several modules, so that the PV string voltage fits into the voltage range of the inverters. PV strings are set up in order to be connected to DC-connection boxes. Each String Box allows the parallel connection of several PV strings (also called “PV sub-field”).

String Boxes monitor the currents in photovoltaic modules and can promptly diagnose faults. String boxes are also designed with a circuit breaker in order to disconnect the photovoltaic sub-fields from the inverters.

The PV sub-fields are thought to be linked to central inverters, located in **75 medium voltage stations**. Each station comprises two adjacent prefabricate buildings designed to host two **DC/AC inverters**, with a total nominal output AC power of 1,000 kW (16 parallel sub-fields), and a **medium voltage power transformer** of 1000 kVA. The DC/AC inverters are deemed to convert direct current (DC) into alternate current (AC) at low voltage (270 V); subsequently the AC will pass through a medium-voltage transformer in order to increase the voltage up to 22 kV (or 11 kV).

The medium-voltage stations are detailed in the drawing of the Annexure A:

- RH1SP_05_r0 *Medium-voltage stations*

The energy delivered from the 75 medium voltage stations will be collected into one (or more) **medium voltage receiving station**(s), parallel connecting all the 75 PV fields of the PV generator.

From the medium voltage receiving station, the energy will be delivered to two high-voltage power transformers (40 MVA each, plus one as spare), which will step up the electric energy from the medium voltage level (11 kV or 22 kV) to the Eskom required connecting voltage (i.e.132 kV). The power transformers will be connected to an on-site 132 kV busbar (the so called "***switching station***"), to be equipped with protection and metering devices, according to Eskom requirements.

The new HV substation will need to be equipped with circuit breakers upstream and downstream, in order to disconnect the PV power plant and/or the power line in case of failure or grid problems**.**

Furthermore, two **metering devices and related kiosks** are foreseen inside the layout: one for Eskom, close to the busbar, and one for Mira Energy, close to the power transformers. The kiosks(2.4 x 4.8 x 3.2 m) will contain the peripheral protection and control cabinets and the metering devices. The HV substation composed of the power transformers, the control building, the 132 kV busbar with protection and metering devices and the kiosks, will have a **footprint covering approximately 4,000 m^2**.

The new power line and the busbar (*switching station*) of the on-site HV substation may be owned and operated by Eskom Distribution.

The layout of the high-voltage substation as well as of the control building and the subdivision between Eskom's side and Mira Energy's side respectively are detailed in the drawings included in Annexure A:

- RH1SP_06_r2 *Control building and medium-voltage receiving station*
- RH1SP_07_r2 *High-voltage substation*

The Rhodes 1 Solar Park may be connected either:

a) to the **Eskom "Hotazel - Heuningvlei" 132 kV power line**, running through the project site: the Eskom 132 kV power line will loop in and out of the 132 kV busbar of the new on-site substation via two new sections of 132 kV line approximately 100 m long (***alternative connection 1 - preferred***);

b) to the **Eskom Hotazel substation**, 7 km south of the project site, via a new 132 kV power line approximately 7.2 km long and running parallel to the existing Eskom "Hotazel - Heuningvlei" 132 kV power line (***alternative connection 2***); or

c) to the new **Eskom Umtu substation**, 8 km south-west of the project site, via a new 132 kV power line approximately 10.2 km long and running parallel to the existing Eskom "Hotazel - Heuningvlei" 132 kV power line (for 5.7 km) and to the Eskom "Hotazel - Umtu" 132 kV power line (for 4.5 km) (***alternative connection 3***).

With regard to **alternative connections 2 and 3**, whereby a new 132 kV power line may be erected outside the project site, a separate **Basic Assessment** is being conducted by AGES (Mira Energy is the applicant).

The power generation capacity at the delivery point will be up to 75 MW.

4.2.2. Access road and internal roads

Access to the Rhodes 1 Solar Park will be from a local upgraded dirt road starting from the regional road R31, which runs parallel to the eastern boundary of the property.

The new section of access road - from the eastern boundary of the property up to the PV plant footprint / fenced area, will be 8.0 m wide and 210 m long.

Access point from the secondary road parallel to the eastern boundary of the property:
Latitude: 27° 08' 19.2" S
Longitude: 22° 58' 35.6" E

Gate at the PV plant security fence / footprint:
Latitude: 27° 08' 21.4" S
Longitude: 22° 58' 28.4" E

Internal roads will consist of gravel roads designed in accordance with engineering standards. The roads will have a width of 8.0 meters allowing for slow moving heavy vehicles.

Once the solar farm is in operation, the internal roads will mainly be used for maintenance and inspections.

The vertical alignment of the roads will not present significant challenges due to the flatness of the terrain. The entire development will be contained inside a fenced area and the roads are not intended for public use.

4.2.3. Lighting system

The lighting system will consist of the following equipment:

- Floodlight-towers: maximum10 meters high, with 6x400W directional lamps, installed around the HV loop-in loop-out substation. Normal lighting: 15 lux; up to 40 lux in case of emergency.
- Street lighting along internal roads, for the stretch from the access point up to the HV substation inside the property: 1 streetlamp, maximum 5.5 meters high, every 20 meters, having a metal-haloids lamp of 400 W.
- 2x400 W spotlights (SAP type) mounted on the top of medium-voltage stations.

The lighting of the MV stations and of the on-site HV substation will be on only in case of intrusion/emergency or necessity to reach the MV stations / HV substation during the night.

During the night, the video-surveillance system will use infra-red (or micro-wave) video-cameras, which do not need a lighting system (which could reduce the functioning). Only streetlamps along internal roads, for the stretch from the main access up to the HV substation inside the property, may be switched on at night.

4.2.4. Stormwater collection system

Given the low rainfall, flat topography and low flow speed of run-off, **no formal storm water structures are required** as the proposed gravel roads will be developed at ground level so as not

to disturb the natural flow of storm water. This means that run-off will not be concentrated and the existing drainage patterns will be left undisturbed.

4.2.5. Water requirements

4.2.5.1. Water requirements during the construction phase

The construction timeframe is estimated to be approximately **15 months.**

A) Construction of internal gravel roads

- Water is necessary for the construction of internal gravel roads, in order to get the gravel compacted to optimum moisture content (OMC).
- The surface of internal gravel roads will be approximately 137,000 m^2.
- 50 liters of water / m^2 of internal of roads will be required.

B) Workers

- approximately 100 people are expected to be employed during the construction period of the PV plant, although this number can increase to 150 for short spaces of time during peak periods. This number can be higher in the case Mira Energy - once being selected as Preferred Bidder by the Department of Energy and having finalized the Connection Agreement with Eskom, where in particular it is agreed the envisaged connection timeline - evaluates to build the Rhodes 1 Solar Park in a timeframe shorter than 15 months (i.e. 330 working days). For example, in the case the construction works are planned to last only **6 months** (*i.e.* 132 working days), the average number of workers required on site during construction is **250**.
- Each worker needs 50 liters / 8 working hours for sanitary use.
- Water consumption will be:
    - 100 people per project x 50 l/person x 330 working days = 1650 m^3 over 15 months, or:
    - 250 people per project x 50 l/person x 132 working days = 1650 m^3 over 6 months.

C) Concrete production

- Concrete is necessary for the basements of the medium-voltage stations, the high-voltage loop-in loop-out substation, the control building and the warehouse and for the foundations of the mounting systems. The overall amount of concrete to be produced will be approximately 15,000 m^3 per project.
- 200 litres of water are needed for 1 cubic meter of concrete.

D) Vehicle cleaning

As mitigation measure, the cleaning of vehicles like excavators, mechanical diggers and pile rammers will be done once or twice per month and no during working days, also in order to not increase the water requirement during the construction activities.
In order not to waste a large amount of water, high pressure cleaners will be used.
Overall, the water requirement for cleaning activity is very low.

The overall and average water consumption during construction is detailed in the following table.

Table 4: Water consumption during the construction phase of the project

WATER REQUIREMENT DURING THE CONSTRUCTION PHASE OF THE PROJECT		
DESCRIPTION	**UNIT**	**TOTAL**
Timeframe of the construction activities	*months*	15
Timeframe of the construction activities - calendar days	*days*	450
Overall water consumption for internal roads	m^3	6,850
Overall water consumption for sanitary use	m^3	1,650
Overall water consumption for concrete production	m^3	3,000
OVERALL WATER CONSUMPTION	***m^3***	**11,500**
Daily water consumption (average over 450 calendar days)	***m^3/day***	**25.5**

Storage tanks will be sized in order to provide a reserve of water approximately **200 cubic meters**.

4.2.5.2. Water requirements during the operational phase

During operation, water is only required for the operational team on site (sanitary use), as well as for the cleaning of the solar panels.
Further water consumption may be only for routine washing of vehicles and other similar uses.

A) Water for sanitary use

Approximately **35-40 people** will be employed during the operation phase of the PV power plant, which will have a lifetime of 25 - 30 years.
Rhodes 1 Solar Park will be in operation 7 days per week; therefore personnel will operate according to shifts. The surveillance team will be present during day-time, night-time and weekends. The average number of people working at the site on the same time will be of **14 people daytime and 6 people at night**.

The average daily water consumption for sanitary use is estimated to be**150 litres** / **day** / **person** per **20 people** (14 people daytime and 6 people at night),The daily water consumption will be approximately **3,000 litres/day.**

B) Water consumption to clean the PV modules

The cleaning activities of the solar panels will take place **twice per year**.
It is assumed that up to 1.0 liters per m^2 of PV panel surface will be needed.
The amount of water for cleaning is up to **850 m^3 per cleaning cycle** ,therefore **1,700 m^3per year on the whole.**

PV modules cleaning activity can last less than 1 month. If the cleaning activity lasts approximately 2 weeks (12 working days), the daily water consumption will be approximately **71,000 liters/day**, **over 12 days**.

<u>Conclusion</u>

The daily water requirement will be approximately **3,000 liters/day** over 12 months for sanitary use (i.e. **90,000 l/month** and **1,095 m^3/year**).

The water consumption will increase up to **74,000 liters/day** during the cleaning of the solar modules (71,000 liters/day for cleaning activity and 3,000 for sanitary use), which will last less than a month and will occur **twice per year** during the dry period. Indeed PV modules are conceived as self-cleaning with the rain.

It is further proposed that **90,000 l** of water will be stored in **storage tanks** for fire, emergency and washing of panels twice a year.

The overall and average water consumption during operation is detailed in the table below.

Table 5: Water consumption during the operational phase of the project

WATER REQUIREMENT DURING THE OPERATIONAL PHASE OF THE PROJECT		
DESCRIPTION	**UNIT**	**TOTAL**
Average daily water consumption for sanitary use	*l/day*	3,000
Average daily water consumption during cleaning activity (*)	*l/day*	74,000
Average monthly water consumption for sanitary use (over 30 days)	*l/month*	90,000
Annual water consumption for sanitary use	***m^3/year***	**1,095**
Annual water consumption for PV modules cleaning activities (twice/year)	***m^3/year***	**1,700**
ANNUAL WATER CONSUMPTION DURING OPERATION	***m^3/year***	**2,795**
DAILY WATER CONSUMPTION DURING OPERATION (average over 365 day)	***m^3/day***	**7.66**

(*) over 12 working days, twice per year

4.2.5.3. Water provision during construction and operation

The property is located on a local watershed on the boundary between the **Quaternary Catchment Areas (QCA) D41K and D41L**.The proposed development site falls within the **Lower Vaal Water Management Area** (WMA).

The available borehole on the property is located in the **D41L** QCA, where **45 m^3/ha/annum** of ground water abstraction is allowed for under the DWA General Authorization.

The estimated annual groundwater recharge (11.07 mm/m2 per annum) from an average annual precipitation of 391 mm falling on the development area (210 ha) results in **23,247 m^3 of water available**.
The maximum annual water requirements are 2795 m^3 / year during the operational phase, therefore **the scale of abstraction relative to recharge is 12.0% (Category A)**.

As indicated in the Geo-technical and Geo-hydrological Report (Annexure H), two boreholes are located on the property. At the present time the landowner uses the boreholes as a source of water for game and cattle.

One borehole is located close to the homestead and will not be available for the project; the second borehole is located in the south eastern corner of the farm.

The Geo-technical and geo-hydrological Study concluded that, should water for the project be sourced by means of groundwater abstraction, a new borehole should be drilled, being the existing on-site boreholes not suitable due to the low yield and poor water quality. It is recommended that the fracture rock aquifer located below the Kalahari sediments be targeted at depths between 80 and 120 m below surface as a source of water for the project. In this case, a Water Use License application should be submitted to the Department of Water Affairs by Mira Energy.

Alternatively (*preferred alternative* - under investigation by Mira Energy) water may be sourced **from the Sedibeng Water Service Provider** by means of the "Vaal Gamagara Pipeline" which crosses the project site.
With a letter dated 6 May 2014, the Joe Morolong Local Municipality indicated that they can't supply water because the area is serviced by Sedibeng Water Service Provider.
Correspondence with Sedibeng Water Service Provider and Joe Morolong Local Municipality is annexed in the Annexure C (*Correspondence for water allocation*).

4.2.6. Sewerage

Considering that the proposed development will not include formal residential properties there is no need to connect the municipal sewer reticulation system. Sewer reticulation will be handled by the patented and commercially available *Ballam Waterslot* (or similar) sewer treatment system.

The sewer system will therefore consist of an installation to serve the offices of the control building. It is foreseen that the system will be installed in line with the requirements of the manufacturer. Typical systems consist of a conservancy tank (built underground on site), and a patented digester. Most systems require electricity to power the pumps and fans used in aeration process, although some systems use wind power (whirlybird). The system could require chlorine tablets available commercially. The effluent from the *Ballam Waterslot* (or similar) system will be suitable for irrigation of lawns, or re-use in the dwellings as water for the flushing of toilets, or for fire-fighting purposes. This could reduce the overall water requirement of the development substantially.

A Water Use License application will be submitted to the Department of Water Affairs by Mira Energy with regard to the water treatment system on site.

4.2.7. Refuse removal

Mira Energy will enter into an agreement with the Joe Morolong Local Municipality for the PV plant's refuse at the nearby municipal refuse site. No refuse will be buried or incinerated on site.

4.3. CONSTRUCTION SITE

The construction site (approximately 10ha) will be located on the south-eastern side of the planned footprint- covering the area where the last 4MWp are planned. Consequently, the construction site area will be gradually reduced at the completion of the last four PV fields (4 MWp), and at the end of the works all the construction area will be converted into the last PV arrays.

The optimal location of the construction site is an important element of the planning phase also in order to minimize impacts on the surrounding environment.

The site's location has been dictated by the nature of the works to be undertaken, specialist studies, site restrictions, town planning intended uses and access.

The area identified for the construction site had to meet the following requirements:

- sufficient size;
- proximity to existing roads;
- availability of water and energy;
- low environmental and landscape value;
- sufficient distance from residential areas; and
- proximity to the worksite.

In addition, to ensure environmental compatibility, the following factors have been considered:

- restrictions on land use (landscape, archaeological, natural, hydrological, etc.);
- terrain morphology;
- presence of high environmental value areas (e.g. wetlands); and
- sand& stone supply.

The establishment of the construction site will be divided into four distinct phases. The steps individuated hereinafter do not follow a time sequence, but it should be considered as overlapping and simultaneous events.

4.3.1. Phase I

The area will be fenced to prevent intrusion of animals and to protect against materials theft within the site. A video surveillance system will be provided.

4.3.2. Phase II

During the fencing operation as described in Phase I, the most valuable trees, if any, will be removed and placed temporarily in a safe location for future planting at the end of work. This procedure is required for environmental mitigation. The other low value tree species will be cut down and transferred to facilities for wood processing.

4.3.3. Phase III

At completion of the works defined in Phases I and II, the following step will be the site clearing and the construction of internal roads. The internal road network should ensure a two-way traffic of heavy goods vehicles in order to minimize trips. The road system is planned for a width of 8 meters. Roads will be of dry and compacted materials.

The facility will require constant access control, a weigh-house for heavy trucks, removable structures for the storage of yard tools and temporary storage areas.

During Phase III, the installation of MV/LV transformers connected to the Eskom grid is also planned, as well as the laying of underground electrical cables.

4.3.4. Phase IV

Temporary storage areas of materials and workshops will be constructed and used for:

- temporary storage of photovoltaic modules (covered with compacted dry material in order to avoid direct contact with the ground);
- temporary storage for frames and piles of the mounting systems of the PV arrays;
- storage and processing of building material for construction (sand, gravel, concrete batching and mixing plant, steel, etc.);
- drinking water storage for human consumption;
- worker care facilities and site management buildings,
- prefabricated housing modules for workers who may require accommodation inside the site (only key personnel should be allowed to stay overnight);
- technical cabins and management offices;
- medical care unit in a prefabricated module, in order to allow immediate first aid and minor surgical emergency;
- recreation area and canteen (prefabricated modules);
- parking lots for employees (located close to the staff housing), for visiting staff (located close to the offices area), and for trucks and work vehicles during inactivity;
- workshop and storage facilities on the site for contractors;
- electrical network for living units, offices and service structures;
- water supply for living units through polyethylene pipes connected to storage;
- *Ballam Waterslot* or similar sewer treatment system. The treated water will be used to moisten dusty areas and reduce dust gathering due to windy actions;
- chemical toilets (one every 15 workers); and
- solid waste collection point.

All facilities present in the construction site will be covered with dry material in order to avoid mud formation in case of rain.

4.3.5. Earthworks

Earthworks will be required during the construction of internal roads. The vertical alignment of the roads will not present any significant challenges due to the flatness of the terrain so that no deep cuts or fills will be required. Considering a road pavement thickness of 300 mm and an overall road surface approximately 137,000 m^2, the amount of cut or fill is estimated to be approximately 41,100 m^3.

Further items of earthworks would be required where temporary storage areas will be prepared for the storage of the photovoltaic modules and other equipment during construction of the solar park. Small earthworks will be required for the installation of the PV modules and of the medium-voltage stations. None of these activities should require earthworks in excess of 500 mm cut or fill.

Only the foundation plate for the small high-voltage substation may require earthworks in excess of 500 mm cut or fill (the footprint will be up to 4000 m^2).The topsoil stripping will result in temporary spoils heaps which must be spread over the site upon completion of the project.

Concrete necessary for the basements of the medium-voltage stations, the high-voltage substation, the control building and the warehouse and will be manufactured using aggregate and sand from commercial sources in the vicinity of the development (in Hotazel, Kathu or Kuruman).

The soil present on site is not suitable for use as aggregate for road construction. Gravel necessary for the construction of internal roads may be provided from the commercial sources in the vicinity of the development(in Hotazel, Kathu or Kuruman). Discard material from the nearby manganese mines can also be used for road construction.

4.4. TRAFFIC IMPACT OF THE PROPOSED DEVELOPMENT

4.4.1. Traffic impact – construction phase

The construction timeframe is estimated to be approximately **15 months.**

Approximately 100 people are expected to be employed during the construction period (15 months), although this number can increase to 150 for short spaces of time during peak periods. This number can be higher in the case Mira Energy - once being selected as Preferred Bidder by the Department of Energy and having finalized the Connection Agreement with Eskom, where in particular it is agreed the envisaged connection timeline - evaluates to build the Rhodes 1 Solar Park in a timeframe shorter than 15 months (i.e. 330 working days). For example, in the case the construction works are planned to last only 6 months (i.e. 132 working days), the average number of workers required on site during construction is 250-300. A small accommodation area with few prefabricated buildings inside the work site may be foreseen, if accommodation facilities in Hotazel are not sufficient to accommodate all workers.

Overall traffic to and from the work site will amount to approximately **1000 medium** / **heavy vehicle trips** over the whole construction period. As indicated in the table below, the average number of medium and heavy trucks to and from the site will be of **3 trucks per working day.**

Table 6: Construction timeframe: average daily trips of medium - heavy vehicles

Transportation of:	months	1	2	3	4	5	6	7	8
fencing and tools	trips/month	8	8	0	0	0	0	0	0
clearance of the site (vegetation transportation)	trips/month	56	32	0	0	0	0	0	0
piles / frames for mounting systems	trips/month	0	0	20	20	20	20	20	0
sands & gravel for on-site concrete production	trips/month	0	30	48	48	48	52	52	54
PV modules	trips/month	0	0	0	0	0	0	0	0
MV stations	trips/month	0	0	0	0	0	12	12	12
HV substation components	trips/month	0	0	8	8	8	0	0	0
cables	trips/month	0	0	0	0	0	0	0	16
Average trips per month	trips/month	**64**	**70**	**76**	**76**	**76**	**84**	**84**	**82**
Average trips per working day (*)	trips/day	**2.9**	**3.2**	**3.5**	**3.5**	**3.5**	**3.8**	**3.8**	**3.7**

Transportation of:	months	9	10	11	12	13	14	15	TOTAL
fencing and tools	trips/month	0	0	0	0	0	0	0	**16**
clearance of the site (vegetation transportation)	trips/month	0	0	0	0	0	0	0	**88**
piles / frames for mounting systems	trips/month	0	0	0	0	0	0	0	**100**
sands & gravel for on-site concrete production	trips/month	52	48	32	0	0	0	0	**464**
PV modules	trips/month	0	16	32	68	66	34	0	**216**
MV stations	trips/month	12	12	0	0	0	0	0	**60**
HV substation components	trips/month	0	0	0	0	0	0	0	**24**
cables	trips/month	16	0	0	0	0	0	0	**32**
Average trips per month	trips/month	**80**	**76**	**64**	**68**	**66**	**34**	**0**	**1000**
Average trips per working day (*)	trips/day	**3.6**	**3.5**	**2.9**	**3.1**	**3.0**	**1.5**	**0.0**	**3.03**

(*)22 working days per month

Medium and heavy trucks will access / leave the site only during working days (Monday to Friday), during daytime (8:00 – 17:00). The provision of a fuelling area at the site could reduce the load of heavy vehicles on public roads. The installation of two steel fuel tanks (30,000 l each) is planned.

4.4.2. Traffic impact – operation phase

The traffic impact during the operation phase will be insignificant, considering that about 35-40 people will work on the PV facility, in the following manner:

- during the daytime approximately 14 people;
- during the night-time, 6 people.

4.5. MANAGEMENT OF THE SOLAR PARK DURING OPERATION

Approximately 35-40 people will be employed during the operation phase, which will have a lifetime of 25 - 30 years. The Rhodes 1 Solar Park will be in operation 7 days per week; therefore personnel will operate according to shifts. The surveillance team will be ensured during day-time, night-time and weekends.

The operational team of the project will consist of the following people:

- 1 person as plant manager
- 1 person for administration
- 4 people as technicians / plant operators
- 9/12 people for electric and generic maintenance
- 20/22 people as guards

The "**fire team**" will comprise of people for generic maintenance, who will attend a fire-fighting training program. After this training programme, the fire team will be able to drive/use/manage properly the fire extinguishers and the fire fighting vehicle, that will be available on the site.

5. PROJECT ALTERNATIVES

The EIA Regulations, Section 28(1)(c) and NEMA, Section 24(4), require investigation and consideration of feasible and reasonable alternatives for any proposed development as part of the environmental impact assessment process. Therefore, a number of possible alternatives for accomplishing the same objectives must be identified and investigated.

In particular:
- the property on which, or location where, it is proposed to undertake the activity;
- the location within the current identified site;
- the type of activity to be undertaken;
- the design or layout of the activity;
- the technology to be used in the activity;
- the operational aspects of the activity (schedule, process);
- the sustainability of other alternatives, and
- the option of not implementing the activity (No Go Alternative).

5.1. SITE ALTERNATIVES

Several sites have been inspected in order to find out the best solution for the PV power plant. The following selection criteria were applied:
- Connection availability and proximity
- Land availability
- Proper land surface area (±300ha)
- Current land use
- Low environmental impact (low biodiversity)
- Low agricultural potential
- High solar radiance
- Socio-economic issues (land cost and local community unemployment)

The macro area North of Hotazel was investigated, due to the high value of solar irradiation and to the presence of the Eskom's "Hotazel - Heuningvlei" 132 kV power line.

Several sites crossed by the Eskom 132 kV power line were investigated during the feasibility assessment, such as:
a) Remaining Portion of Farm Bowden 223, Kuruman RD
b) Farm Rhodes 269, Kuruman RD
c) Remaining Portion of Farm East 270
d) Portion 2 of the Farm East 270, Kuruman RD
e) Remaining Portion of Farm Kipling 271, Kuruman RD
f) Other farm portions crossed by the Eskom "Hotazel - Heuningvlei" 132 kV power line

a) **Remaining Portion of Farm Bowden 223, Kuruman RD** is 1214 ha in extent; even if almost suitable for a solar park, resulted to be not ideal for the proposed development, due to the presence of a large drainage / wetland which affects the southern side of the farm. Furthermore, this farm belongs to the Municipality; therefore the negotiation of a long-term lease would possibly be a lengthy and time consuming process.

b) **Farm Rhodes 269, Kuruman RD** is1810.8314 ha in extent; this property was found to be highly suitable, due to the easy access and the presence of the Eskom "Hotazel - Heuningvlei" 132 kV line, crossing the site. The eastern side of the farm is also suitable from an environmental point of view, with little to no environmental issues. The landowner resulted to be available to enter into an agreement for a long-term lease of a part of the farm, for the proposed development.

c) **Remaining Portion of Farm East 270, Kuruman RD** is approximately 974 ha in extent; this farm portion resulted to be not ideal for the proposed development, due to the small size.

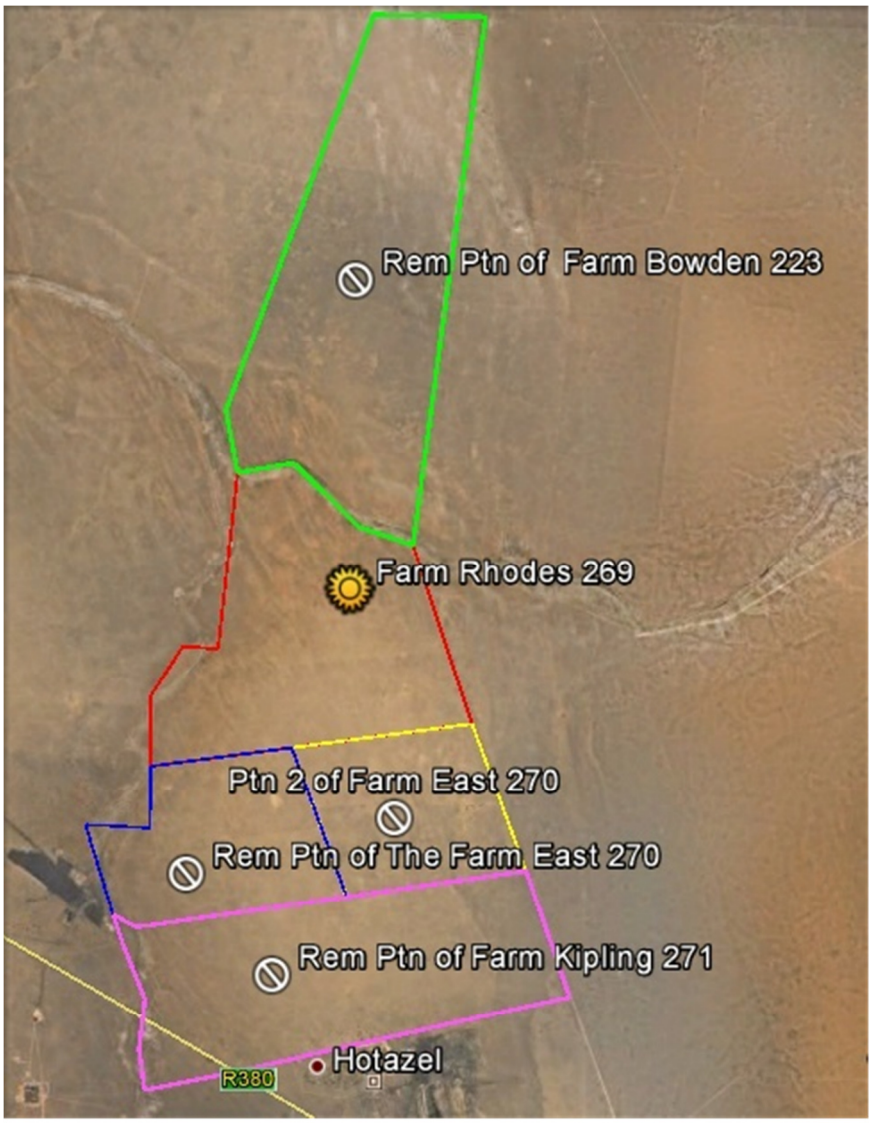
d) **Portion 2 of the Farm East 270, Kuruman RD** is approximately 861 ha in extent; this farm portion resulted to be not ideal for the proposed development, due to the small size and the lack of accessibility to the site.

e) **Remaining Portion of Farm Kipling 271,Kuruman RD** is approximately 1905 ha in extent; this farm portion was found to be not suitable because of future plans for manganese mining activities.

f) Other farm portions crossed by the Eskom "Hotazel - Heuningvlei" 132 kV power line resulted to be either: not suitable due to the difficult accessibility and/or ecological constrains(e.g. the presence of wetlands / drainage areas, which reduce the suitable areas to less than the required minimum footprints); or not available for a long-term lease, since owned by the Government of South Africa and already involved in current or planned mining activities.

Therefore, **Farm Rhodes 269** is the *preferred site*, being the most suitable and available alternative.The location of the alternative sites is indicated in the Figure 8 below.

Figure 8: Location of the alternative sites



5.2. TECHNOLOGY ALTERNATIVES

5.2.1. PV Plant and Solar Thermal Power Plant

The alternative to PV for producing energy from the sun is the thermal solution. There are different forms of this technology: linear Fresnel, parabolic through or tower. These technologies can also be with or without thermal storage and they can use diathermic oils or, the more sophisticated ones can use water and/or molten salts.

The final choice is the PV option because these kinds of project result in:

- lower construction costs;
- lower operating and maintenance costs (O&M);
- it is a simpler, quicker and more experienced technology; and
- lower environmental impact, considering that, among other factors, the PV solution requires a minor quantity of water.

5.2.2. Solar Photovoltaic Technology – PV

The project consists of a photovoltaic power plant with a generating capacity of75 MW, on a footprint of up to210 ha.

The preferred types of PV modules are:

- **mono-crystalline or polycrystalline PV modules** and,
- **thin-film PV modules**,

which currently represent the best performing options in terms of reliability and costs/efficiency.

At present, mono/polycrystalline modules provide higher solar conversion efficiency (14% to 16%), if compared to the thin-film /PV modules (9% to 13%).On the other hand, thin-film modules (or amorphous silicon / Cd-Te as well) are cheaper and best performing at high temperatures, having an efficiency degradation of only 0.25 %/℃ instead of 0.45 %/℃ in the case of mono/polycrystalline modules.

It is important to consider the fact that the PV technology is in continuous evolution and it may be possible that thin-film (or amorphous silicon / Cd-Te as well) PV modules achieve a higher solar conversion efficiency in a very short time.
Furthermore, it should be kept into account the high volatility of prices of PV modules which depends on the worldwide availability of modules. Therefore the final choice will be taken at the commissioning date, on the basis of the prices and availability of mono/polycrystalline and thin-film / amorphous silicon / Cd-Te PV modules.
The development will not exceed the current planned footprint (210ha).Therefore, the final choice of the type of PV modules, whatever it is, will not imply any additional visual or environmental impacts nor the necessity of specific or different mitigation measures.

5.2.3. Alternatives for the Mounting System of the PV Modules

The preferred technical solutions for the proposed solar park entails PV modules mounted on **fixed mounting systems** (*alternative option 1*) or on **single-axis horizontal trackers** (*alternative option 2*).

The tracking solution is the best performing in terms of efficiency, because its energy production is approximately 15% more if compared with fixed systems. This type of technology is characterized by higher technical complexity and deeper installing and maintenance costs, if compared with the fixed mounting solution.
As previously mentioned, the selected tracking system is the horizontal single-axis tracker (SAT), which doesn't differ from the fixed system, except for the presence of the tracking devices and the orientation of the rows of the PV arrays (north - south instead of west – east direction).

The technology of mounting systems is under continuous evolution. Consequently, the final decision about the mounting system technology will be taken only at the commissioning date: if addressed toward the fixed mounting system or toward horizontal single-axis trackers, the layout of the PV power plant will not imply any additional visual or environmental impacts nor the necessity of specific or different mitigation measures. The development will not exceed the currently planned footprint (210ha) and the height of the structures (PV modules and support frames) will be maximum 3.1 m above the ground level.

Both fixed and horizontal single-axis tracking solutions grant the reversibility of the development in respect of the terrain's morphology, geology and hydrogeology. This means that at the end of the PV plant's lifetime, the site can easily be returned to its status prior to the establishment of the PV plant.

5.3. LAYOUT DESIGN, LOCATION AND CONNECTION ALTERNATIVES

The site chosen for the establishing of the proposed Rhodes 1 Solar Park is **the Farm Rhodes 269, Kuruman RD**. The PV power plant will have a generation capacity **up to 75 MW**, on a footprint **up to 210 ha**.

5.3.1. Layout design and Location alternatives

The layout of the proposed development is the result of a comparative study of various layout alternatives and had been defined in consideration of the results of some specialists studies conducted / under drafting during this scoping phase.

The PV plant has been designed and conceived in order to minimize visual and noise impacts, as well as to operate safely and assuring a high level of reliability, with low water consumption and the need only for easy and quick maintenance and repair for approximately 25-30 years.

As mentioned in the paragraph 4.1 - *Project layout*, the main drives of the proposed layout are:

- to maximize the energy production and the reliability of the PV plant, by choosing proven solar technologies: thin-film or mono/polycrystalline solar modules mounted on single-axis horizontal trackers (SAT) or on fixed mounting systems;
- to develop the PV power plant on the southern and eastern side of the Farm Rhodes269 (1810.8314 ha), since this area is flat and has a *low to medium* ecological sensitivity, while the western and northern boundaries of the property are affected by two streams / drainages (*Gamagara and Kuruman Rivers*) and by sand dunes;
- to include as much as possible in the proposed footprint the low ecological sensitivity areas, in order to reduce the extension of the medium ecological sensitivity areas to be cleared and as consequence the number of protected trees to be removed;
- the proposed footprint has been located at a minimum distance of 50 m from the southern boundary and 150 m from the eastern boundary, so that the distance and the existing vegetation would be able to minimise the potential visual impact of the proposed development to the surrounding properties.

As anticipated in the Chapter 1 - *Introduction* and mentioned in the paragraph 4.1- *Project layout*, two alternative development areas are proposed and discussed in this EIA Report:

a) **Alternative Location 1 (preferred):** on the south-eastern side of the property, East of the 132 kV power line crossing the project site (Eskom "Hotazel - Heuningvlei" 132 kV power line);

b) **Alternative Location 2:** on the southern side of the property, parallel to the southern boundary of the farm, West and East of the Eskom "Hotazel - Heuningvlei" 132 kV power line.

Alternative location 1 is better from an ecological point of view, because the proposed fenced area (210 ha) is optimized in order to include the *low to medium* ecological sensitivity areas located East of the Eskom 132 kV power line. The development area (210 ha) entails the clearance of 64.5 ha (31%) of *medium to low* sensitivity areas and 145.5 ha (69%) of *medium* sensitivity areas.

Alternative location 2 is the best one in terms of visual impact from the secondary road parallel to the eastern boundary of the property, thanks to the shape, parallel to the southern boundary of the property. Furthermore, the fenced area (210 ha) excludes the borehole BH2, currently used for the livestock on the property. This development area (210 ha) encloses 50.6 ha (24%) of *medium to low* sensitivity areas and 159.4 ha (76%) of *medium* sensitivity areas. It should be noted that the actual footprint would be approximately 205 ha, since 5 ha are affected by the Eskom servitude of the existing 132 kV power line, which may be rebuilt by Eskom parallel to the current corridor. Indeed the layout plan takes into account a possible new Eskom servitude - parallel to the existing one - necessary for the re-built of this 132 kV line.

The *alternative connection 1* resulted to be the preferred development area, being the best one from the ecological point of view. As far as the borehole is concerned, Mira Energy will equip it with an electric pump and will install a water reservoir outside the fenced area, in order to make water available for the animals and other landowner's uses at any time. The maintenance of this borehole and related equipment will be made by Mira Energy for the landowner's benefit.

The two proposed development areas, superimposed to the vegetation and sensitivity map, are depicted in the Figures 9 and 10 below and in the drawings of the Annexure A:

- RH1SP_00.1_r0 Development area: Alternative Location 1 and Sensitivity Map
- RH1SP_00.2_r0 Development area: Alternative Location 2 and Sensitivity Map

The two proposed layout plans, attached as Annexure A, were drawn using PV modules mounted on single-axis horizontal trackers; in the case of PV modules mounted on fixed mounting systems, the layout plan does not change, except for the orientation of the PV arrays: east-west instead of north-south. The required **footprint** - corresponding on the fenced area - **will not exceed 210 ha**, and the maximum height of the structures (PV modules and support frames) will be approximately 3.1 m above the ground level. Therefore the impacts and mitigation measures will remain exactly the same.

The project layout and the other PV plant components are detailed in the following drawings:

- RH1SP_00.3_r1 Connection alternatives
- RH1SP_01_r2 Layout plan on the Alternative Location 1 - PV power plant up to 75 MW
- RH1SP_02_r0 Layout plan on the Alternative Location 2 - PV power plant up to 75 MW
- RH1SP_03_r0 Mounting System – Alternative option 1: fixed mounting systems
- RH1SP_04_r0 Mounting System – Alternative option 2: horizontal single-axis trackers
- RH1SP_05_r0 Medium-voltage stations
- RH1SP_06_r2 Control building and medium-voltage receiving station
- RH1SP_07_r2 High-voltage substation
- RH1SP_08_r0 Warehouse

5.3.2. Connection alternatives

The Rhodes 1 Solar Park may be connected either:

a) to the **Eskom "Hotazel - Heuningvlei" 132 kV power line**, running through the project site: the Eskom 132 kV power line will loop in and out of the 132 kV busbar of the new on-site substation via two new sections of 132 kV line approximately 100 m long (***alternative connection 1 - preferred***);

b) to the **Eskom Hotazel substation**, 7 km south of the project site, via a new 132 kV power line approximately 7.2 km long and running parallel to the existing Eskom "Hotazel - Heuningvlei" 132 kV power line (***alternative connection 2***); or

c) to the new **Eskom Umtu substation**, 8 km south-west of the project site, via a new 132 kV power line approximately 10.2 km long and running parallel to the existing Eskom "Hotazel - Heuningvlei" 132 kV power line (for 5.7 km) and to the Eskom "Hotazel - Umtu" 132 kV power line (for 4.5 km) (***alternative connection 3***).

Please refer to the Figure 11 below, and to the drawing of the Annexure A:

- RHSP_00.3_r1 Connection alternatives

With regard to **alternative connections 2 and 3**, whereby a new 132kV power line may be erected outside the project site, a separate **Basic Assessment is currently being conducted by AGES** (the applicant is Mira Energy).

In the Cost Estimate Letter dated 12 May 2014, Eskom confirmed that the **Eskom "Hotazel - Heuningvlei" 132 kV power line** is available for the proposed "loop-in loop-out" connection, therefore **the alternative connection 1 is the preferred one.** A copy of the Eskom Cost Estimate Letter is enclosed in the Annexure M (Consents and Approvals).

Figure 9: Alternative Location 1 and Sensitivity Map

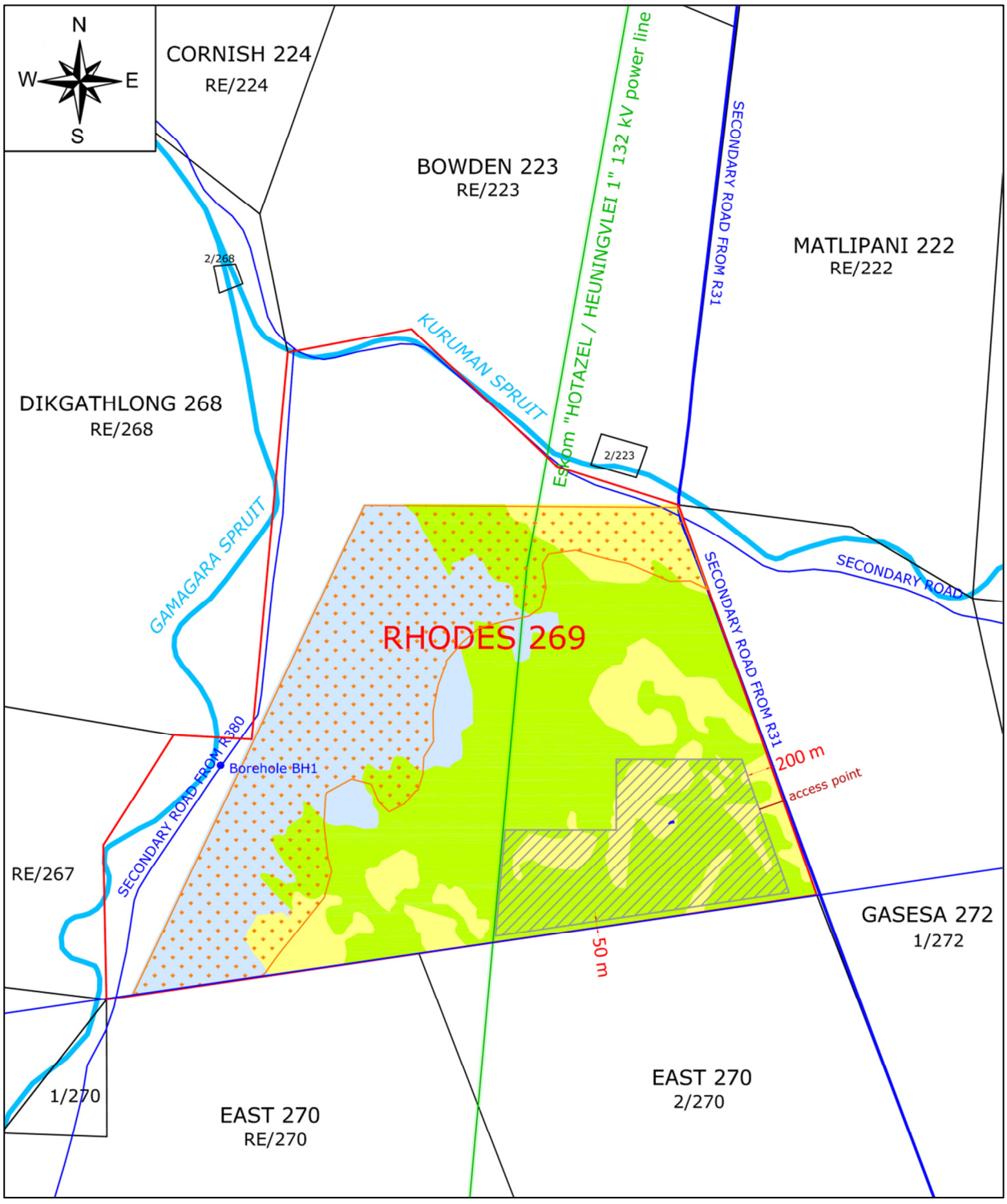
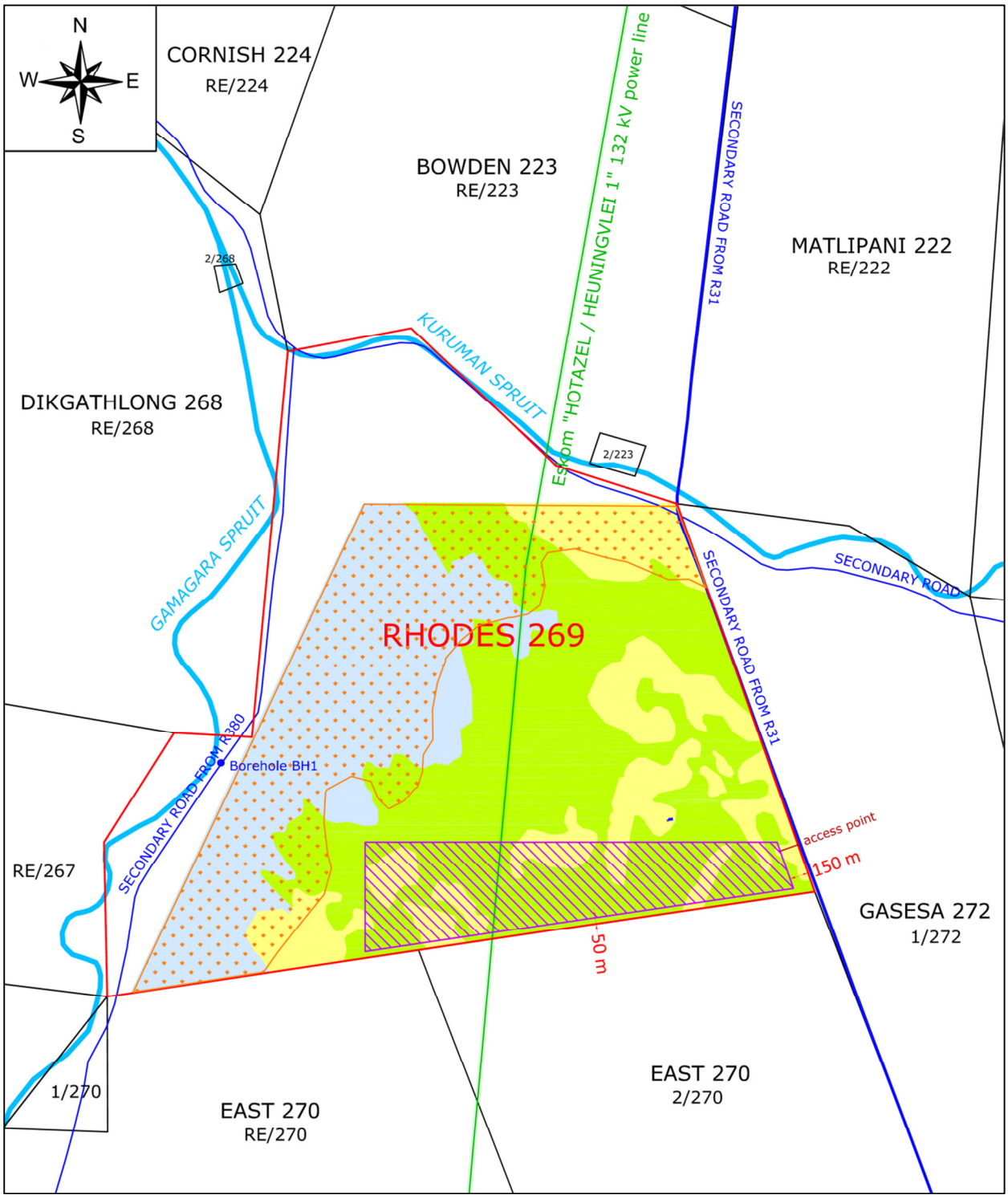


Figure 10: Alternative Location 2 and Sensitivity Map



Alternative Location 2
Extent: 210.0 hectares

Borehole BH2

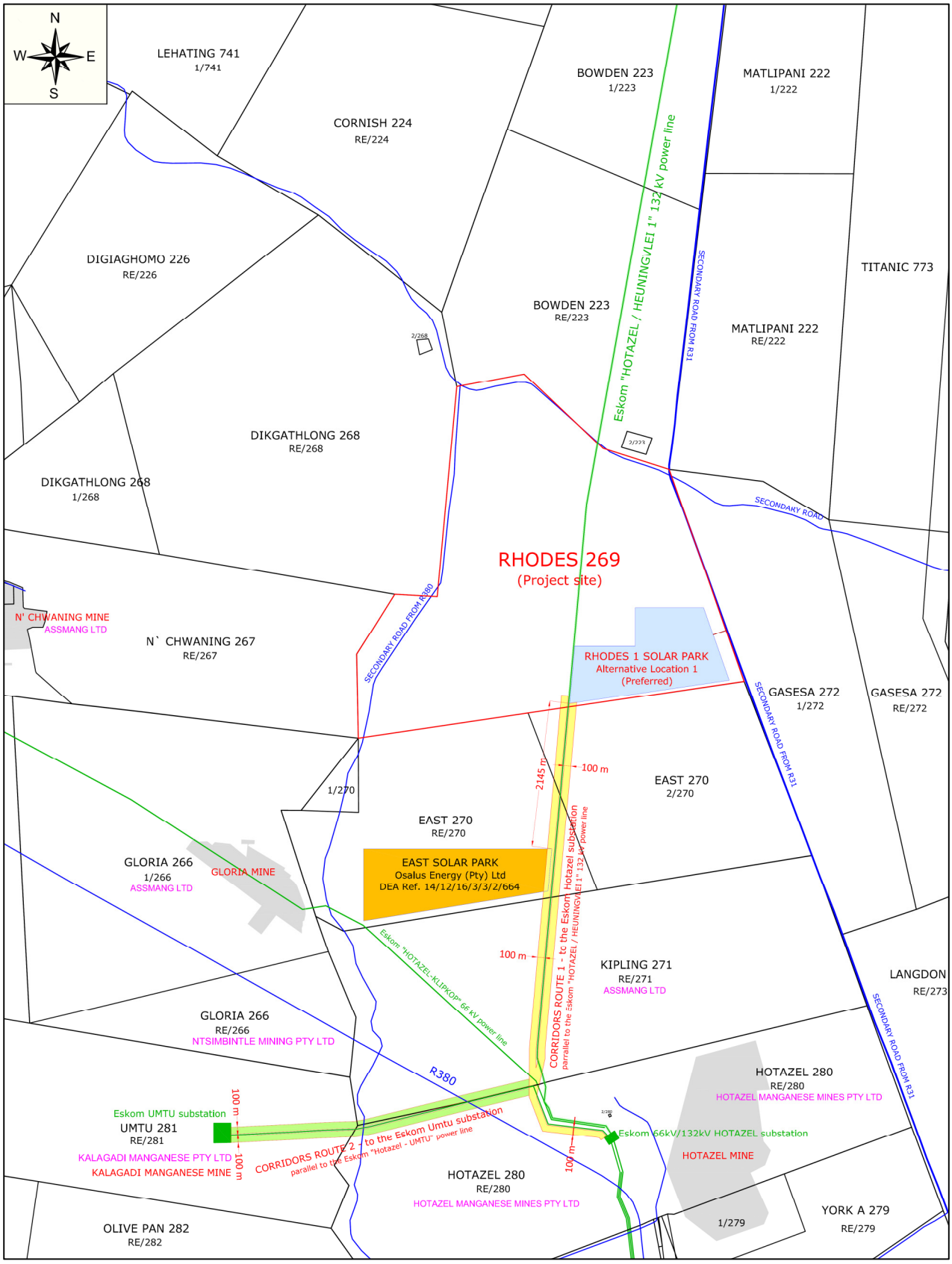
Medium Ecological Sensitivity
Woodland with protected tree species

Medium-Low Ecological Sensitivity
Indigenous woodland in slightly encroached state

Medium-High Ecological Sensitivity
Sloping terrain along dunes with protected tree species

Land Use Area B of the Geo-technical Study
Undulating topography (sand dunes)

Figure 11: Connection alternatives - to be investigated in the Basic Assessment



Alternative corridors to the Hotazel substation
Length: ±7.2 km - Study area width: 100 m + 100 m

Alternative corridors to the Umtu substation
Length: ±4.4 km - Study area width: 100 m + 100 m

5.4. NO-GO ALTERNATIVE

The no-go alternative is the option of not establishing Photovoltaic Power Plants on the site, or any of its alternatives. The environment will remain in its current state (*status quo*). This will not create any new employment opportunities, and therefore the anticipated economic benefits of the project will accrue to the study area (see the paragraph 6.4 *Socio-Economic Environment*).

Should this alternative be selected the socio-economic and environmental benefits related to the use of renewable energy resources will not be realised with prejudice to the development of the area. The benefits related to the establishment of a renewable energy power plant are for example analysed in detail in the REFIT Regulatory Guideline published by NERSA (March 2009:

- ***Enhanced and increased energy security***: renewable energy plays an important role in terms of power supply, improving grid strength and supply quality and contemporarily reducing transmission and distribution costs and losses.
- ***Resource economy and saving***: the energy production by coal fired plants consumes a significant amount of water, this amount of water could instead be saved if a renewable energy facility like the proposed one is put in operation.(the Energy White Paper envisages that the implementation of its targets will determine water savings approximately 16.5 million kilolitres). This will be beneficial on the large scale for the water conservation measures that the country is currently undertaking.
- ***Support of new technologies and new industrial sectors***: the development and establishment of renewable energy power plants contribute to the growth of new technologies and new industrial sectors with benefits for its economy.
- ***Exploitation and capitalization of South Africa's renewable resources***: with the aim of increasing energy security.
- ***Employment creation and career opportunities***: the construction and operation of a renewable energy power plant contributes to job creation and new career opportunities.
- ***Pollution reduction***: the use of renewable energy resources decreases the demand and the dependence from coal and oil for electricity generation.
- ***Contrast to Global warming and climate mitigation***: the development of renewable energy contributes to reduce global warming through the reduction of greenhouse gas (GHG) emissions.
- ***Protection of natural foundations of life for future generations***: the development and establishment of renewable energy power plants offers the opportunity of consistently reducing the risks related to climate change caused by CO2 and CO emissions, therefore preserving life for future generations.
- ***Acceptability to society and community***: the use of renewable energy is largely accepted by society and community as a mean to reduce pollution concerns, improve human health and wellness, protect the environment, the ecosystem and climate;
- ***Commitment to and respect of international agreements***: in particular in light of the possible commitment to the Kyoto Protocol.

6. STATUS QUO OF THE RECEIVING ENVIRONMENT

The receiving environment has been described using a combination of specialist inputs, on-site observations, a review of existing literature and utilizing Geographic Information Systems (GIS) planning tools.

6.1. PROPERTY DESCRIPTION AND CURRENT LAND USE

The proposed development will stretch over a part of the Farm Rhodes 269, Kuruman RD.

Farm Rhodes269, Kuruman RD	
Surveyor-general 21 digit site	C04100000000026900000
Local Municipality	Joe Morolong
District Municipality	John Taolo Gaetsewe
Province	Northern Cape
Extent	1810.8314 ha
Land Owner	HAUMAN FAMILIE TRUST
Diagram deed number	G30/1947
Title deed number	T3472/2013
Registration date	20131030
Current land use	farming
Geo-graphical Co-ordinates:	27° 08' 30" S, 22° 58' 00" E (Alternative Location 1, preferred) 27° 08' 40" S, 22° 57' 20" E (Alternative Location 2)

The site is located 7 km North of Hotazel and 50 km North of Kathu.

As aforementioned, the Farm Rhodes 269 is already affected by energetic infrastructure such as the **Eskom "Hotazel - Heuningvlei" 132 kV power line.**

Farm portions close to the project site are mainly used for farming purpose. South and West of the project site, several manganese mines are under operation or under construction, as the **Hotazel mine, the Kalagadi Manganese mine (under construction) and Assmang mines**.

6.2. OTHER RENEWABLE ENERGY PROJECTS CLOSE TO THE PROPOSED DEVELOPMENT

The renewable energy project closest to the proposed Rhodes 1 Solar Park is the **proposed East Solar Park** (DEA Ref. 14/12/16/3/3/2/664): a 75 MW Photovoltaic plant to be located on the **Remainder Portion of the Farm East 270**; the applicant is Osalus Energy (Pty) Ltd and the EAP is AGES. The authorisation process of this project is still on-going and Environmental Authorization has not been granted yet. The planned development area of the East Solar Park is located 2.1 km South of the preferred development area (alternative location 1) of Rhodes 1 Solar Park.

Please refer to the Annexure A:

- RHSP_00.3_r1 Connection alternatives

It should be noted that Mira Energy (the applicant of the Rhodes 1 Solar Park) and Osalus Energy (the applicant of the East Solar Park) should still participate in the REIPP Procurement Programme and be selected "Preferred Bidders" in respect of the Rhodes 1 and East Solar Parks before the proposed developments can take place. **Due to the high competition of this programme, it's very unlikely that both of the PV projects are selected by the DoE.** Furthermore, considering that the two projects are envisaged to be connected to the same Eskom network (Eskom "Hotazel - Heuningvlei" 132 kV power line and Hotazel substation), they may be in competition also in terms of grid availability.

The renewable energy project closest to the proposed Rhodes 1 Solar Park and already selected by the DoE under the REIPP Procurement Programme is the **Adams PV project** (DEA Ref. 12/12/20/2567): a 75 MW Photovoltaic plant to be located on the Remainder Portion of the Farm Adams 328. This project has been selected by the DoE under the Window 3 of the REIPP Procurement Programme; the construction will start once the Financial Close is reached (July 2014). The Adams PV development area is located **26 km South** of the Rhodes 1 Solar Park.

Due to the distance (minimum 26 km) from the proposed Rhodes 1 Solar Park of the other renewable energy projects already built or under construction, as well as mitigation measures implemented for the proposed Rhodes 1 Solar Park, **the cumulative impacts are not applicable / very low.**
As far as the proposed East Solar Park is concerned, It's very unlikely that two projects close to each other will be selected by the DoE, as they would be in competition also in terms of "grid availability".

6.3. ENVIRONMENTAL FEATURES

6.3.1. Climate

Hotazel (the closest town with climatic record, 8 km south of the site) is a summer rainfall area and has an average rainfall of approximately 223mm per year. Minimum rainfall of 0mm is in June and the maximum rainfall of 50mm is in February. The average daily maximum temperature is 33.2°C during summer and 19.1°C in winter. The coldest temperature occurs during July with an average night temperature of 1°C.
The Weinert climatic N-number for the area is 9. This indicates that the climate is semi-arid and that physical mineral grain disintegration is the predominant mode of weathering.

6.3.2. Topography and drainage

The eastern portion of the property (where the development area is planned to be located) is underlain by a plain land facet with a gentle undulating to flat topography with a gradient of 1.5%. The average elevation is 1042 m amsl, with the lowest point 1040 m amsl and the highest point 1045 m amsl. The western portion of the property consists of undulating vegetated dunes with a elevation difference of 8 m over 250 m. The permeability of the sand is high, so the rainfall penetrates the soil immediately. Sheet wash do occur along preferred pathways but the water sinks into the ground after some distance. No pans or wetland areas was identified on site. Sub surface drainage is expected to occur towards the Gamagara River.

6.3.3. Soils and geology

A Geo-technical and Geo-hydrological Report is attached as Annexure H. The site visit was conducted on 27 February 2014, when 12 trial pits were excavated across the property.

The site is underlain by unconsolidated recent aeolian sand of the Kalahari Formation (Qs). The unconsolidated recent deposits vary in thickness of as little as 3 m to over 17 m thick overlying calcrete and clay. Competent bedrock occurs at depths of 21m to 37m.

The proposed solar park development area is underlain by a single soil profile. The aeolian sand profile is consistent across the site. The soil profile underlain by dry to slightly moist, loose, uniform pale orange brown, intact, fine sand of transported (aeolian) origin with grass roots. The sidewalls of the trial pits collapsed due to the loose consistent of the soil.
No perched water table was encountered. The TLB excavated the soil with ease to reach limit.
The aeolian soil is non plastic and consists of a 67% fine sand and 33% silt mixture. The soil has a moderate to high collapse potential.

For the structures supporting the PV modules it is recommended that rammed piles be used as the depth of the loose sand allows sufficient shear resistance to be developed. The type and shape of the material used to manufacture the piles will determine the length of the piles as the material across the site fairly homogeneous.

For the other conventional structures on site (MV stations, warehouses, control building) normal strip foot foundations with compacted trenches is recommended. The trenches should be wetted during the compaction process.

Using the COLTO Standard, the **excavatability** below surface is classified as **soft** to at least 3.5m below surface. Sidewall collapse occurred in all the trial pits excavated. The potential for collapse of side walls of deep excavations is high. It is recommended that the sidewalls of any excavation deeper than 0.8m be battered back to a 1:1.5 grade slope or shored.

Two LAND USE AREAS across the property have been assessed:

The **LAND USE AREA A** (where the development area is planned) is defined as **DEVELOPABLE with PRECAUTIONS**. The status of the area is based on the low density and collapsible nature of the silty sand. Detailed testing will be required to define the collapse potential and shear strength of the soils.

The **LAND USE AREA B** (on the western and northern side of the property, close to the Gamagara River) is defined as **DEVELOPABLE with PRECAUTIONS.**
The status of the area is based on the low density and collapsible nature of the silty sand and the undulating topography of the vegetated sand dunes. The undulating topography is not well suited for the solar park development which requires gentle slopes. Therefore it is recommended that the solar park development is restricted to Land Use Area A.

No shallow groundwater conditions were encountered in any of the trial pits on site.

No mining activities (past or present) occurred in the property. Nearby mining activities (e.g. at the Gloria Manganese Mine) is unlikely to impact on the geotechnical aspects of the project.

The soil present on site is not suitable for use as aggregate for road construction. Discard material from the nearby manganese mines can be uses for roads. Other aggregates should be sourced from commercial suppliers in the area.

The Geo-technical and Geo-hydrological Study concluded that - from a geo-technical perspective - the project site is suitable for the proposed development.

6.3.4. Geo-hydrology

As indicated in the Geo-technical and Geo-hydrological Report (Annexure H):

The property is located on a local watershed on the boundary between the **Quaternary Catchment Areas(QCA) D41K and D41L**.
The proposed development site falls within the **Lower Vaal Water Management Area** (WMA).

The borehole on the property is located in the **D41L** QCA, where **45 m³/ha/annum** of ground water abstraction is allowed for under the DWA General Authorization.

The D41L QCA has a recorded mean annual precipitation of 391 mm per annum, with an annual run-off of 2 mm. The groundwater recharge is 11.07 mm per year. The groundwater level of the area is 30 m below surface. The Eco status is category B. The total groundwater use in this QCA is 3.99 Mm^3 per year.

The estimated annual groundwater recharge (11.07 mm/m2 per annum) from an average annual precipitation of 391 mm falling on the development area (210 ha) results in **23,247 m^3 of water available**.

The maximum annual water requirements are 2795 m^3 / year during the operational phase, therefore **the scale of abstraction relative to recharge is 12.0% (Category A)**.

6.3.4.1. Boreholes, groundwater availability and quality on the project site

Two boreholes are located on the property. At the present time the landowner uses the boreholes as a source of water for game and cattle.

One borehole is located close to the homestead and will not be available for the project.

The second borehole is located in the south eastern corner of the farm. This borehole is available for the project. This borehole is only 18m deep and equipped with a centrifugal pump; the groundwater level is shallow at approximately 5 m from surface.
The pump yield was determined at 0.36 l/s (1300 l/h); the borehole can however only sustain that pump rate for 3-4 hours per day. This indicate a maximum daily yield of **4000l/day**, therefore such borehole is not suitable to supply water during the construction phase of the project and during the PV modules cleaning activity.

The water sample collected from the borehole pump has elevated chloride, nitrate, selenium and sodium levels that support the high TDS count and conductivity. According to the SANS 241 drinking water standards the raw water is not suitable for human consumption. Therefore the drinking water should be treated by osmosis prior to consumption.
The high salt load will also make the water unusable for cleaning the solar panels as using the water will cause scale build-up on the PV module surfaces.

The Geo-technical and geo-hydrological Study concluded that, should water for the project be sourced by means of groundwater abstraction, a new borehole should be drilled, being the existing on-site boreholes not suitable due to the low yield and poor water quality. It is recommended that the fracture rock aquifer located below the Kalahari sediments be targeted at depths between 80 and 120 m below surface as a source of water for the project.

Alternatively water can be sourced **from the Vaal Gamagara Pipeline**, which crosses the project site.

6.3.5. Ecology (fauna & flora)

An Ecological Impact Assessment (Annexure D) was conducted by AGES in order to describe the ecology (fauna and flora) present in the site, to assess its ecological sensitivity and to indicate the most suitable areas for the proposed development. For this purpose, detailed ecological (fauna habitat & flora) surveys were conducted during March 2014 to verify the ecological sensitivity and ecological components of the site at ground level.

6.3.5.1. Vegetation types

The development site lies within the Savanna biome which is the largest biome in Southern Africa. It is characterized by a grassy ground layer and a distinct upper layer of woody plants (trees and shrubs). The environmental factors delimiting the biome are complex and include altitude, rainfall, geology and soil types, with rainfall being the major delimiting factor. Fire and grazing also keep the grassy layer dominant.

The most recent classification of the area by Mucina & Rutherford (2006) shows that the sites forms part of the Kathu Bushveld and Gordonia Duneveld vegetation types.

The proposed development is planned on a landscape that varies from slightly undulating plains to moderately undulating terrain associated with dunes. The property is currently managed as a livestock farm. The vegetation units on the site vary according to soil characteristics, topography and land-use. Most of the site is characterized by microphyllous woodland that varies in density and species composition. No major drainage features occur on site, although the Kuruman and Gamagara Rivers occur to the north and west of the site, respectively.

The following vegetation units were identified during the survey:

- *Open Acacia haematoxylon woodland on deep Aeolian sand;*
- *Acacia mellifera thickets;*
- *Mixed Acacia haematoxylon – Grewia flava – Acacia mellifera low duneveld;*
- *Acacia mellifera – Grewia flava woodland*

6.3.5.2. Fauna

A survey was conducted during March 2014 to identify specific fauna habitats, and to compare these habitats with habitat preferences of the different fauna groups (birds, mammals, reptiles, amphibians) occurring in the QDS. The area represents microphyllous woodland with some broadleaf elements in isolated areas. Detailed fauna species list for the area is included in Appendix C (birds), D (mammals) and E (herpetofauna) of the Ecology Impact Assessment enclosed as Annexure D. During the site visits mammals, birds, reptiles, and amphibians were identified by visual sightings through random transect walks. In addition, mammals were also recognized as present by means of spoor, droppings, burrows or roosting sites. The 500 meters of adjoining properties were scanned for important fauna habitats.

The recommendations and mitigating measures highlighted in the Ecological Impact Assessment (Annexure D) should be implemented to ensure the survival of these species other fauna habitats and feeding grounds.

6.3.5.3. Summary and results of the Ecological Impact Assessment

Detailed ecological (fauna habitat & flora) surveys were conducted during March 2014 to verify the ecological sensitivity and ecological components of the site at ground level.

An important aspect relating to the proposed development should be to protect and manage the biodiversity (structure and species composition) of the Kathu Bushveld and Gordonia Duneveld vegetation types which are represented in the project area. Vegetation removal should be kept to a minimum during any future construction activities and only vegetation on the footprint areas should be removed. The unnecessary impact on the surrounding vegetation types and riverine ecosystems should be avoided as far as possible.
Considering the footprint area to form part of a widespread vegetation entity and slightly degraded state of the proposed development sites, the impact on the vegetation of the larger area would be *medium*. Mitigation measures and monitoring should therefore be implemented should the development be approved.

The development of the solar plant would be dependent on obtaining a licence from DAFF for the eradication of the following protected trees:

- *Acacia haematoxylon* (Grey camel thorn) and
- *Acacia erioloba* (Camel thorn).

The woodland variations with dense stands of protected trees have a *medium sensitivity*. Strict mitigation is needed for the preservation of some sections of this natural vegetation entity, while the eradication of invasive species should be considered a high priority. The herbaceous layer should be revived after clearance of the vegetation and actively managed through slashing during the entire lifetime of the project.

No red data plant species were found on the site due to the state of the vegetation and physical environment of the larger area mostly not being suitable for any of the red data plant species that may be found in the area.

Some potential rare fauna may also occur in the area, and specific mitigation measures need to be implemented to ensure that the impact of the development on the species' habitat.

Mitigation measures are provided that would reduce these impacts from a higher to a lower significance. Provided that al mitigation measures and recommendations in the Ecological Impact Assessment are strictly adhered to, the proposed development won't significantly influence the potential rare habitats for flora and fauna on the site.

An application was submitted to DAFF in terms of *National Forests Act*, Act 84 of 1998 for a "Forest Act Licence" to cut protected trees (*Acacia haematoxylon* and *Acacia erioloba*) located in the 210 ha footprint.

With a letter dated 22 August 2014 (F13/6/8/2/131) DAFF indicated that a licence can be granted only once the Environmental Authorisation is granted and Mira Energy is appointed "Preferred Bidder" by the Department of Energy in respect of the Rhodes 1 Solar Park.

Furthermore, DAFF indicated that a site visit should be conducted by DAFF, DENC, DEA, the landowner and Mira Energy in order to assess whether a "biodiversity offset" is required in order to compensate for the loss of protected trees which may occur if the licence is granted and the project goes ahead. Should a "biodiversity offset" be required, Mira Energy will negotiate the offset agreement in respect of the areas indicated by DAFF / DENC following the outcomes of the site visit.

6.3.6. Avifauna

An Avifauna Impact Assessment (Annexure E) was conducted by AGES in order to determine whether the proposed development would have negative impact on avifauna.

About 210 hectares of natural bird habitats will be modified through the development if one considers the vegetation types (Kathu Bushveld, Gordonia Duneveld) associated with the larger area. The following bird habitats were identified in the study area during the field surveys that formed part of the avifauna scoping study:

- *Microphyllous woodland*
- *Duneveld*

The project area still supports low densities of priority species such as secretary bird, kori bustard, vulture species and lanner falcons. The presence of these birds could cause collisions and increase mortality rate of these species.

The potential impacts associated with the proposed solar farm development include the following:

- Habitat destruction, fragmentation and human disturbances (indirect impacts);
- Electrocutions and collisions (direct impacts),

A series of specific mitigation measures were individuated in respect of all the aforementioned potential impacts in the Avifauna Impact Assessment.

The Avifauna Impact Assessment concluded that, provided that the suggested mitigation measures and recommendations are adhered to, it is unlikely that the proposed development will have a long-term, significant negative impact on the local avifauna.

6.3.7. Visual

A Visual Impact Assessment (Annexure I) was conducted to determine the visual impact of the proposed solar park, for both the proposed Alternative Locations 1 and 2.

The sense of place of the study area can be described as mainly pastoral with some mining activities. At night time, the mining activities in the south-west would light up the otherwise dark rural skies. Because there is already mining activities within the study area, even though they are not dominating the sense of place, it can no longer be regarded as 'pristine'. However, in terms of preserving the landscape quality, the aim should still be to partially retain the existing character of the landscape. Therefore the level of change to the characteristic landscape should not dominate the view of the casual observer, and changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.

When looking at the four nearest farmsteads (Rhodes, East, Bowen and Matlipani), in comparison, the Alternative Location 1 would not be visible from the farmstead located on the farm East. In terms of distance along main roads it is similar for both the two alternatives however, Alternative Location 2 has a shorter length of the footprint along the secondary road from the R31, thus having a greater possibility to be viewed through breaks in the vegetation. Taking the above factors into consideration, Alternative Location 1 would be the preferred alternative in terms of sensitivity of VSR's.

For this project a large impact would occur within a distance of 2km from the proposed development structures, an intermediate impact up to 5km, a small impact up to 10km. An impact further than this would be regarded as negligible. With reference to the Magnitude maps on Figure 8 and Table 2 of the Visual Impact Assessment, VSRs with a large impact includes the farmsteads of Rhodes, Bowen and Matlipani, as well as main road travellers (especially along the Secondary road of the R31) as well as hunting activities on the farm Rhodes.

The ***Significance*** of the visual impact would be *Moderate* for the construction and decommissioning phases and *Moderate to High* for the operational phase for both the Location Alternatives. When the effect of the existing vegetation as well as other correct and effectively applied mitigation measures are incorporated into the rating, the significance for all phases would be reduced to ***Low to Moderate*** for both the Location Alternatives. It is thus important that integrity of the existing vegetation as well as the other proposed mitigation measures be correctly and effectively implemented.

The only lighting that might be switched on at night time would be the street level lighting along the entrance road. Security lighting would only be activated upon illegal entry to the site, therefore the impact during night time can be regarded as negligible.

The existing landscape already have the ability to partially screen some of the views towards the proposed development. Every care should therefore be taken to disturb as little as possible of the landscape surrounding the project footprint. This would reduce the need for additional mitigation measures other than addressing dust clouds and light impacts a night.

6.4. SOCIO-ECONOMIC ENVIRONMENT

A report on the socio-economic considerations related to the proposed project was compiled by Glen Steyn & Associates - development economists (Annexure J).

The following aspects were highlighted in the report:

- The national and local economies will benefit from civil contractor work, labour and building materials that will be required on site. On the whole, a share approximately **40% of total CAPEX (investment costs)** will be sourced locally. This share is likely to increase once there will be a specific and competitive industry in the Republic of South Africa able to supply PV modules and other technological components.
- After approval, the project will take approximately **15 months** to be built and will have a lifetime of 25-30 years. Approximately **100 people** are expected to be employed during the construction period, although this number can increase to 150 for short spaces of time during peak periods. This number can be higher in the case Mira Energy- once being selected as Preferred Bidder by the Department of Energy and having finalized the Connection Agreement with Eskom, where in particular it is agreed the envisaged connection timeline - evaluates to build the Rhodes 1 Solar Park in a timeframe shorter than 15 months. For example, in the case the construction works are planned to last only **6 months**, the average number of workers required on site during construction is **250/300**.
- During operational phase, the power plant will require a permanent staff approximately **35/40 people**. That impact will be positive, also in consideration of the slowing down of the recruitment rate due to mining stabilization activities.
- Approximately **50% of the operation costs** will have a local economic return (mostly for maintenance works by local sub-contractors), then the impact will also be positive during the operational phase (25÷30 years).
- The project will comply with the Economic Development Requirements, as requested by the REIPP Procurement Programme, issued on 3rd August by the DoE. This economic development programme identifies needs of the surrounding communities in order to have a positive socio-economic impact. In particular, Mira Energy is required to identify a **Local Community** for the purpose of entering into a partnership for the Projects.

6.5. AGRICULTURAL POTENTIAL

An Environmental Report on the Soils, Land Use, Agricultural Potential And Land Capability is attached as Annexure F; the site survey was conducted during March 2014.

The current land-use of the proposed development site is grazing by livestock and game. Neighbouring farms are being used for livestock grazing and game farming, with mining further away from the site.

The soils of the project site were classified into broad classes according to the dominant soil form and family as follows:

- Shallow, calcareous soils of the Glenrosa or Mispah soil form;
- Medium depth red Aeolian sands of the Hutton / Clovelly soil forms;
- Very deep red apedal Aeolian sandy soils of the Hutton soil form.

The area is expected to receive an annual total rainfall between 120 and 260 mm, mostly between October to April. This amount is very low. The site is considered to be located in an area too dry for rained arable crop production. The high variability in rainfall distribution within the area could further render dryland farming a risky venture, even under irrigated conditions. The climatic conditions, in combination with the sandy nature of the soil are the main factors determining the soils to be unsuitable for arable agriculture.
The project site is thus dry which would contribute to moisture stress condition during crop growth and development. The potential of groundwater is relatively low to sustain a high water demanding irrigated cropping, expected at the project site.
The proposed development site is largely composed of very sandy Aeolian sands (clay content varies between 2 and 8% with depth mostly deeper than 1200mm). The soils are predominantly deep with some areas where the calcrete are exposed closer to the surface.
The sandy nature of the soils and climatic conditions of the area renders the area investigated unfavourable for effective crop production. **Economically viable crop production is therefore not considered as a viable option on this site.**

The project site has a **low to moderate potential for grazing**. The soil form is suitable for livestock grazing purposes, although it is limited due to the low nutrient content of the sandy soils and the palatability of the grass layer.

The remainder area of the farm, outside the footprint (210 ha) of the solar park, **will still be able to sustain an economically viable unit of livestock (123 to 178 LSU's).**

The **low agricultural and low grazing potential** of the soil is confirmed by the Agricultural Maps below (Figures 14 to 17):

- **Agricultural Potential Map** - indicating that the project site (Farm Rhodes 269) is classified as *Low Agricultural Potential land.*
- **Land Capability Map**- indicating that the site is classified as *Non-arable – Low potential grazing land.*
- **Potential Grazing Capacity Map (1993)** - indicating that the project site has a potential grazing capacity of **9 to 13 ha/large stock units**. As indicated in the previous map, this grazing potential is *low*, if compared to the maximum value indicated in the legend: less 3 ha / large stock units.
- **Potential Grazing Capacity Map (2007)** - indicating that the project site has two potential grazing capacity classes:
    - **11 to 15 ha/large stock units** on the south eastern-side of the farm, and
    - **26 to 30 ha / large stock units** on the north-western side of the farm,

  which is *low*. This map (2007) is not official yet and should be further confirmed by the Department of Agricultural, therefore in the calculation below we refer to the Map (1993).

It can be deduced that the project site - being 1810.8314 hectares in extent - would allow for **139 to 201 *potential* large stock units (LSU's)**, while the proposed developments (210 ha in extent) would entail a reduction of its grazing potential for only 16 to 23 *potential* large stock units.

Therefore, the property is a viable grazing farm (123 to 178 LSU > 60 LSU's) both with and without the proposed development in place.

These maps were generated from the Website: ***http://www.agis.agric.za/agisweb/agis.html***
[AGIS (Agricultural Geo-Referenced Information System) Comprehensive Atlas, commissioned by the Department of Agricultural to CETI Development CC (http://www.ceit.cc/)]

6.6. CULTURAL AND HERITAGE RESOURCES

An archaeological-cum-heritage assessment (Annexure G1) was conducted by AGES to ascertain whether there are any remains of significance in the area that will be affected by the proposed development.

No heritage resource sites or finds of any value or significance were identified in the indicated study area.

The Heritage Impact Assessment concluded that the proposed development of the Rhodes 1 Solar Park in the indicated area can continue from a heritage point of view if the recommendations suggested in the report are adhered to.

A Palaeontological Desktop Study (Annexure G2) was conducted by Pr. B. Rubidge in July 2014.

Although not exposed, the entire study area is deeply underlain by Precambrian rocks of the Griqualand West Sequence and more superficially by Quaternary sands of the Kalahari Group.

According to the report, there is a slight, but unlikely, possibility that the sands of the Kalahari Group could contain fossils of Quaternary age.

In the author opinion, the development will not negatively affect palaeontological heritage. If, in the extremely unlikely event that fossils are exposed in the aeolian sand deposits in the process of development activities, a qualified palaeontologist must be contacted to assess the exposure for fossils so that the necessary rescue operations are implemented.

Figure 12: Vegetation Map of the project site

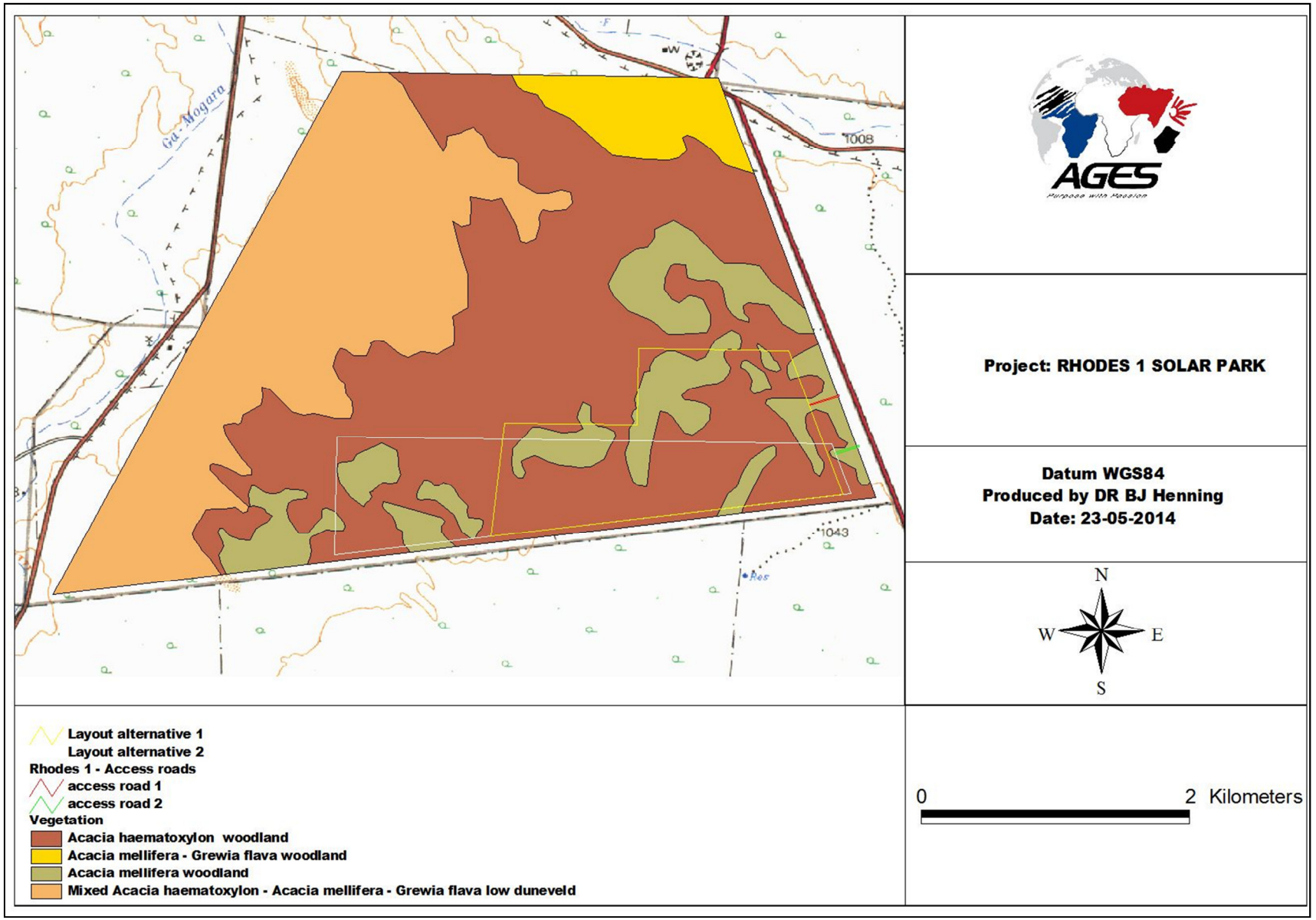


Figure 13: Sensitivity Map of the project site

Figure 14: Agricultural Potential Map of the project site

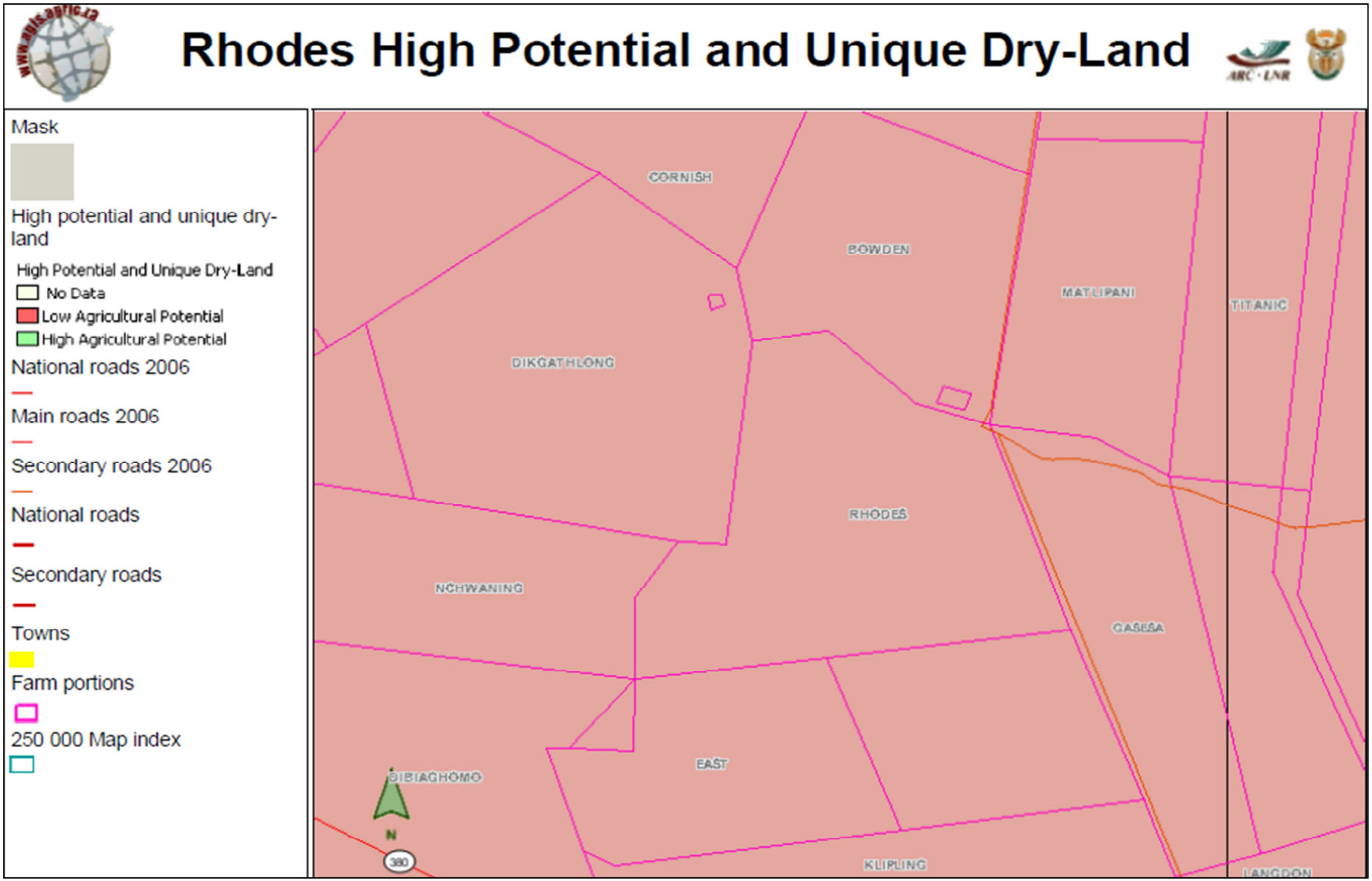


Figure 15: Land Capability Map of the project site

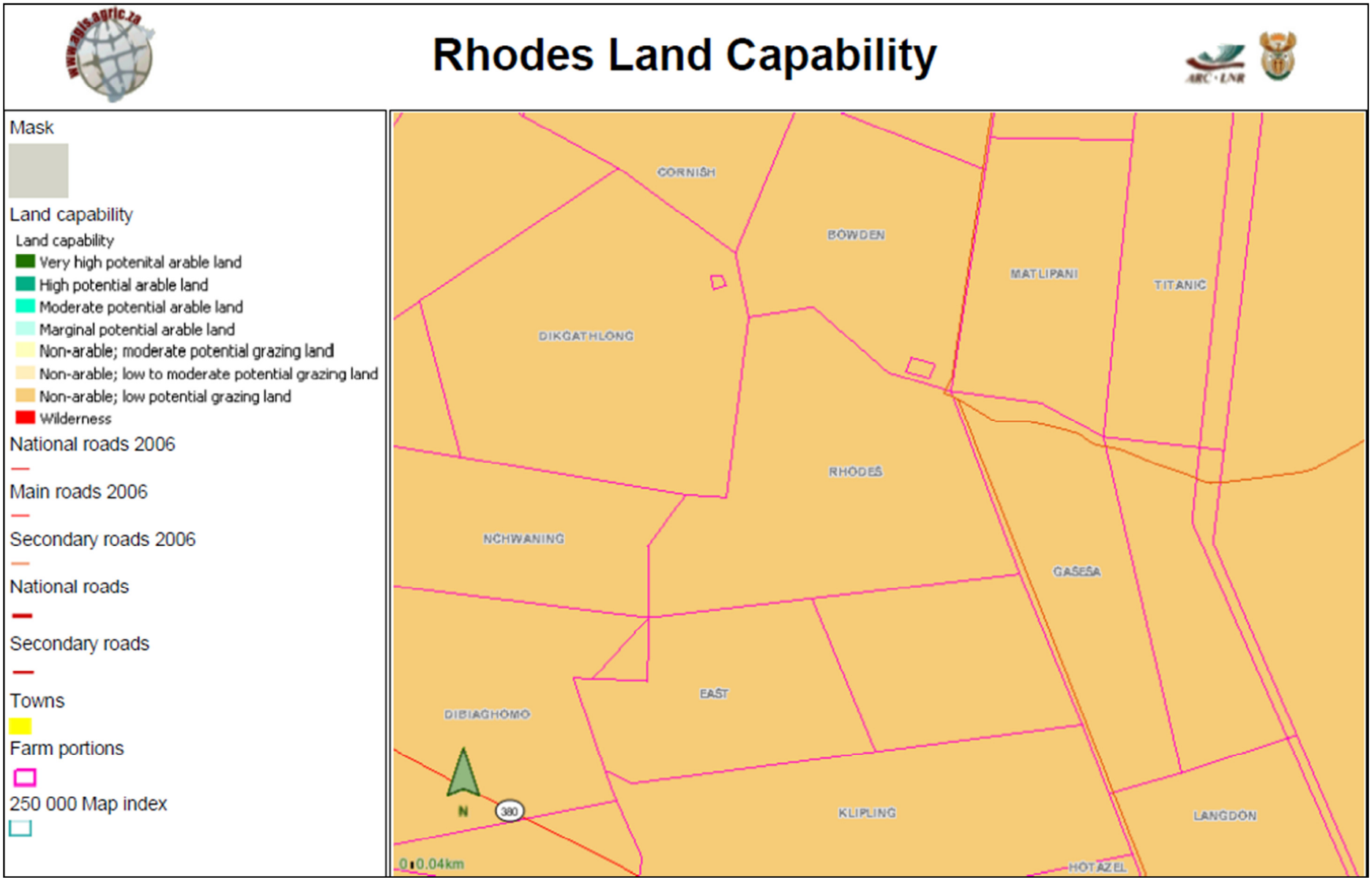


Figure 16: Potential Grazing Capacity Map (1993)

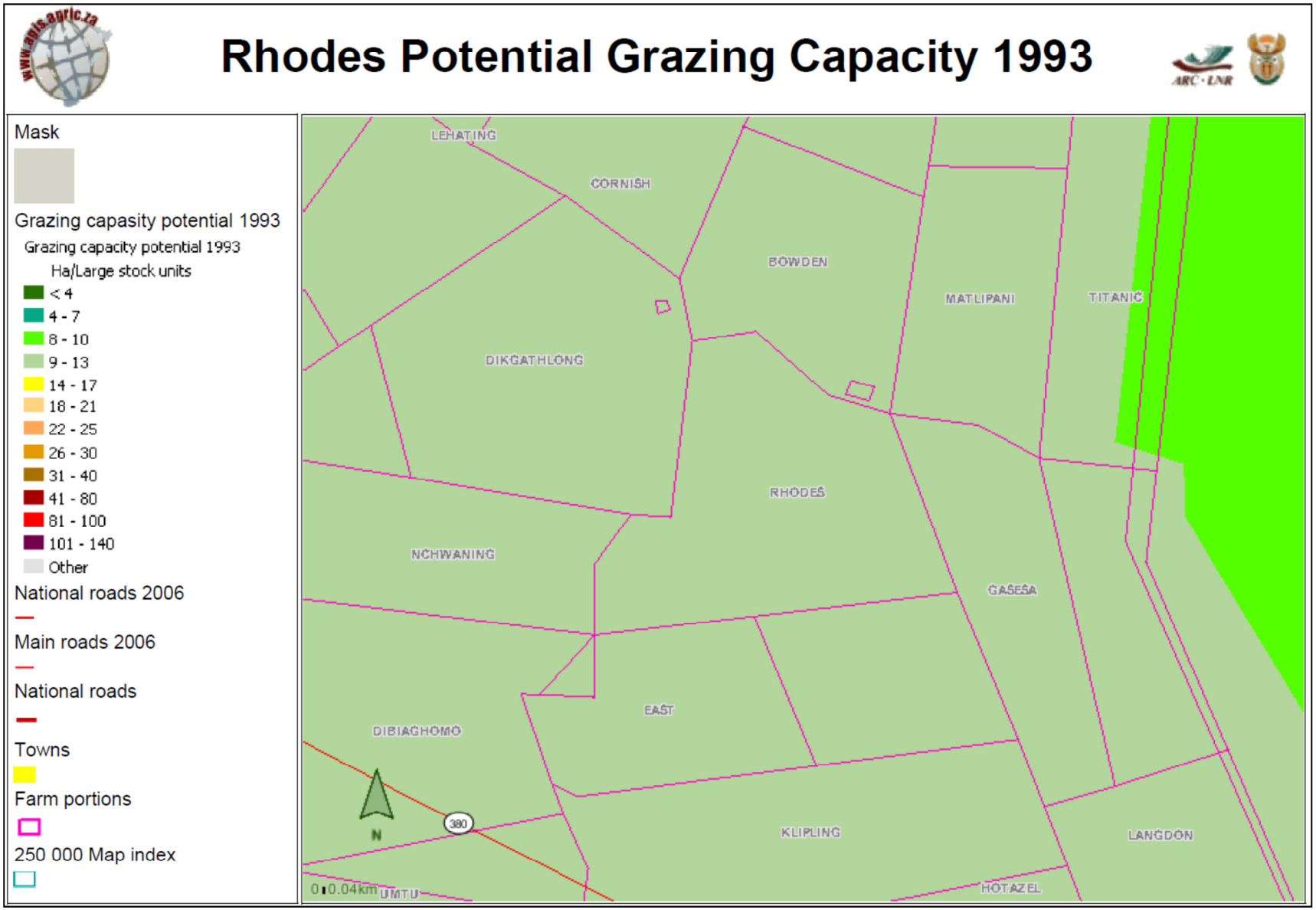
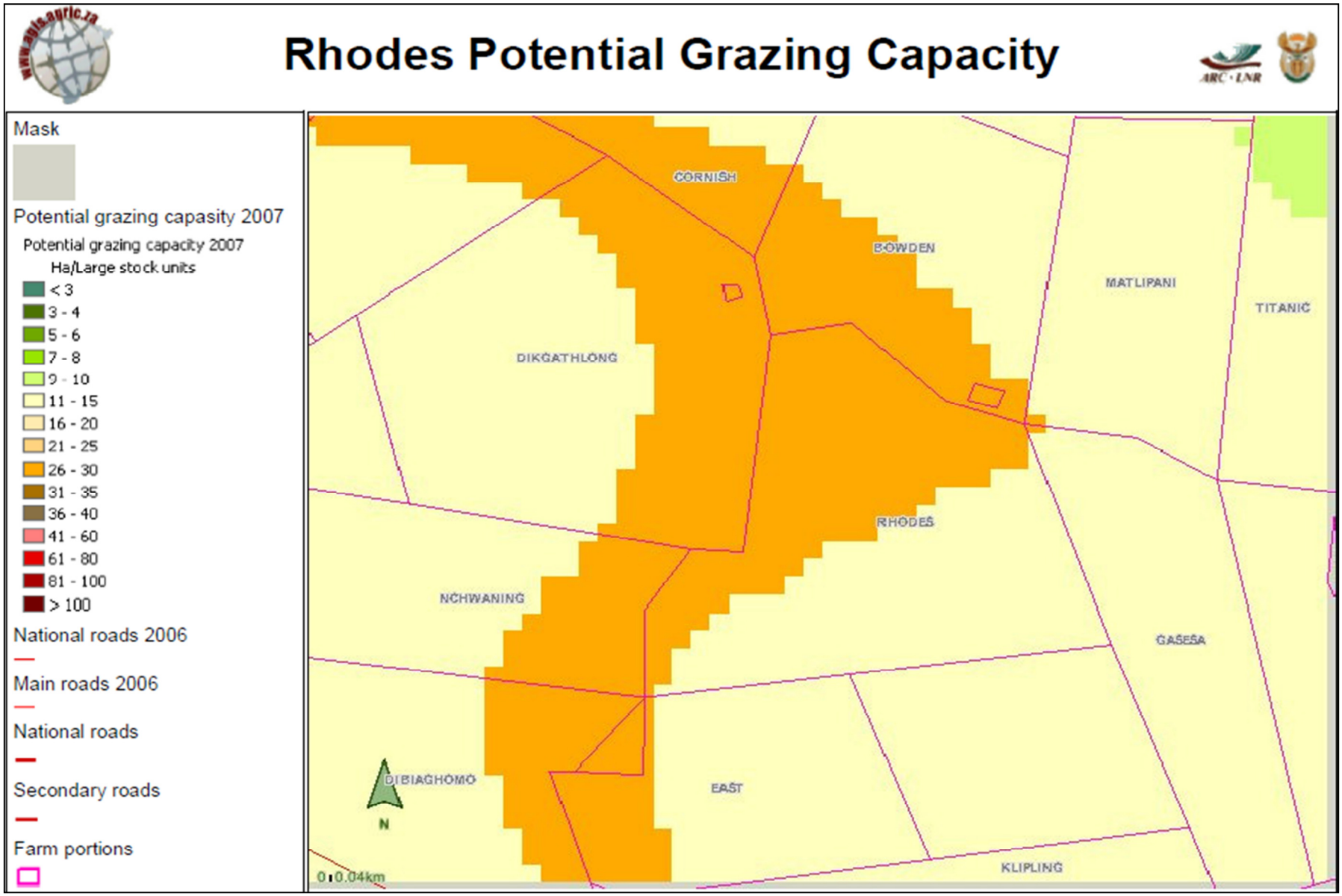


Figure 17: Potential Grazing Capacity Map (2007)



7. ENVIRONMENTAL IMPACT ASSESSMENT (EIA) PROCESS AND PUBLIC PARTICIPATION PROCESS (PPP)

The environmental impact studies can be summarized in a two-phased approach:

- Phase 1: Environmental Scoping Study (ESS)
- Phase 2: Environmental Impact Assessment (EIA) and Environmental Management Program (EMP)

The scope of the EIA procedure is to provide an assessment of all impacts related to the proposed project in compliance with the EIA Regulations 2010.

7.1. SCOPING PHASE

The Scoping Phase aims to produce the following:

- a description of the proposed activity, the property and the receiving environment;
- the identification of potential significant positive and negative impacts;
- the identification of opportunities and constraints, alternatives and mitigation measures which need to be evaluated and investigated during the successive EIA phase, especially in order to prevent environmental fatal flaws and sensitive or “no-go” areas.

The Scoping Phase includes the Public Participation Process. The PPP has the aim to identify concerns and issues by the interested and affected parties (I&AP’s).
Issues and concerns raised by the I&AP’s and key stakeholders during the Public Participation Process have been collected, processed and addressed in the Comments and Response document which forms a part of the Final Scoping Report.

All issues and concerns identified during the Scoping Phase were documented in the Final Scoping Report which was submitted to the DEA together with a Plan of Study for EIA.

7.2. EIA PHASE

The next (current) step of the EIA process is the development of guidelines for execution of the impact assessment and the compilation of an Environmental Impact Assessment Report.

The database of the stakeholders and I&AP’s developed during the scoping process is used as a reference to ensure that stakeholders are involved and participate in this second phase of the EIA process.
All relevant issues considered during the Scoping Phase are further investigated and assessed during the EIA Phase of this project. The EIA involves various specialist studies and should provide an overall assessment of the biophysical, social and economic environment affected by the proposed project.

A detailed assessment is carried out in terms of environmental criteria and rating of significant impacts of all options identified in the scoping phase. Appropriate mitigation measures are identified and recommended for all significant impacts. These measures have been included in the Environmental Management Programme (EMPr) submitted together with the Environmental Impact Assessment Report (EIAR) to the DEA.
During the EIA phase stakeholders and I&AP’s are notified in writing of the continuation of the project to the EIA Phase and are informed as to the way forward and where and when the Final Environmental Impact Assessment Report is made available for review. Comments from the stakeholders and I&AP’s on the EIA and the Draft EMPr are incorporated into the Final EIAR.
The stakeholders and I&AP’s will furthermore be informed of the final decision regarding the Environmental Authorization and the appeal process.

7.3. PUBLIC PARTICIPATION PROCESS (PPP)

All relevant I&AP's have been identified and involved in the public participation process from the beginning of the project as per sections 54, 55, 56 and 57 of the EIA regulations 2010.

The public participation process offers the opportunity to become actively involved through constant sharing of information. The main purposes of the public participation process are to ensure that:

- all relevant information in respect of the application is made available to I&AP's for their evaluation and review;
- reasonable opportunity is given to I&AP's to comment and to submit queries related to the proposed project;
- comments and queries by the I&AP's to the Draft Scoping and to the EIA Reports are submitted and evaluated in a reasonable timeframe and in predetermined terms.

The initial informative stage of the public participation was done from 4 December 2013 until 15 January 2014.

The public was informed of the proposed development and a database of Interested and Affected parties was compiled.

In the enclosed Annexure C there is the list of all components of the public participation process.

The public was informed of the project by means of:

- Site notices;
- Background Information Documents (BID) sent to all adjacent land owners;
- Notices in a local newspaper; and
- Sending of BID to other possible interested and affected parties/stakeholders.

A data base of registered I&AP's has been established to date and will be maintained and added to as required.

Site notices were put up on site on the fence surrounding the proposed development area on 25 November 2013

After a Deed Search was done on the surrounding properties Background Information Documents were sent to adjacent landowners. Proof of this is attached in Annexure C. A number of these documents were also distributed to the relevant governmental departments including *inter alia* Department of Water Affairs, Agriculture Land Reform & Rural Development. Other identified interested and/or affected parties/stakeholders include Eskom, the Local municipality, the District municipality *etc*. Proof of all correspondence is included in Annexure C.

A newspaper advertisement was published in the 27 November 2013 edition of the Gemsbok, which is a local daily newspaper.

One response was received during the initial public participation process and it entailed only the registration of an adjacent landowner as I&AP.

The Final Scoping report was made available for comments but nothing was received. Notifications were sent to the Local Municipality office as well as all applicable governmental organizations.

With a letter dated 24 April 2014, the DEA requested additional information to be included in the Final Scoping Report. A letter providing additional information was submitted to the DEA on 5

May 2014. The Final Scoping was approved by the DEA on 25 June 2014.Please refer to Annexure C - Public Participation Process (Authority consultation).

The Draft EIA Report was submitted to the DEA on 8 July 2014 and made available to I&AP's for a 40 day commenting period, until 18 August 2014.

On 9 September 2014 notifications were sent to I&APs and applicable state departments to indicate that the final EIA report is available for comments.

7.3.1. Further steps in Public Participation Process

To ensure a transparent and complete public participation process the following steps are still to be taken during the rest of the EIA process:

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- All I&APs and governmental organizations will be notified about the final decision of the DEA (Environmental Authorisation granted or not).
- A notice with regard to the department's decision will be published in a local newspaper

7.3.2. Results of the public participation process

Not a lot of registrations as I&APs were received throughout the public participation process. Two adjacent landowners registered as I&APs and all relevant documentation were sent to them. Mr. Reyneke indicated that after studying the site lay out plan, he has no objection to the proposed Rhodes Solar Park. Ms. Williamson indicated that she wanted to send comments but has not done so, we are awaiting her comments.

Comments were received from the Northern Cape Department of Environment and Nature Conservation (DENC) on the draft EIA report, dated 13 August 2014.
AGES responded to these comments in a letter dated 14 August 2014. Further correspondence took place between DENC and AGES and the official from DENC indicated that he was satisfied with the response from AGES and will forward an official letter indicating this. Once the letter is received, it will be forwarded to DEA.

No further comments were received on the Draft EIA report.

Notifications were sent to I&APs to indicate that the final EIA report is available for comments. It was specified that there is a 21 day commenting period and that the comments must be directed to the DEA (and the EAP) and the contact details were included in the letter. Proof of this is included in Annexure C.

8. METODOLOGY USED FOR THE IDENTIFICATION AND ASSESSMENT OF THE IMPACTS

The potential environmental impacts identified in the study have been quantified and the significance of the impacts has been assessed according to the criteria set out below. Each impact has been assessed and rated. The assessment of the data, where possible, has been based on broadly accepted scientific principles and techniques. In defect, judgements and assessments are necessarily based on the consultant's professional expertise and experience.

8.1. PROJECT PHASING

For the purpose of assessing these impacts, the project has been divided into phases from which impacting activities can be identified:

- **Planning**
- **Site clearing & construction phase**
- **Operational phase**

The phases have been carefully examined in relation to the PV plant and in relation to the connection infrastructure. Indeed, as already described, in this document all impacts and mitigations are defined also for the connection infrastructure, although this part of the project may be executed, owned and operated by Eskom.

As far as the **decommissioning** phase is concerned, it is important to specify that this phase will be subject to a decommissioning plan once the project is nearing its operational life (25-30 years). Decommissioning will also be subject to an environmental authorization (Activity 27 of R544 of 18 June 2010).

This phase is important because it states the **reversibility of the development** and has to be carefully planned and executed, in order to enable the natural re-growth of indigenous vegetation and fauna re-population as well as the reuse of the area for agricultural and grazing purposes. For this reason, in the Draft Environmental Management Plan the decommissioning phase has been included and carefully analyzed, in order to anticipate activities and actions to be taken in order to minimize the relevant impacts.

The decommissioning phase, as described in Chapter 10, is similar to the commissioning phase but all possible care must be considered for the recycling of the materials and for the re-establishment of the site as it was the *status quo – ex ante* the development.

8.2. ASSESSMENT CRITERIA

The terms of reference for the study include criteria for the description and assessment of environmental impacts. These criteria are drawn from the Integrated Environmental Management Guidelines Series, Guideline 5: Assessment of Alternatives and Impacts, published by the Department of Environmental Affairs and Tourism in terms of the Environmental Impact Assessment. These criteria include:

Table 7: Impact Assessment Criteria

Nature of impact This is an appraisal of the type of effect the proposed activity would have on the affected environmental component. The description should include what is being affected, and how.		
Extent The physical and spatial size of the impact.	**Site**	The impact could affect the whole, or a measurable portion of the above-mentioned properties.
	Local	The impacted area extends only as far as the activity, e.g. a footprint.
	Regional	The impact could affect the area including the neighbouring farms, the transport routes and the adjoining towns.
Duration The lifetime of the impact; this is measured in the context of the lifetime of the proposed base.	**Short term**	The impact will either disappear with mitigation or will be mitigated through natural process in a span shorter than any of the phases.
	Medium term	The impact will last up to the end of the phases, where after it will be entirely negated.
	Long term	The impact 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.
	Permanent	The only class of impact, which will be non-transitory. Mitigation either by man or natural process will not occur in such a way or in such a time span that the impact can be considered transient.
Intensity	**Low**	The impact alters the affected environment in such a way that the natural processes or functions are not affected.
	Medium	The affected environment is altered, but function and process continue, albeit in a modified way.
	High	Function or process of the affected environment is disturbed to the extent where it temporarily or permanently ceases.
Probability This describes the likelihood of the impacts actually occurring. The impact may occur for any length of time during the life cycle of the activity, and not at any given time.	**Improbable**	The possibility of the impact occurring is very low, due either to the circumstances, design or experience.
	Probable	There is a possibility that the impact will occur to the extent that provisions must be made therefore.
	Highly probable	It is most likely that the impacts will occur at some or other stage of the development. Plans must be drawn up before the undertaking of the activity.
	Definite	The impact will take place regardless of any prevention plans, and there can only be relied on mitigation actions or contingency plans to contain the effect.
Determination of significance.	**No**	The impact is not substantial and does not require

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.	**significance**	any mitigation action.
	Low	The impact is of little importance, but may require limited mitigation.
	Medium	The impact is of importance and therefore considered to have a negative impact. Mitigation is required to reduce the negative impacts to acceptable levels.
	High	The impact is of great importance. Failure to mitigate, with the objective of reducing the impact to acceptable levels, could render the entire development option or entire project proposal unacceptable. Mitigation is therefore essential.

The general approach to this study has been guided by the principles of Integrated Environmental Management (IEM). In accordance with the IEM Guidelines issued by the DEA, an open, approach, which encourages accountable decision-making, has been adopted. The underpinning transparent principles of IEM require:

- informed decision-making;
- accountability for information on which decisions are made;
- a broad interpretation of the term “environment”;
- an open participatory approach in the planning of proposals;
- consultation with I&APs;
- due consideration of alternatives;
- an attempt to mitigate negative impacts and enhance positive impacts of proposals;
- an attempt to ensure that the social costs of development proposals are outweighed by the social benefits;
- democratic regard for individual rights and obligations;
- compliance with these principles during all stages of the planning, implementation and decommissioning of proposals; and
- the opportunity for public and specialist input in the decision-making process.

The study is also guided by the requirements of the EIA Regulations in terms of the NEMA. The NEMA EIA Regulations, which are more specific in their focus than the IEM principles, define the detailed approach to the EIA process.

9. POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

9.1. POTENTIAL IMPACTS

Potential impacts associated with the construction and operational phases of the Rhodes 1 Solar Park together with its connection infrastructure are outlined and evaluated hereinafter.

As previously described, **construction activities** for the establishment of PV power plant include:

- land clearing activities necessary for preparation of the site and access routes;
- excavation and filling activities;
- transportation of various materials;
- construction of the storage structures;
- installation of the PV modules and construction of associated structures and infrastructure;
- construction of the on-site high-voltage substation;
- construction of the 132 kV power line which will deliver the energy to the Eskom grid (**a separate Basic Assessment is currently undergoing by Ages in this respect**).

Environmental impacts associated with the **operational phase** of a solar energy facility may include visual and other impacts.

The **decommissioning activities** of the PV plant mainly include the removal of the project infrastructure and the restoring of the site *status quo ante*.

The identification of impacts will be based on:

- legal and administrative requirements;
- the nature of the proposed activity;
- the nature of the receiving environment;
- specialist studies;
- issues raised during the public participation process.

Potential impacts may include:

- Impacts on soils & agricultural potential;
- Impacts on ground water;
- Impacts on the road system and traffic;
- Impacts on air quality and potential emissions;
- Geological, soil and erosion impacts;
- Impacts on avifauna;
- Impacts on vegetation;
- Impacts on heritage resources;
- Noise impacts;
- Impacts on tourism;
- Social impacts;
- Visual impacts.

9.2. CUMULATIVE IMPACTS

Cumulative impacts were assessed and it was found that due to the distance of other renewable energy developments from the proposed Rhodes 1 Solar Park, the cumulative impacts will be very low. Also, a number of mitigation measures are proposed which will lead to the impacts that may result from the establishment of the Rhodes 1 Solar Park to be low. The cumulative impacts of each of the possible impacts are also assessed hereunder.

9.3. SPECIALIST STUDIES

Due to the nature of the project, a number of specialist studies are required in the EIA process in order to investigate the potential environmental impacts associated with the proposed development.

Detailed studies on potentially significant impacts have been carried out to address these impacts throughout the EIA process. The public participation process provides valuable information in the identification of issues requiring further and specific investigation throughout the EIA process.

The specialist studies which have been conducted and attached to this EIA Report are the following:

- Services Report (Annexure K)
- Ecological Impact Assessment (Annexure D)
- Avifauna Impact Assessment (Annexure E)
- Agricultural Potential Assessment (Annexure F)
- Geo-technical and Geo-hydrological Report (Annexure H)
- Visual Impact Assessment (Annexure I)
- Socio-economic Impact Assessment (Annexure J)
- Heritage Impact Assessment (Annexure G1)
- Palaeontological Desktop Study (Annexure G2)

9.4. IMPACTS & MITIGATION MEASURES

9.4.1. Construction & operational phases impacts and mitigation measures

All the possible impacts that can be predicted in both the construction and operational phases of the PV plant are addressed. Specific mitigation measures are proposed and the significance of these impacts is described with and without the mitigation measures.

Furthermore, considering that all or part of the construction infrastructure may be owned and/or operated by Eskom, the mitigation measures described in the following paragraphs and in particular in the attached Environmental Management Plan can be, accordingly, of the responsibility of Eskom or of the developer.

9.4.1.1. Atmospheric pollution and noise

Construction Phase
During this phase there will be a concentration of earthmoving equipment and construction vehicles that will level the area, clear vegetation for construction purposes and in the process will create dust and exhaust smoke that will impact on air quality. There will also be more noise created by the vehicles during this phase. Burning of waste and fires at construction sites may also create smoke.

Operational phase
The increased traffic volumes and people will lead to increased levels of air pollution and noise. Smoke from burning of waste can cause air pollution.

ALTERNATIVE LOCATIONS 1 AND 2									
Project Phase	Impact :Atmospheric Pollution and noise								
	Activity/Aspect	Specific impact	Severity	Duration	Extent	Frequency	Probability	Significance	
								With Mitigation	Without Mitigation
Construction	Earthworks and Vegetation clearance	Air pollution : Dust	Low-medium	Medium-high	Low-medium	Medium-high	Medium-high	Low-medium	Medium
	Vehicle movement	Air pollution : Smoke	Low	Medium-high	Low-medium	Medium-high	Medium-high	Low-medium	Medium
	Vehicle movement	Air pollution : Dust	Low	Medium-high	Low-medium	Medium-high	Medium-high	Low-medium	Medium
	Vehicle movement	Noise pollution	Low-medium	Medium-high	Low-medium	Medium-high	Medium-high	Low-medium	Medium
	Burning of cleared vegetation, solid waste & veld fires	Air pollution by excessive smoke	Low-medium	Medium-high	Low-medium	Medium	Medium	Low-medium	Medium
	Cooking fires of workers	Air pollution : Smoke	Low	Medium-high	Low-medium	Medium	Medium	Low	Medium
Operation	Vehicle movement	Noise pollution	Low-medium	Medium-high	Low-medium	High	Medium-high	Low-medium	Medium
	Fireplaces and veldt fires	Air pollution caused by smoke	Low-medium	Medium-high	Low-medium	High	Medium-high	Low-medium	Medium
	Burning of vegetation refuse and solid waste	Air pollution by excessive smoke	Low-medium	Medium-high	Low-medium	High	Medium-high	Low-medium	Medium
Cumulative impacts	Pollution & Noise	Increase in release of smoke and increase in noise levels	Low	Medium-high	Low-medium	Medium	Medium	Low	Medium

Mitigation measures - Construction Phase

- Vehicles must be well serviced so that it does not produce excessive smoke and noise.
- Speed of construction vehicles should be kept as low as possible to reduce the generation of dust and noise.
- Construction areas must be damped to prevent excessive dust formation.
- The clearing of the site should be done in phases as the construction progresses.
- Construction should only take place during the hours between sunrise and sunset on weekdays and Saturdays.
- Contractors must comply with Provincial noise regulations. The construction machinery must be fitted with noise mufflers and be maintained properly.
- Vegetation cleared from the site and solid waste generated by the construction teams may not be burned on site or the surrounding areas, but be regularly removed to the municipal waste disposal site.
- Fire belts must be made around the development according to the regulations of the

Veld and Forest Fire Act.
- The cleared vegetation stock-piled and should be removed to a licensed waste disposal site on a regular basis.

Mitigation Measures - Operational Phase
- Speed of vehicles on roads should be controlled e.g. speed bumps and speed restrictions.
- All roads should preferably be sealed to eliminate dust formation caused by strong winds and vehicle movement.
- Solid waste should not be burned on the project area.
- Fire belts around the development must be made according to the regulations of the Veld and Forest Fire Act.
- Vegetation refuse should be composted if possible and re-used.

9.4.1.2. Groundwater and surface water pollution

Construction Phase
- Lack of sanitation could result in ground water pollution and associated health risks.
- Construction vehicles will be refuelled at the construction camp.
- Spillage of fuel and lubricants from construction vehicles could occur. Storm water contamination by solid waste could lead to groundwater and surface water pollution.
- In this phase the soil cover as well as the vegetation is removed and storm water over the area could cause erosion as well as siltation of watercourses. Road construction will also increase the possibility of erosion and the siltation/sedimentation of surface water streams, because of increased storm water run-off.

Operational Phase
- Pollution by sanitation leakages, solid waste and erosion may lead to water pollution. Storm water run-off over open areas can cause erosion as well as the washing of soil into the surface water streams.
- Storm water flowing over sealed and/or paved areas could lead to ground and surface water pollution. Chemicals from the vehicle wash area could negatively impact on the quality of surface and groundwater resources.
- Fertilizers, pesticides and herbicides used at the project during operation can create pollution if not handled and applied correctly.

ALTERNATIVE LOCATIONS 1 AND 2									
Project Phase	Impact: Groundwater and Surface water Pollution								
	Activity/Aspect	Specific impact	Severity	Duration	Extent	Frequency	Probability	Significance	
								With Mitigation	Without Mitigation
Construction	Spillage of fuel and lubricants from construction vehicles	Water Pollution	Medium	Medium-high	Low-medium	Medium-high	Medium-high	Low	Medium
	Clearing of vegetation	Erosion & siltation of streams	Low-medium	Medium-high	Low-medium	Medium	Medium-high	Low-medium	Medium

ALTERNATIVE LOCATIONS 1 AND 2									
Project Phase	Impact: Groundwater and Surface water Pollution								
	Activity/Aspect	Specific impact	Severity	Duration	Extent	Frequency	Probability	Significance	
								With Mitigation	Without Mitigation
	Solid waste disposal freshwater resources	Pollution of freshwater resources	Low	Medium-high	Low-medium	Medium-high	Medium-high	Low-medium	Medium
	Sanitation seepage from chemical toiletsand/or from the temporary sanitation system	Water Pollution	Medium	Medium-high	Low-medium	Medium	Medium	Low	Medium
Operation	Spillage of fuel and lubricants from vehicles	Water Pollution	Medium	High	Low-medium	Medium-high	Medium-high	Low-medium	Medium
	Solid waste disposal-freshwater resources	Water Pollution	Low	High	Low-medium	Medium-high	Medium-high	Low-medium	Medium
	Leakage from the permanent Sanitation system	Water Pollution	Medium-high	High	Medium	Medium	Medium-high	Low-medium	Medium-high
	Use of fertilizers, insecticides and herbicides	Pollution of streams & rivers	Low-Medium	High	Low-medium	Medium	Medium	Low-medium	Medium
	Storm water runoff	Erosion & siltation of streams	Low-medium	Medium-high	Low-medium	Medium	Medium-high	Low	Medium
Cumulative impacts	Water pollution and increased water run-off	Increased potential for water pollution and increased water run-off	Low-Medium	High	Low-medium	Medium	Medium	Low-medium	Medium

Mitigation measures - construction phase

The following precautionary measures are recommended to prevent any surface or groundwater pollution:

- Clearance of vegetation should be restricted to 210 ha footprint and access road.
- Construction activities should be restricted to the proposed 210 footprint.
- The areas close to the western and northern boundary of the property, affected by the *Gamagara and Kuruman Spruits*, should be avoided.
- Cleared areas should be rehabilitated by reintroducing a grass layer as soon as possible to limit the occurrence of erosion.
- Berms to limit the flow of water over cleared areas will limit erosion and the siltation of surface streams. Preference should be given to plant species indigenous to the area.
- Drip pans should be used during re-fuelling and servicing of construction vehicles. Used

parts like filters should be contained and disposed of at a site licensed for dumping of these waste products.
- Oil traps must be installed in the vehicle wash bay to prevent pollution. Oil traps must be serviced on a regular basis by an approved service agent.
- Diesel storage must not exceed 80 000 litres at construction camps. Diesel tanks and other harmful chemicals and oils must be within a bunded area.
- The vehicle maintenance yard and construction storage area should be placed 100m away from watercourses. This area should have bund walls and lined with impermeable material to prevent ground and surface water pollution.
- Chemical sanitation facilities and the temporary sanitation system in the construction site should be regularly serviced by appropriate companies to ensure that no spills or leaks to surface and groundwater take place. Chemical toilets and the temporary sanitation system should not be placed within 100m from any watercourse.
- Solid waste must be kept in adequate waste bins. Building rubble and various waste products should be removed on a regular basis to a licensed landfill site.
- If all possible soil pollution is restricted and prevented, there would be no cumulative impacts as a result of the establishment of the Rhodes 1 Solar Park.

Mitigation measures - operational phase
- Solid waste must be kept in adequate waste bins and removed on a weekly basis to a waste disposal site.
- The use of eco-friendly products e.g. Organic Compost, herbicides and insecticides should be promoted.
- The permanent sanitation system should be regularly inspected to ensure that no spills or leaks from sanitation system to groundwater take place.
- All possible pollution can be prevented and therefore there would be no cumulative impacts where soil pollution is concerned.

9.4.1.3. Water use / water quantity

Construction phase

During this phase, water consumption will be the highest because it will be utilized for gravel roads and building constructions. The water needed for the construction activities will be provided either:
- from a new on-site borehole, or
- from the Vaal Gamagara Pipeline, which crosses the project site.

Operational phase

Water use will be limited except for short periods(twice per year) when the PV modules are cleaned. The water needed for the operational phase will be provided either:
- from a new on-site borehole, or
- from the Vaal Gamagara Pipeline, which crosses the project site.

ALTERNATIVE LOCATIONS 1 AND 2									
Project Phase	Impact: Water use								
	Activity/Aspect	Specific impact	Severity	Duration	Extent	Frequency	Probability	Significance	
								With Mitigation	Without Mitigation
Construction	Construction process	Depletion of water resources: Water consumption	Low-medium	Medium-high	Medium-high	High	High	Medium	Medium-high
Operational	Water use & cleaning of panels	Depletion of water resources: Water consumption	Low	High	Medium	High	High	Low-Medium	Medium
Cumulative impacts	Water use	Increased pressure on local water resources	Medium	Medium - High	Very Low	Low	Low-Medium	Low-Medium	Medium

Mitigation measures – Construction Phase

- Water should be used sparingly and it should be ensured that no water is wasted.
- Roads should be treated with chemicals to lower the use of water.
- Washing of construction vehicles should be limited to once or twice a month and must be done with high-pressure sprayers to reduce water consumption.
- Drinking water supply for the staff on site should be treated through an osmotic water filtration system.

Mitigation measures - Operational Phase

- Cleaning of panels should be done only when necessary, twice per year.
- Roads should be treated with chemicals to lower the use of water.
- Washing of vehicles should be limited to once a week and must be done with high-pressure sprayers to reduce water consumption.
- Care must be taken not to waste any water. In the offices, half-flush systems in the toilets as well as water aerators in all taps must be installed to reduce water consumption.
- The workers should be educated on the value of water and how to use it sparingly.
- Drinking water supply for the staff on site should be treated through an osmotic water filtration system.

9.4.1.4. Land and soils

Planning phase

The medium-high sensitivity area (*sand dunes*) located on the western and northern side of the project site (close to the Gamagara and Kuruman Rivers) should remain undeveloped - in compliance with the requirements highlighted in the Ecological Impact Assessment (Annexure D) and in the Geo-technical and Geo-hydrological Study (Annexure H).

Construction phase

During construction, the vehicles used have the potential to spill diesel and lubricants that can pollute the soil. The storage of solid waste before it can be disposed of has the potential to pollute the soil and becomes a nuisance.

Operational phase

Solid waste can be a nuisance and has the potential to pollute the soil if not managed correctly. The use of conventional fertilizers, herbicides and insecticides should be limited as far as possible. Wastewater from activities can pollute the soil.

ALTERNATIVE LOCATIONS 1 AND 2									
Project Phase	Impact: Land and soils								
	Activity/Aspect	Specific impact	Severity	Duration	Extent	Frequency	Probability	Significance	
								With Mitigation	Without Mitigation
Construction	Spilling of oil/diesel by construction machines	Contamination of soil	Medium	Medium-high	Low-medium	Medium-high	Medium-high	Low	Medium
	Solid waste disposal	Soil pollution + nuisance	Low	Medium-high	Low-medium	Medium-high	Medium-high	Low-medium	Medium
	Storm water over roads and cleared areas	Erosion	Low-medium	Medium-high	Low-medium	Medium	Medium-high	Low-medium	Medium
	Trenches for electric cables and water and sewerage pipes	Erosion	Low-Medium	Medium-high	Low	Medium	Medium-High	Low-medium	Medium
Operation	Solid waste	Soil pollution + nuisance	Low	High	Low-Medium	Medium-High	High	Low	Medium
	Storm water from paved areas and roofs	Erosion	Low-medium	High	Low-medium	Medium	Medium-high	Low	Medium
	Use of fertilizers, insecticides and herbicides	Pollution	Low-Medium	High	Low-medium	Medium	Medium	Low-medium	Medium
Cumulative impacts	Increased potential for negative impacts on soil resource	Increased potential for erosion and soil pollution	Low-medium	High	Low-medium	Medium	Medium-high	Low	Medium

Mitigation measures - Construction Phase

- Clearance of vegetation should be restricted to 210 ha footprint and access road.
- Construction activities should be restricted to the proposed 210 footprint.
- The areas close to the western and northern boundary of the property, affected by the *Gamagara and Kuruman Spruits*, should be avoided.
- Construction vehicles must be well maintained and serviced to minimise leaks and spills.
- Spill trays must be used during refuelling of vehicles on site.
- Diesel storage must not exceed 80 000 litres at construction camp. Diesel tanks and other harmful chemicals and oils must be within a bunded area.

- Solid waste must be kept in containers and disposed of regularly at licensed dumping site.
- Any building rubble must be removed to a licensed disposal site on a regular basis during construction.
- Trenches that are dug for the supply of services and electrical cables must be filled up and compacted well and slightly higher than the areas around it.
- The clearing of the site should be done in phases as the construction progresses.
- Slopes produced by removing soil must be kept to a minimum to reduce the chances of erosion damage to the area.

Mitigation measures - Operational Phase

- Solid waste must be kept in adequate waste bins and removed on a weekly basis to the waste disposal site.
- The surface drainage system should be monitored after storms and storm water damage should be repaired. The maintenance of the roads must be kept up to standard to prevent and reduce the incident of erosion next to the roads.
- The use of eco-friendly products e.g. organic compost, herbicides and insecticides should be promoted.

9.4.1.5. Archaeological, Cultural and Social Features

Construction phase

The clearing of the site may have a negative impact on the archaeological features of the site. Care must be taken in the excavations and moving of soil to observe any archaeological feature of importance, which must be left and reported to the archaeological consultant for comments and actions.

Operational phase

The operational phase will not have any negative impact on the archaeological features of the site, if the recommendations of the Heritage Impact Assessment and Palaeontological Desktop Study (Annexures G1 and G2) to be undertaken will be adhered to.

ALTERNATIVE LOCATIONS 1 AND 2									
Project Phase	Impact: Loss of Archaeological, Cultural and social features								
	Activity/Aspect	Specific impact	Severity	Duration	Extent	Frequency	Probability	Significance	
								With Mitigation	Without Mitigation
Construction	Earth moving and soil clearance	Destroy archaeological evidence and heritage and graves	Low-medium	Medium-high	Low	Low	Low-medium	Low	Low-medium
Operation	Operational activities of development	Destroy archaeological evidence and heritage and graves	Low-medium	High	Low	Low	Low-medium	Low	Low-medium
Cumulative impacts	Activities on site during construction and operational	Increase in potential to unearth archaeological evidence and graves	Low-medium	High	Low	Low	Low-medium	Low	Low-medium

Mitigation measures – Construction and operational phases

Care must be taken during the construction process that anything of archaeological value that is unearthed must be recorded. Please refer to the Heritage Impact Assessment, Annexure G1. The archaeologist or SAHRA must be notified whenever anything of importance is discovered. According to the Palaeontological Desktop Study (Annexure G2), there is a slight, but unlikely, possibility that the sands of the Kalahari Group could contain fossils of Quaternary age. If, in the extremely unlikely event that fossils are exposed in the aeolian sand deposits in the process of development activities, a qualified palaeontologist must be contacted to assess the exposure for fossils so that the necessary rescue operations are implemented

9.4.1.6. Impact of the development on the ecology (fauna & flora) of the area

Planning and construction phase

The removal of natural vegetation and destruction of habitat will have a negative effect on the biodiversity. The specific mitigation measures included in the Ecological and Avifauna Impact Assessment (Annexures D & E) should be adhered to.

The medium-high sensitivity area (*sand dunes*) located on the western and northern side of the project site (close to the Gamagara and Kuruman Rivers) should remain undeveloped - in compliance with the requirements highlighted in the Ecological Impact Assessment (Annexure D) and in the Geo-technical and Geo-hydrological Study (Annexure H).

Operational phase

The operation of the development can have a negative impact on the bio-diversity if it is not managed correctly. Exotic invasive plant species can have a negative impact on the indigenous vegetation.

ALTERNATIVE LOCATION 1									
Project Phase	Environmental Aspect: Ecology (Fauna and Flora)								
	Activity that causes impact	Specific impact	Severity	Duration	Extent	Frequency	Probability	Significance	
								With Mitigation	Without Mitigation
Construction	Earthworks and vegetation clearance at construction site	Loss of indigenous plant species & disturbance to sensitive habitat	Medium	Medium	Low-Medium	Medium	Medium-High	Low-medium	Medium
	Vegetation clearance and the use of herbicides to control re-growth at the different development areas	The eradication and control of exotic invasive plant species Loss of indigenous plant species	Medium	Medium	Medium	Low-Medium	Medium-High	Low-Medium	Medium
	The occurrence of veldt fires on site	Destruction of flora/habitats Loss of indigenous fauna	Medium-High	Medium	Medium	Medium-High	High	Medium	Medium-high
	Littering (e.g. cans and plastics) along access road and at construction site	Public nuisance and loss/death of indigenous fauna	Low-Medium	Medium	Medium	Medium-High	Medium	Low	Medium
	The control of animals on site Killing, poisoning or hunting of animals	Loss of indigenous fauna to the area	Medium-High	Medium	Medium	Medium	Low-Medium	Low-Medium	Medium

ALTERNATIVE LOCATION 1									
Project Phase	Environmental Aspect: Ecology (Fauna and Flora)								
	Activity that causes impact	Specific impact	Severity	Duration	Extent	Frequency	Probability	Significance	
								With Mitigation	Without Mitigation
Operation	Rehabilitation of cleared areas	The spreading of exotic invasive plant species Loss of habitat and indigenous flora	Medium	High	Medium	Low-Medium	Medium	Low-Medium	Medium
	The occurrence of veldt fires	The loss of indigenous fauna and flora	Medium-High	Medium	Medium	Low-Medium	High	Medium	Medium-high
	The functioning of the permanent sewage treatment systems – treated sewage outflow	Deterioration in the habitat for avifauna and aquatic life	Medium-High	High	Medium	Medium-High	Medium	Low-Medium	Medium-High
	Disposal and storage of solid waste and littering	The death/loss of indigenous fauna e.g. raptors, mammals and reptiles	Medium-High	High	Medium-High	Medium-High	Medium	Low-Medium	Medium
	The control of pests and vermin	Killing and poisoning of fauna feeding on the poisoned vermin or pest	Low-Medium	High	Low-Medium	Medium-High	Medium	Low	Medium
	The feeding of fauna e.g. birds &small mammals	Disturbance to bio-diversity and the natural movement of the animals through the site The death/loss of indigenous fauna	Low-Medium	High	Low-Medium	Medium-High	Low-Medium	Low	Medium
	Catching of wild animals e.g. reptiles, bids and small mammals as pets	Disturbance to bio-diversity and decline in indigenous faunal numbers	Medium-High	High	Low-Medium	Low-Medium	Low	Low	Medium
	Birds colliding with power line and panels	Electrocution of birds	Medium-High	High	Low-Medium	Low-Medium	Low	Low	Medium
	The erection of fences and the construction of roads with a kerb	The fragmentation of available habitat and the restriction of movement of small mammals, reptiles and amphibians	Low-Medium	High	Low-Medium	High	Medium	Low	Medium
Cumulative Impacts	Increased potential of negative impacts on ecology of the area	Increase in natural vegetation to be removed.	Medium-High	High	Medium-High	Medium-High	Medium	Low-Medium	Medium

ALTERNATIVE LOCATION 2									
Project Phase	**Environmental Aspect: Ecology (Fauna and Flora)**								
	Activity that causes impact	**Specific impact**	**Severity**	**Duration**	**Extent**	**Frequency**	**Probability**	**Significance**	
								With Mitigation	**Without Mitigation**
Construction	Earthworks and vegetation clearance at construction site	Loss of indigenous plant species & disturbance to sensitive habitat	Medium	Medium	Low-Medium	Medium	Medium-High	Low-medium	Medium
	Vegetation clearance and the use of herbicides to control re-growth at the different development areas	The eradication and control of exotic invasive plant species Loss of indigenous plant species	Medium	Medium	Medium	Low-Medium	Medium-High	Low-Medium	Medium
	The occurrence of veldt fires on site	Destruction of flora/habitats Loss of indigenous fauna	Medium-High	Medium	Medium	Medium-High	High	Medium	Medium-high
	Littering (e.g. cans and plastics) along access road and at construction site	Public nuisance and loss/death of indigenous fauna	Low-Medium	Medium	Medium	Medium-High	Medium	Low	Medium
	The control of animals on site Killing, poisoning or hunting of animals	Loss of indigenous fauna to the area	Medium-High	Medium	Medium	Medium	Low-Medium	Low-Medium	Medium
Operation	Rehabilitation of cleared areas	The spreading of exotic invasive plant species Loss of habitat and indigenous flora	Medium	High	Medium	Low-Medium	Medium	Low-Medium	Medium
	The occurrence of veldt fires	The loss of indigenous fauna and flora	Medium-High	Medium	Medium	Low-Medium	High	Medium	Medium-high
	The functioning of the permanent sewage treatment systems – treated sewage outflow	Deterioration in the habitat for avifauna and aquatic life	Medium-High	High	Medium	Medium-High	Medium	Low-Medium	Medium-High
	Disposal and storage of solid waste and littering	The death/loss of indigenous fauna e.g. raptors, mammals and reptiles	Medium-High	High	Medium-High	Medium-High	Medium	Low-Medium	Medium
	The control of pests and vermin	Killing and poisoning of fauna feeding on the poisoned vermin or pest	Low-Medium	High	Low-Medium	Medium-High	Medium	Low	Medium
	The feeding of fauna e.g. birds &small mammals	Disturbance to bio-diversity and the natural movement of the animals through the site The death/loss of indigenous fauna	Low-Medium	High	Low-Medium	Medium-High	Low-Medium	Low	Medium

ALTERNATIVE LOCATION 2									
Project Phase	Environmental Aspect: Ecology (Fauna and Flora)								
	Activity that causes impact	Specific impact	Severity	Duration	Extent	Frequency	Probability	Significance	
								With Mitigation	Without Mitigation
	Catching of wild animals e.g. reptiles, bids and small mammals as pets	Disturbance to bio-diversity and decline in indigenous faunal numbers	Medium-High	High	Low-Medium	Low-Medium	Low	Low	Medium
	Birds colliding with power line and panels	Electrocution of birds	Medium-High	High	Low-Medium	Low-Medium	Low	Low	Medium
	The erection of fences and the construction of roads with a kerb	The fragmentation of available habitat and the restriction of movement of small mammals, reptiles and amphibians	Low-Medium	High	Low-Medium	High	Medium	Low	Medium
Cumulative Impacts	Increased potential of negative impacts on ecology of the area	Increase in natural vegetation to be removed.	Medium-High	High	Medium-High	Medium-High	Medium	Low-Medium	Medium

Mitigation measures – Construction phase

- Clearance of vegetation should be restricted to 210 ha footprint and access road.
- Construction activities should be restricted to the proposed 210 footprint.
- The areas close to the western and northern boundary of the property, affected by the *Gamagara and Kuruman Spruits*, should be avoided.
- Care must be taken that unnecessary clearance of vegetation does not take place. Where possible, natural vegetation must be retained.
- The herbaceous layer should be revived after clearance of the vegetation and actively managed through slashing during the entire lifetime of the project.
- The medium-high sensitivity area (sand dunes) located on the western and northern side of the project site (close to the Gamagara and Kuruman Rivers) should remain undeveloped.
- Protected trees and protected plant species can only be removed once the necessary permits have been obtained (DAFF and DENC).
- The protected tree species *Acacia haematoxylon* (Grey camel thorn) and *Acacia erioloba* (Camel thorn) were found across the project site. No protected trees should be removed without authorisation from DAFF.
- The project should comply with the *Northern Cape Nature Conservation Act* (Act No. 9 of 2009).
- The herbicides used to control the invasive plant species should be chosen in consultation with an ecologist, as some of the agents might be detrimental to the surrounding indigenous fauna and flora e.g. Roundup is for example extremely toxic to frogs.
- Poisons for the control of problem animals should rather be avoided since the wrong use thereof can have disastrous consequences for the raptors occurring in the area. The use of poisons for the control of rats, mice or other vermin should only be used after approval from an ecologist.
- Limit pesticide use to non-persistent, immobile pesticides and apply in accordance with label and application permit directions and stipulations for terrestrial and aquatic applications.

- Fires should only be allowed in designated places within the construction camp and extra care should be taken to prevent veldt fires of occurring.
- Firebreaks should comply with the National Veldt and Forest Fire Act, 1998 (Chapter 4: Duty to Prepare and maintain firebreaks).
- Cleared areas should be rehabilitated by reintroducing a grass layer as soon as possible to limit the occurrence of erosion.
- The cleared vegetation should not be burned on site. The cleared vegetation should be stockpiled and taken to the closest available landfill site.
- Solid waste must be kept in adequate animal proof waste bins at the construction camp and construction sites. Building rubble and various wastes should be removed on a regular basis to the closest available landfill site.
- Regular clean-up programs should be put into effect along the access road and throughout the premises to limit the impact of littering caused by construction activities.
- The stockpiled topsoil and construction material should be managed in such a way that the material is not transported by wind or rain. This can be done by restricting the height of the stockpiles, sandbagging and avoiding steep slopes.
- No animals may be killed, captured or hunted on site by construction workers. Do not feed any wild animals on site.
- Where trenches pose a risk to animal safety, they should be adequately cordoned off to prevent animals falling in and being trapped and/or injured. This could be prevented by the constant excavating and backfilling of trenches during construction process.
- Existing game on the developed area will be relocated when the proposed solar park is developed. The relocation of the game will be executed according to the relevant legislation.
- Cumulative impacts on the ecology of the area can be significant. However, with the mitigation measures in place, the potential is very low for significant negative impacts on the ecology of the area.
- The EMPr will have to be adhered to both during the construction as well as operational phases and regular monitoring should be done to ensure that there is sound environmental practice at the Rhodes 1 Solar Park.

Mitigation measures – Operational phase

- The herbaceous layer should be revived after clearance of the vegetation and actively managed through slashing during the entire lifetime of the project.
- An ecologist should be consulted on the use of herbicides/eco-friendly products to control exotic tree and shrub species.
- Poisons for the control of problem animals should rather be avoided since the wrong use thereof can have disastrous consequences for the raptors occurring in the area. The use of poisons for the control of rats, mice or other vermin should only be used after approval from an ecologist.
- Limit pesticide use to non-persistent, immobile pesticides and apply in accordance with label and application permit directions and stipulations for terrestrial and aquatic applications.
- The high-risk sections of the power line should be marked with a suitable anti-collision marking device on the earth wire as per the Eskom guidelines.
- Solid waste must be kept in animal proof waste bins.
- A monitoring program should be compiled and implemented to ensure that the sewage treatment system is functioning properly and that the treated wastewater conforms to the standards set by the Department of Water Affairs.
- Staff members should be discouraged from attempting to catch or kill any wildlife for use as food, pets or to feed any wild animals.

- Firebreaks should comply with the National Veldt and Forest Fire Act, 1998 (Chapter 4: Duty to Prepare and maintain firebreaks).
- The impact on the flying invertebrates will be minimized through the use of sodium vapour (yellow) lights as outside lighting.
- The use of eco-friendly products e.g. Organic Compost and/or Effective Microorganisms (EM), which reduces the frequency of application of conventional fertilizers, herbicides and insecticides, should be promoted.
- The EMPr will have to be adhered to both during the construction as well as operational phases and regular monitoring should be done to ensure that there is sound environmental practice at the Rhodes 1 Solar Park.

9.4.1.7. Visual impacts

Construction phase

The natural aesthetic character of the site will be changed. The the Eskom“ Hotazel - Heuningvlei” 132 kV power line crossing the project site, have already changed the visual characteristics of the site.

Operational phase

Buildings and the solar modules have a *visual impact* and lights at night can be a *nuisance.*

ALTERNATIVE LOCATIONS 1 AND 2									
Project Phase	Impact: Visual disturbance								
	Activity/Aspect	Specific impact	Severity	Duration	Extent	Frequency	Probability	Significance	
								With Mitigation	Without Mitigation
Construction	Buildings& panels	Visual	Low	High	Low-Medium	High	High	Low-Medium	Medium
	Lights	Visual	Low	Medium	Low-medium	Medium-high	High	Low-Medium	Medium
Operation	Buildings and panels	Visual	Medium	High	Medium	High	High	Medium-High	Medium
	Lights	Nuisance	Low	High	Low-medium	Medium-High	High	Low-Medium	Medium
	Electrical lines	Visual	Low	High	Low	High	High	Low-Medium	Low-Medium
Cumulative Impacts	Increased in visibility of yet another solar park in the area	Increased visual intrusion and nuisance	Medium-High	Medium	Medium	Low-Medium	High	Low-Medium	Low-Medium

Mitigation measures

- Earth works should be executed in such a way that only the footprint and a small “construction buffer zone” around the proposed components are exposed. In all other areas, the natural occurring vegetation, more importantly the indigenous vegetation should be retained.
- Install light fixtures that provide precisely directed illumination to reduce light “spillage” beyond the immediate surrounds of the project site.
- Minimise the amount of light fixtures to the bare minimum and connecting these lights to motion sensors can also considered in reducing light pollution.

- A video-surveillance system using infrared or microwave video cameras, which do not need a switched on lighting system, is recommended.
- Cumulative impacts will be low as it was possible to mitigate the visual impact at Rhodes 1 Solar Park successfully as a result of the natural characteristics of the area.

9.4.1.8. Safety, security and fire hazards

Construction phase

Construction activities such as excavating of foundations and trenches, movement of construction vehicles, the use of equipment and the congregation of workers and staff on site further increases the risk of injury. The activities of construction personnel on site may contribute to an increase in the level of crime in the area and may also contribute to an increase in the risk for fires.

Operational phase

Fires and criminal activities pose a significant risk during the operation of the development.

ALTERNATIVE LOCATIONS 1 AND 2									
Project phase	Impact: Safety, security and fire hazards								
	Activity/Aspect	Specific impact	Severity	Duration	Extent	Frequency	Probability	Significance	
								With Mitigation	Without Mitigation
Construction	Construction activities – excavation of foundations, trenches etc.	Loss or injury to human life	Low-medium	Medium-high	Low	High	Medium	Low	Medium
	Security	Crime	Medium	Medium-high	Low-medium	Medium	Medium-high	Low - medium	Medium
	Fire hazards	Loss of human life and construction equipment etc.	High	Medium-high	Medium	Low	Low-Medium	Low-Medium	Medium
Operation	Security	Crime	Medium	High	Medium	Medium	Medium-high	Medium	Medium-high
	Fire hazards	Loss of human life, bio-diversity, buildings, infrastructure etc.	High	Medium	Medium -High	Low	Low	Low	Medium
Cumulative Impacts	Higher number of people in the area increases safety risks	Potential for an increase in criminal activity	High	Medium	Medium -High	Low	Low	Low	Medium

Mitigation measures

- The Contractor shall conform to the Occupational Health and Safety act (Act 85 of 1993) and regulations applicable. The Act requires the designation of a Health and Safety representative when more than 20 employees are employed.
- Open trenches or excavations must be marked with danger tape.

- The number of construction workers to stay on site should be limited to the minimum.
- Proper access control (I.D. cards) should be enforced to ensure that no authorised persons enter the site.
- No solid waste or vegetation may be burnt on the premises or surrounding areas.
- Firebreaks should comply with the National Veldt and Forest Fire Act, 1998 (Chapter 4: Duty to prepare and maintain firebreaks).
- Fire extinguishers and fire fighting equipment must be available.
- A fence should be constructed along the boundary of the development.
- The cumulative impacts of this impact can be successfully mitigated if managed properly.

9.4.1.9. Socio-economic impact

Construction phase

The construction and operation phases of the development will have a positive impact on the socio-economic environment of beneficiary communities through employment opportunities and training and skills development.

Operational phase

A number of permanent jobs will be created for local people during this phase.
Mira Energy should identify a local Community for the purpose of entering into a partnership for the Project, as required by the rules of the IPP Procurement programme.

ALTERNATIVE LOCATIONS 1 AND 2									
Project phase	Impact: Job creation								
	Activity/Aspect	Specific impact	Severity	Duration	Extent	Frequency	Probability	Significance	
								With Mitigation	Without Mitigation
Operation	Job creation	Job Creation	High +	High +	Medium-high +	High +	High +	N/A	High +
Operation	Local Community development	Local Community development	High +	High +	high +	High +	High +	N/A	High +
Cumulative impacts	Increased potential for job creation.	Increased potential for local Community development	High +	High +	high +	High +	High +	N/A	High +

Mitigation measures

- During the construction and operational phases, jobs must be created for unemployed local people and skills must be transferred to them.
- Where viable, the work must be executed in a labour intensive manner to create as many jobs possible.
- The cumulative impact of this impact can just be positive. As one of the poorest provinces in South Africa, the Northern Cape is definitely in need of more job opportunities.

9.6. POTENTIALLY SIGNIFICANT IMPACTS

Impacts with a rating of Medium-high or High are impacts which are regarded as potentially significant, rated without any mitigation measures. In this impact assessment, the following impacts were regarded as potentially significant impacts:

i. Water pollution by the inadequate functioning of the sanitation system.
ii. Water consumption and depletion during construction phase.
iii. The occurrence of veldt fires.

These impacts (i-iii) will now briefly be discussed.

9.6.1. Cumulative impacts

i. The effect of water pollution (surface and groundwater) by a malfunctioning of the sanitation system will have a cumulative effect only if it is not detected by a regular monitoring and if it takes place on a regular basis.
ii. This effect is cumulative only if care is not taken to conserve water and if water usage and the water levels of boreholes are not monitored regularly.
iii. This can have a cumulative effect if preventative measures are not followed.

9.6.2. Nature of impact

i. This is pollution of a renewable resource.
ii. This is a negative impact that affects water quantity available for use in the area.
iii. Damage to property, ecology and safety of people.

9.6.3. Extent and duration of impact

i. The extent could potentially be within the farm of the proposed development and the surrounding farms.
ii. The extent could potentially be within the area of the proposed development and the surrounding farms. The duration is only during construction.
iii. The extent is potentially on the development area as well as surrounding properties and even regional. The duration is for the life of the development.

9.6.4. Probability of occurrence

i. The probability is unlikely.
ii. The probability is possible.
iii. The probability is infrequent or seldom.

9.6.5. Degree to which impact can be reversed

i. Impact is reversible if mitigated in time.
ii. This impact is reversible because the higher abstraction will only be during the construction period.
iii. If the development is not continuing there will be no guarantee that veldt fires will not occur on the property. This impact must therefore be managed accordingly.

9.6.6. Degree to which impact can cause irreplaceable loss of resource

i. If this impact takes place over a very long time and there is gross negligence, the water resource can be damaged to a point where it will take very long to recover and where it could almost be seen as being irreplaceable.
ii. The recovery of the water resource is linked to rainfall and will recover accordingly. The negative impact is during the construction period.
iii. Veldt fires can create such damage that it will take a long time for the veldt to recover but the fact is that the vegetation has been subjected to veldt fires ever since. Loss of property (buildings) can be replaced.

9.6.7. Degree to which impact can be mitigated

i. Successful mitigation is possible
ii. Successful mitigation is possible
iii. Successful mitigation is possible

10. DECOMMISSIONING PHASE

Decommissioning activities of the PV plant mainly include removal of project infrastructure and restoring of the site's *status quo ante*.

The decommissioning phase will start at the end of the PV power plant lifetime (25 - 30 years) and will last approximately 6 months, involving a team of 50 workers.

Decommission will be subject to a decommissioning plan once the project is nearing its operational life (25-30 years). Decommissioning will also be subject to an environmental authorization (Activity 27 of R544 of 18 June 2010).

10.1. SITE PREPARATION

In order to ensure a correct decommissioning of the site, the first step of the process will include adequate site preparation. Integrity of access points and of laydown areas will be confirmed and eventually re-established in order to accommodate equipment and to load vehicles.

10.2. DISASSEMBLE AND REPLACEMENT OF EXISTING COMPONENTS

All components will be disassembled. Silicon of the PV modules will be recycled, as well as mounting structures (aluminium or zinced steel frames and piles) and cables (copper and/or aluminium conductor).

Non-recyclable components of inverter, transformers and electrical devices will be disposed in appropriate way, in compliance with applicable laws and international standards.

10.3. RESTORATION OF THE SITE

Adequate measures will be undertaken in order to restore the site by re-planting of indigenous plant species.

10.4. ALTERNATIVE OPTION: UPGRADING THE SOLAR PARK

At the end of the PV power plant lifetime (25 ÷ 30 years), as alternative option to the decommissioning, it will be evaluated the feasibility of upgrading the solar park with the most appropriate technology/infrastructure available at that time.

11. CONCLUSIONS AND RECOMMENDATIONS

The Final EIA Report describes the activities undertaken for the development of the Rhodes 1 Solar Park.

The purpose of this report is to provide the relevant authorities and interested and affected parties with sufficient information regarding the potential impacts of the development to render meaningful comments. Potential impacts were identified in consultation with I&AP's and technical specialists (where applicable) and were assessed using a matrix and by applying professional knowledge.

The potentially significant negative impacts that have been identified should be mitigated through the implementation of the mitigation measures highlighted in this report. It is submitted that the proposed mitigation measures, will effectively diminish the impacts to acceptable levels. Given the socio-economic imperatives of the development, the residual impacts are not of sufficient importance to thwart the development.

It is the professional opinion of AGES that the proposed development does not present any fatal flaws in terms of negative impacts to the environment and therefore will not have any significant detrimental impacts to render the project unfeasible.

It is proposed that the following conditions must be included in the Record of Decision if the project is authorised:

- The mitigation measures contained in this report must be implemented.
- The management and or mitigation measures contained in the Environmental Management Plan must be implemented.
- The responsibilities to obtain any further authorisations and/or licenses will rest on the proponent of the project, PRIOR to any activities on site.