PROPOSED DEVELOPMENT OF A PHOTO-VOLTAIC SOLAR POWER GENERATION PLANT ON THE FARM ADAMS 328 NEAR HOTAZEL IN THE NORTHERN CAPE

ESCIENCE ASSOCIATES (PTY) LTD

POSTAL ADDRESS:
PO Box 2950
Saxonwold
2132

PHYSICAL ADDRESS:
9 Victoria Street
Oaklands
Johannesburg
2192

TEL:
+27 11 718 6380

FAX:
+27 86 610 6703

WEBSITE:
www.escience.co.za

E-MAIL:
info@escience.co.za

R No 2009/014472/07

SCOPING REPORT

NEAS Reference: DEA/EIA/0000739/2011
DEA EIA reference number: 12/12/20/2567

June 2012

SCOPING REPORT:
PROPOSED DEVELOPMENT OF A PHOTO-VOLTAIC SOLAR POWER GENERATION PLANT ON THE FARM ADAMS 328 NEAR HOTAZEL IN THE NORTHERN CAPE

COMPILED BY EAP:

EScience Associates (Pty) Ltd
PO Box 2950, Saxonwold, 2132
9 Victoria Street,
Oaklands,
Johannesburg,
2192

Tel: (011) 718 6380
Cell: 083 564 9445
Fax: 086 512 2366
E-mail: brian@escience.co.za

ON BEHALF OF APPLICANT:

AURORA POWER SOLUTIONS (PTY) LTD
2D Nautica Building, Water Club Complex,
100 Beach Road, Moullie Point,
Cape Town, South Africa, 8001
SOUTH AFRICA

Tel: +27 21 421 9764
Fax +27 86 513 8648

PREPARED FOR APPROVAL BY COMPETENT AUTHORITY:

National Department of Environmental Affairs (DEA)
Director: Environmental Impact Management
4th Floor, South Tower,
Fedsure Forum Building
315 Pretorius Street
Pretoria
0001

Tel:(012) 395 1694/1768
Fax: (012) 320 7539

INCLUDING FURTHER REVIEW BY PUBLIC AND OTHER STAKEHOLDERS

June 2012

DEA & LEGAL REQUIREMENTS FOR SOLAR ENERGY FACILITIES: INFORMATION LIST FOR EIA PROJECTS:

1. General Site Information		
No.	**Information**	**Reference/Provided**
1.1	Description of all affected farm portions	Section 2 & 6
1.2	21 Digit Surveyor General Codes of all affected farm portions	Section 2
1.3	Copies of deeds of all affected farm portions	Will be provided as part of the Environmental Impact Report.
1.4	Photos of areas that give a visual perspective of all parts of the site	Appendix 4
1.5	Photographs from sensitive visual receptors (Tourism routes, tourism facilities, etc.)	Will only be provided once the Visual Impact Assessment (VIA) has been completed as part of the EIA phase of the project
1.6	Solar plant design specifications including: • Type of technology • Structure height • Surface area to be covered (including associated infrastructure such as roads. • Structure Orientation • Laydown area dimensions (Construction period and thereafter. Generation capacity of the facility as a whole at delivery points	Section 3

2. Site maps and GIS information		
No.	**Information**	**Reference/Provided**
2.1	All maps/information layers must also be provided in ESRI Shapefile format	Contained in the CD version of this report
2.2	All affected farm portions must be indicated	Section 2 & 6
2.3	The exact site of the application must be indicated (The areas that will be occupied by the application)	Will only be determined after all specialist assessment have been completed as part of the EIA phase of the project
2.4	A status quo map/layer must be provided that includes the following: Current use of the land on site including:	Section 6
	2.4.1 Building and other structures	Figure 6.3 & 6.4
	2.4.2 Agricultural fields	Figure 6-7
	2.4.3 Grazing Areas	Will be included in the EIA phase of development
	2.4.4 Natural vegetation areas (Natural veld not cultivated for the preceding 10 years) with an	Will only be determined once the detailed

	indication of the vegetation quality as well as fine scale mapping in respect of critical Biodiversity Areas and Ecological Support areas.	biodiversity assessment has been completed.
	2.4.5 Critically endangered and endangered vegetation areas that occur on the site	Will only be determined once the detailed biodiversity assessment has been completed.
	2.4.6 Bare Areas which may be susceptible to soil erosion	Will only be determined once the detailed soil assessment has been completed.
	2.4.7 Cultural historical sites and elements	Will only be determined once the detailed Heritage assessment has been completed.
	2.4.8 Rivers, Streams and water courses	Figure 6-8
	2.4.9 Ridgeline and 20m continuous contours with height references in the GIS database	Will be provided within the Environmental Impact Report (EIR)
	2.4.10 Fountains, boreholes, dams (in-stream as well as off- stream) and reservoirs	Will be provided within the Environmental Impact Report (EIR)
	2.4.11 High potential agricultural areas as defined by the Department of Agriculture, Forestry & Fisheries	N/A the site does not fall within an area which has high agricultural potential as defined by DAFF.
	2.4.12 Buffer zones (also where it is dictated by elements outside the site): • 500m from any irrigated agricultural land • 1km from residential areas • Indicate isolated residential, tourism facilities on or within 1km of the site	Will be provided within the Environmental Impact Report (EIR)
	2.4.13 A slope analysis map/layer that include the following slope ranges": • Less than 8% slope • Between 8% and 12 % slope • Between 12% and 14% slope • Steeper than 18 % slope	Will be provided within the Environmental Impact Report (EIR)
	2.4.14 A map/layer that indicate locations of birds and bats including roosting and foraging areas	Will only be determined once the detailed biodiversity assessment has been completed.
2.5	A site development proposal map(s)/layer(s) that indicate:	Will be provided within the Environmental Impact Report (EIR)
	2.5.1 Position of solar facility	
	2.5.2 Foundation footprint	
	2.5.3 Permanent laydown area footprint	
	2.5.4 Construction period laydown footprint	
	2.5.5 Internal road indicating width (construction period width and operation period width) and with numbered sections between the other site elements which they serve	

	2.5.6 River, stream and water crossing of roads and cables indicating the type of bridging structures that will be used	
	2.5.7 Substation (s) and /transformer (s) sites including their entire footprint	
	2.5.8 Cable routes and trench dimensions (where they are not along the internal roads)	
	2.5.10 Connection routes to the distribution/transmission network	
	2.5.11 Cut and fill areas along roads and at substation/ transformer sites indicating the expected volume of each cut and fill	
	2.5.12 Borrow pits	
	2.5.13 Spoil heaps (Temporary for topsoil & subsoil and permanently for excess material	
	2.5.14 Building including accommodation	

3. Regional map and GIS information		
No.	**Information**	**Reference/Provided**
3.1	All maps/information layers must also be provided in ESRI Shape file format	Contained in the CD version of this report
3.2	The map/layer must cover an area of 20km around the site	Noted
3.3	Indicate the following: • Roads including their types (tarred or gravel) • Railway lines and stations • Industrial areas • Harbours and airports • Electricity transmission and distribution lines and substation's • Pipelines • Water sources to be utilized during construction and operational phases • Critical Biodiversity areas and Ecological Support area • Critical Endangered and endangered vegetation areas\Agricultural fields • Irrigated areas • An indication of new road or changes and upgrades that must be done to existing roads in order to get equipment onto the site including cut and fill areas and crossings of rivers and streams	Figure 6-1 to Figure 6-8

1. EXECUTIVE SUMMARY

Aurora Power Solutions (APS) is proposing to develop a commercial photo-voltaic solar power plant on the farm Adams approximately 21 km's south of Hotazel, in Northern Cape Province. The facility will be referred to as the Adams PV Solar Energy Facility and is proposed to be developed in phases starting with a 20 MW facility (applied for authorisation under a basic assessment process) and increase this capacity to cover the entire feasible area of the site (applied for in this scopping and EIA process). Solar power plants in South Africa are few and far between, but the potential for the development of more plants, specifically in the Northern Cape, is huge. As one can see from the map below (Figure 2-1), levels of Solar radiation in the north-western extent of the Northern Cape are very high (>9001 MJ/m^2/annum). This potential for electricity generation via a renewable energy source is massive, and must be sustainably used.

The Environmental Impact Assessment (EIA) is considered one of the early steps in evaluating the feasibility of a project of this scale. EScience Associates (ESA) has been appointed by Aurora Power Solutions as independent Environmental Assessment Practitioners (EAP) to conduct the scientific investigations of the EIA, and to facilitate the associated legal and administrative processes on their behalf. The main aim of the EIA is to assess the significance of potential environmental and socio-economic impacts, and to provide this information to the public and relevant Government Authorities who are responsible for making decisions on the environmental approvals that the project would require before it may commence. The key Competent Authority (CA) responsible is the National Department of Environmental Affairs (DEA) - previously the Department of Environmental Affairs and Tourism (DEAT).

The activity involves the construction of a solar power (Photovoltaic) facility. With populations in South Africa growing rapidly, and the need for "green" energy (such as solar power) is becoming more prevalent, the project will provide a sustainable, green energy, resource for present and future generations. The positive aspects of using solar power far outweigh the negative. This proposed site will aid the new generation capacity to the national grid from renewable energy and share a part of the 42% (17.8GW) share targeted by the Department of Energy for renewable energy (Integrated resource plan, 2010-2030).According to the above strategy 8.4GW of the new generation capacity is proposed to be obtained from PV solar sources over the next twenty years.

The activity will provide local communities in Hotazel and Kathu areas with several benefits including job creation, socio-economic development and a reliable and clean source of energy for many years. Society in general will be benefited, as this project will create electricity without any emissions to air i.e. zero carbon emission to the atmosphere. This is in contrast to coal-fired power stations, which have massive carbon emissions. Society will be benefited as less carbon emissions means less global warming, which evidently means healthier and better functioning environmental ecosystems on the planet. Further to this, and as described by de Jong 2011, "*the project has the potential to create sustainable employment in the Northern Cape while addressing some of the fundamental drivers of Climate Change. Being one of the pioneers of solar power in South Africa the project has the inherent role of developing solar power technology for the region. The viability and success of this project is strategic to paving the way for sustainable power technologies in this region. This is a project of strategic and national importance and capable of enhancing South Africa's position in the global technology arena while aligning the commitments made by South Africa in Copenhagen*."

Photovoltaic's (PVs) are materials that convert solar radiation directly into electricity. Photo-voltaic solar cells are divided into two distinct groups: Traditional crystalline silicon solar cells and thin film solar cells. The absorbed solar radiation excites the electrons inside the cells and produces what is referred to as photovoltaic effect. The crystalline silicon solar cells are made from monocrystalline silicon or polycrystalline silicon. The thin film technologies comprise of thinner layers of semiconductor material which are produced using a splutter process. Due to the growing demand for renewable energy sources, the manufacture of solar cells and photo-voltaic modules has advanced dramatically in recent years. The proposed project will also consist of a component Concentrated Photo-voltaic (CPV) panels to be developed in combination with the PV panels. CPV systems are very unique because they concentrate sunlight though a lens onto high performance solar cells and by doing so increases the electricity generated. These CPV panels are mounted on tracking systems as to maximise the collection of energy from the sun.

The concentrated light improves the efficiency of the cells and reduces amount of expensive solar cell material needed to produce a certain amount of electricity required. Some of these CPV panels can generate twice as much power per hectare in comparison with conventional solar panel technology. In comparison to normal PV panels certain designs of CPV uses 23.5 meter wide panels with more than 1000 pairs of lenses and solar cells on each (See Figure 3-3). These panels are all mounted on a dual axis installed with tracking systems to maintain 0.8 degrees angels with the sun thought out the day (Bullis, 2011). Due to the growing demand for renewable energy sources, the manufacture of solar cells and photo-voltaic modules has advanced dramatically in recent years.

Based on the independent evaluation and assessment of the proposed project during the Scoping Phase by the Environmental Assessment Practitioner (EAP), a Plan of Study for Environmental Impact Assessment (PoSEIA) has been developed (See Section 8 of this report). The PoSEIA includes the scope of further specialist studies to be conducted, which would inform the accurate assessment and mitigation of potential environmental impacts that may arise from the proposed project. This would result in the compilation of a detailed EIA Report, which would allow the competent authorities (DEA) to make an informed decision regarding the authorisations needed for the proposed Photo-voltaic Solar Power generation project and components thereof.

In conclusion, it is felt that the scoping study has highlighted numerous areas that will need to be properly evaluated during the EIA phase due to the sensitivity of the site that will need to be addressed at EIA phase. It is felt that the scoping study has been undertaken thoroughly and that authorization be granted to continue with the full Environmental Impact assessment to adequately quantify and assess the impacts of the proposed Solar Facility on the receiving environment.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ABBREVIATIONS

BID: Background Information Document
DAFF: Department of Agriculture, Forestry and Fisheries
CO_2: Carbon dioxide
DEA: Department of Environmental Affairs
DENC: Department of Environment and Nature Conservation
DoE: Department of Energy
DWA: Department of Water Affairs
EAP: Environmental Assessment Practitioner
EIA: Environmental Impact Assessment
EMP: Environmental Management Plan
Ha: **Hectare**
IAPs: Interested and Affected Parties
IPP: Independent Power Producer
Km^2: Square Kilometres
kV: Kilovolt
MAR: Mean Annual Rainfall
m^2: Square meters
m/s: Meters per second
MW: Mega Watt
NEMA: National Environmental Management Act, No. 107 of 1998
NERSA: National Energy Regulator of South Africa
NEMA EIA Regulations: Regulations GN R.543, R.544, 545 and R.546 (18 June 2010), as amended. promulgated in terms of Section 24(5) read with Section 44, and Sections 24 and 24D of the National Environmental Management Act, 1998
NGOs: Non-governmental Organisations
NWA: National Water Act
POSEIA: Plan of Study for EIA
PV: Photovoltaic (refers to both normal PV and concentrated PV (CPV) in this document)
SAHRA: South African Heritage Resources Agency
SANBI: South Africa National Biodiversity Institute
SR: Scoping Report

2. INTRODUCTION AND PURPOSE

2.1 BACKGROUND

Aurora Power Solutions (APS) is proposing to develop a commercial photo-voltaic solar power plant on the farm Adams approximately 21 km's south of Hotazel, in Northern Cape Province. The facility will be referred to as the Adams PV Solar Energy Facility and is proposed to be developed in phases starting with a 20 MW facility to be authorised under a basic assessment and increase this capacity to cover the entire feasible area of the site. Solar power plants in South Africa are few and far between, but the potential for the development of more plants, specifically in the Northern Cape, is huge. As one can see from the map below (Figure 2-1), levels of Solar radiation in the north-western extent of the Northern Cape are very high (>9001 MJ/m^2/annum). This potential for electricity generation via a renewable energy source is massive, and must be sustainability used.

The EIA is considered one of the early steps in evaluating the feasibility of a project of this scale. EScience Associates (ESA) has been appointed by Aurora Power Solutions as independent Environmental Assessment Practitioners (EAP) to conduct the scientific investigations of the EIA, and to facilitate the associated legal and administrative processes on their behalf. The main aim of the EIA is to assess the significance of potential environmental and socio-economic impacts, and to provide this information to the public and relevant Government Authorities who are responsible for making decisions on the environmental approvals that the project would require before it may commence. The key Competent Authority (CA) responsible is the National Department of Environmental Affairs (DEA) - previously the Department of Environmental Affairs and Tourism (DEAT).

The proposed project would entail so-called 'listed activities', which may not commence prior to obtaining an Environmental Authorisation, in terms of Section 24 of the National Environmental Management Act, 1998 (Act No. 107 of 1998)[NEMA]. An application for Environmental Authorisation, in terms of NEMA, for activities listed in Government Notices R.544 and R.545 of 18 June 2010, was submitted to the CA (DEA), on 31 October 2011, which this authority acknowledged on 23 November 2011(Appendix 2). The reference number **12/12/20/2567** has been issued by DEA for this project.

Due to the nature and/or scale of some of the activities that would be associated with the proposed project, NEMA requires that the potential environmental impacts must be considered, investigated, assessed and reported on to the CA through a Scoping and detailed Environmental Impact Assessment process, described in Regulations 26–35 of Government Notice R.543 (the so-called NEMA EIA 2010 amendment Regulations), promulgated in terms of Section 24(5) of NEMA.

The nature and extent of the solar facility as well the potential environmental impacts associated with the proposed development (Construction, Operation and decommissioning phases) are investigated in the Draft Scoping Report.

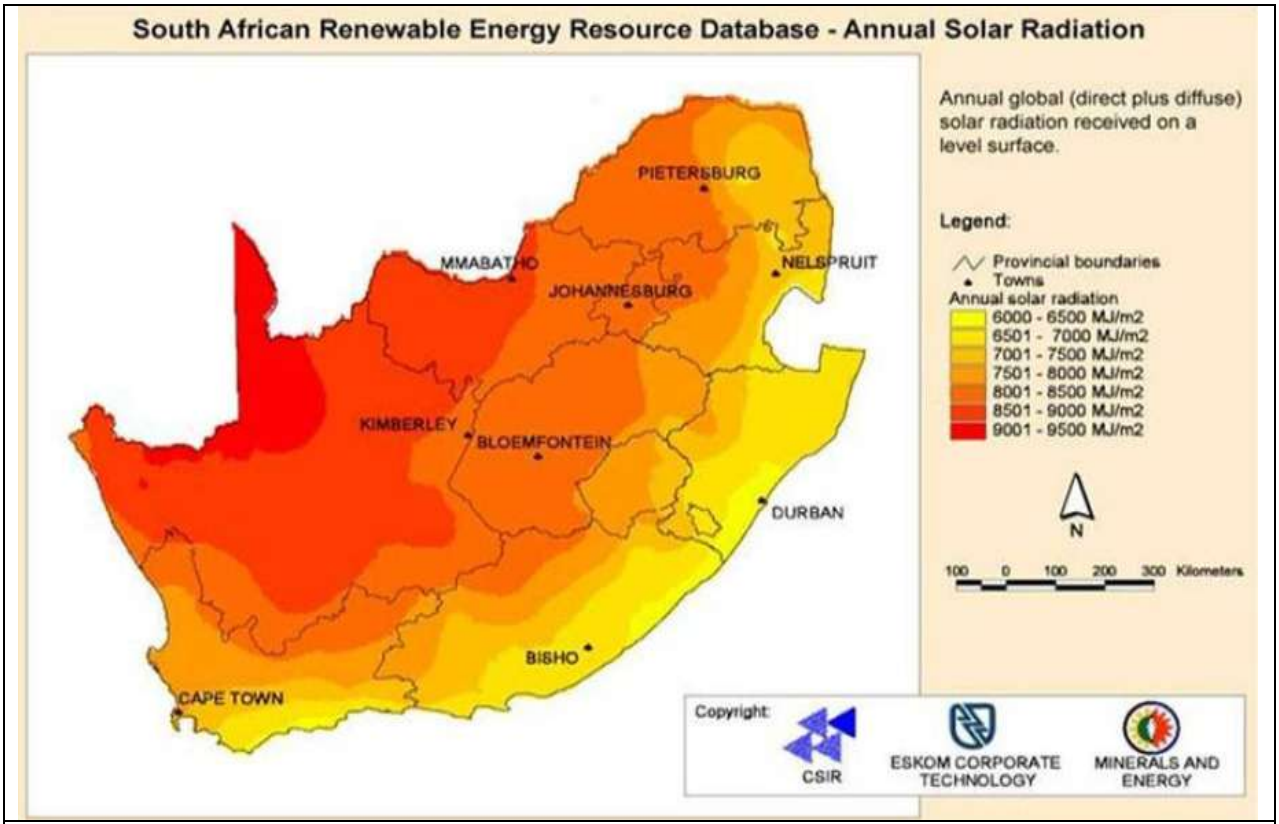

Figure 2-1: Annual Solar Radiation map (Source: CSIR, ESKOM and the DME)

Further to the above, the site investigated for the proposed PV power plant has been selected for its proximity to existing electrical substations, the location in terms of annual average direct irradiation and topography. Figure 2-2 below shows (in shaded black) the ideal position of solar power plants in the Northern Cape, taking into consideration annual average direct normal irradiation > 7.0 kWh/m²/d, slope < 1%, distance to high-voltage transmission lines < 20 km, no environmentally sensitive areas. The proposed site indicated by the red dot on the map.

Although the map below indicates suitability for the installation of large concentrating solar thermal power plants, it can be concluded that the site for the proposed photovoltaic solar power plant are in an excellent position to take advantage of the right environmental conditions for sustainable renewable electricity generation.

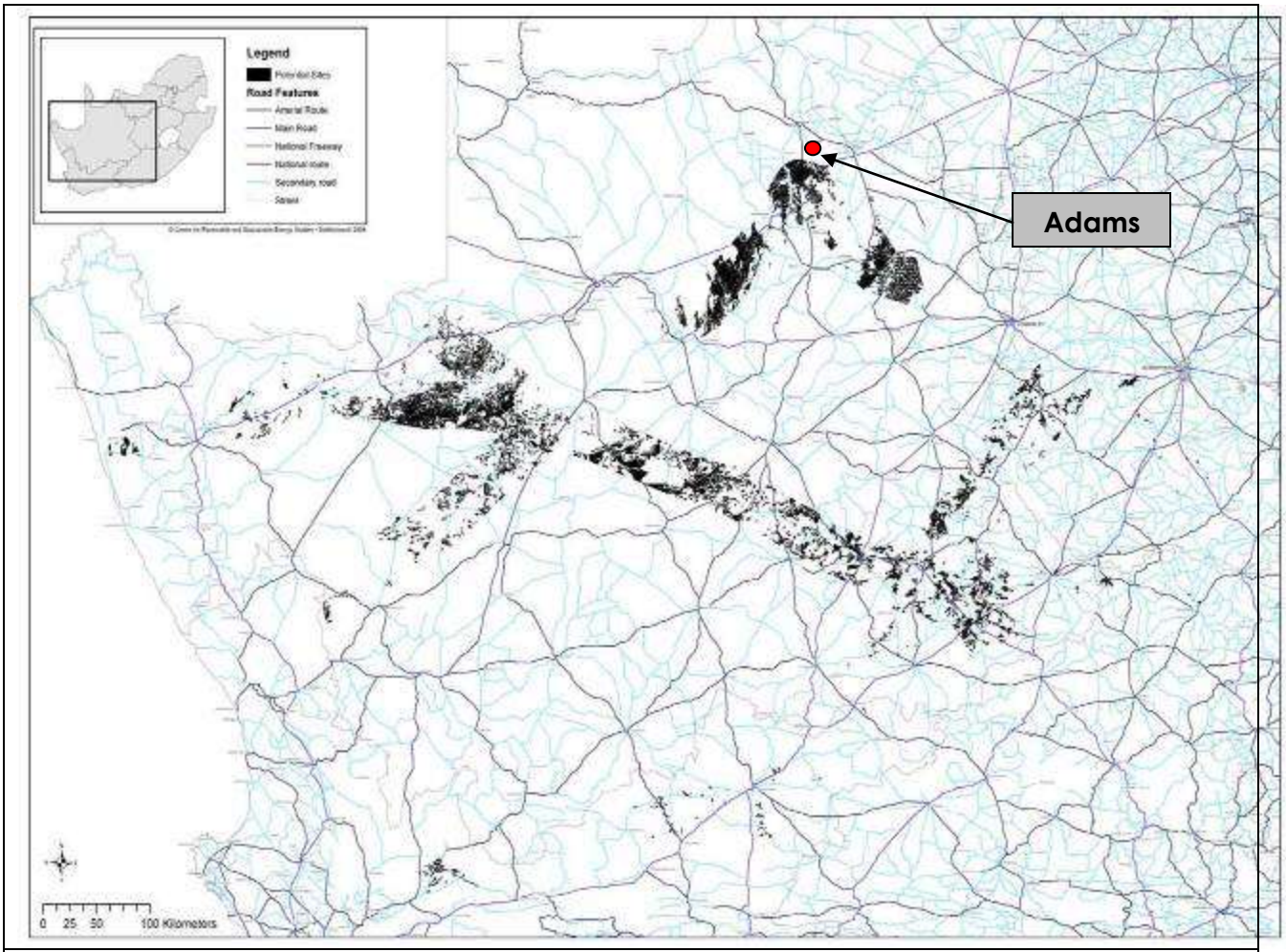

Figure 2-2: Map of South Africa indicating areas which are suitable for the installation of large concentrating solar thermal power plants (criteria: annual average direct normal irradiation > 7.0 kWh/m2/d, slope < 1%, distance to high-voltage transmission lines < 20 km, no environmentally sensitive areas). Source: http://www.crses.sun.ac.za/html/solar.htm

2.2 PURPOSE OF A SCOPING REPORT

This section of the report gives a brief background of the purpose of the scoping report as there is more than often misinterpretation between the scoping phase and the Environmental Impact Assessment phase of the EIA process. The Scoping and Environmental Impact Assessment (EIA) process flow diagram is presented in Figure 2-3.

The EIA process is divided into two main phases: Scoping and EIA. Scoping is a critical stage of any EIA process, and it is the initial step in involving interested and affected parties (I&AP's) in environmental considerations for all stages of planning and development processes. Scoping involves the identification of various priority issues from a broad range of issues that should be addressed in the EIA, therefore scoping is the first critical step in compiling an EIA. Its main purpose is to identify the most important and significant issues that must be further investigated as part of the EIA and exclude issues that are of no concern; it therefore focuses the assessment on key issues. Scoping focuses the EIA process on significant issues and always involves participation by interested and affected parties (government, the public, proponent and industries) as to help identify key issues of concern. It gives I&AP's an opportunity to participate in planning decisions of the development.

Upon approval of the final Scoping Report and plan of study for EIA to the competent authority, detailed visual, heritage, soil and biodiversity studies will be finalised and made available for stakeholder review, together with the draft EIA Report and draft Environmental Management Plan (EMP). Please kindly also refer to section 8 of the draft scoping report to review the proposed terms of reference for investigations that will be undertaken as part of the EIA phase. The proposed investigation will be undertaken by specialists in various fields to determine the extent of the potential impacts.

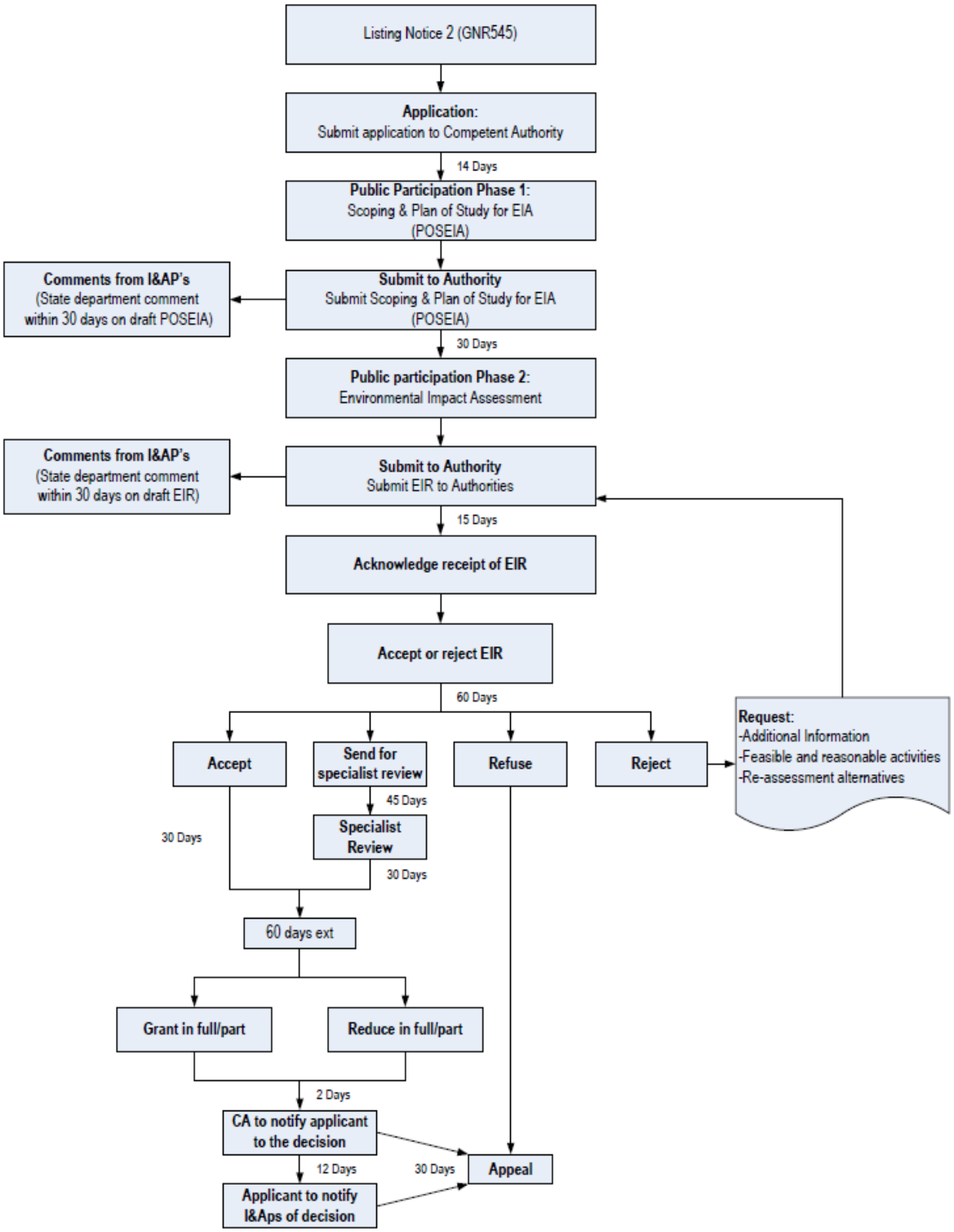

Figure 2-3: Scoping & EIA Process as prescribed by the NEMA 2010 EIA regulations

2.3 DETAILS OF ENVIRONMENTAL ASSESSMENT PRACTITIONERS (EAP)

The Scoping assessment for this application was undertaken by EScience Associates (Pty) Ltd. (ESA), as independent Environmental Assessment Practitioners (EAP) to Aurora Power Solutions. The Environmental Impact Assessment study team was led by Mr Theo Fischer, senior environmental scientists with more than 10 years' experience in environmental management, with Brian Gardner, Roelof Letter in EIA project management roles (see Appendix 4 for relevant CVs).

2.4 LAND, LANDOWNER DETAILS AND SURFACE RIGHTS

The EIA will be undertaken on the farm 328 Adams in the Northern Cape approximately 21km south of Hotazel on the R380. Only the area in close proximity to the Dougnor substation on the farm Adams will be investigated. Figure 6-1 indicates the area on the farm Adams which was identified as potential location of the solar facility and that will be assessed in detail as part of scoping and Environmental Impact Assessment process. The delineated study area is approximately 880 hectares, however only a portion of this area will be chosen as the best practical location from an environmental perspective for the development of the solar facility and will be assessed in detail as part of the environmental assessment phase of the proposed project (see Figure 2-3).

Farm Portion	Owner/ contact person
No. 328 Adams near approximate 21km south of Hotazel on the R380 in Northern Cape.	Mr. Hendrik Venter

Surveyor General 21 digit codes for farm Adams 328 included in the EIA process:																			
C	0	4	1	0	0	0	0	0	0	0	0	0	3	2	8	0	0	0	0	0

2.5 MUNICIPALITY AND REGIONAL DETAILS

District Municipality:	John Taolo Gaetsewe (formerly Kgalagadi) District Municipality
Local Municipality (LM):	Joe Morolong Local Municipality
Nearest town/city:	Hotazel

2.6 THE PROPONENT (APPLICANT)

Aurora Power Solutions (APS) is a renewable Energy and Energy Efficiency project development and management Company. Their main focus is on delivering long-term alternative energy solutions for industrial and commercial customers, from concept to implementation. APS focuses on developing large scale grid connected Solar Power project's to financial closure and then onto commissioning in sub-Saharan Africa. APS aims to de-risk the project by performing several project development activities so as to maximise shareholder returns. These activities include:

- Site identification
- Solar Resource Measurement
- Permitting and Licensing
- Technology Assessment and design
- Project Finance
- EPC Structuring

2.7 PROJECT MOTIVATION, NEEDS AND DESIRABILITY

The activity involves the construction of a solar power (Photovoltaic) facility. With populations in South Africa growing rapidly, and the need for "green" energy (such as solar power) becoming more prevalent, the project will provide a sustainable, green energy, resource for present and future generations. The positive aspects of using solar power far outweigh the negative. This proposed site will aid the new generation capacity to the national grid from renewable energy and share a part of the 42% share targeted by the Department of Energy for renewable energy (Integrated resource plan, 2010-2030). According to the above strategy 8.4GW of the new generation capacity is proposed to be obtained from PV solar sources over the next twenty years.

A target of 10,000 GWh of renewable energy was set by the South African government by 2013, due to the high level of renewable energy potential in the country. To contribute towards this target, and kick start the renewable energy industry in South Africa and socio-economic and environmentally sustainable growth a need for a market mechanism was established. The Independent Power Producer (IPP) Procurement Programme was introduced in 2011 for the procurement of renewable energy projects. A maximum tariff was set for each technology and developers would bid for projects and compete on a competitive price basis.

The IPP Procurement Programme therefore supports the Government's 10,000 GWh 2013 Renewable Energy Target and also promotes competitive markets in long term renewable sustained growth in comparison with conventional energies. South Africa electricity generation from renewable energy offers various socio-economic and environmental benefits. These benefits include:

- Increased energy security: the current electricity crisis outlines the need for more sustainable sources of electricity generation as consumers increase. Grid connections with renewable energy acts as an alternative source of electricity as traditional sources become strained and more expensive.
- Resource savings: Water and natural resources can be saved by using solar technologies as conventional coal fired power plants are major consumers of valuable natural resources.
- Pollution reduction: Major by-products of fossil fuel burning are nitrogen, oxides and sulphur and have a detrimental impact on human health through the formation of smog and cause the spread of respiratory illnesses. PV solar generation transforms solar radiation directly into electrical energy and therefore no toxic pollutants are emitted.
- Employment creation: The development, scale, installation, management and maintenance of solar facilities have significant potential for job creation in South Africa.

The activity will provide local communities in Hotazel and Kathu areas with several benefits including job creation, socio-economic development and a reliable and clean source of energy for many years. Society in general will be benefited, as this project will create electricity without any emissions to air i.e. zero carbon emission to the atmosphere. This is in contrast to coal-fired power stations, which have massive carbon emissions and require vast amounts of water for power generation. Society will be benefited as less carbon emissions means less global warming, which evidently means healthier and better functioning environmental ecosystems on the planet. Further to this, and as described by de Jong 2011, "*the project has the potential to create sustainable employment in the Northern Cape while addressing some of the fundamental drivers of Climate Change. Being one of the pioneers of solar power in South Africa the project has the inherent role*

of developing solar power technology for the region. The viability and success of this project is strategic to paving the way for sustainable power technologies in this region. This is a project of strategic and national importance and capable of enhancing South Africa's position in the global technology arena while aligning the commitments made by South Africa in Copenhagen."

3. PROJECT DESCRIPTION

3.1 PROCESS DESCRIPTION AND PROPOSED ONSITE INFRASTRUCTURE

Photovoltaic's (PVs) are materials that convert solar radiation directly into electricity. Photo-voltaic solar cells are divided into two distinct groups: Traditional crystalline silicon solar cells and thin film solar cells. The absorbed solar radiation excites the electrons inside the cells and produces what is referred to as photovoltaic effect. The crystalline silicon solar cells are made from monocrystalline silicon or polycrystalline silicon. The thin film technologies comprise of thinner layers of semiconductor material which are produced using a splutter process. Due to the growing demand for renewable energy sources, the manufacture of solar cells and photo-voltaic modules has advanced dramatically in recent years. The proposed project may also consist of Concentrated Photo-voltaic (CPV) panels.. CPV systems are very unique because they concentrate sunlight though a lens onto high performance solar cells and by doing so increases the electricity generated. These CPV panels are mounted on tracking systems as to maximise the benefit of energy collected from the sun.

The concentrated light improves the efficiency of the cells and reduces the amount of expensive solar cell material needed to produce a certain amount of electricity required. In comparison to normal PV panels certain designs of CPV uses 23.5 meter wide panels with more than 1000 pairs of lenses and solar cells on each (See Figure 3-3). These panels are all mounted on a dual axis installed with tracking systems to maintain 0.8 degree angles with the sun thought out the day (Bullis, 2011). Due to the growing demand for renewable energy sources, the manufacture of solar cells and photo-voltaic modules has advanced dramatically in recent years.

Photovoltaic production has been doubling roughly every 2 years, increasing by an average of 48% each year since 2002, making it the world's fastest-growing energy technology. Globally, PV systems connected to the grid rose from 16.6 GW in 2010 to 27.7 GW in 2011. This increased the PV capacity worldwide to over 67.4GW. Such installations may be ground-mounted (and sometimes integrated with farming and grazing) or built into the roof or walls of a building, known as Building Integrated Photovoltaic's. The proposed solar PV power station will have the capacity to contribute over 100 MW to the national grid.

Photovoltaic solar power plants comprise of solar modules connected together to form solar arrays for the production of electricity. Direct current electricity is produced from the solar array which in turn is connected to inverters for conversion to alternating current (AC). Power from the inverters is then stepped up via transformers to voltages suitable for injection into the national grid for distribution to consumers.

Solar power plants can either have fixed tilt systems or tracking systems as shown in the diagrams below. Modules in a fixed tilt system are mounted at an optimised angle facing the sun. With tracking systems, the surface of the arrays is moved to follow the sun resulting in large radiation gains. Systems can be set to track the sun's daily path and/or its annual

path. Figure 3-1 below shows a typical example of a fixed tilt PV array and Figure 3-2 shows a typical example of a tracking PV array. (This is an example only)

Figure 3-1: Fixed tilt PV array

Figure 3-2: Tracking PV array

Photovoltaic (PV) Arrays can be up to several hundred hectares in spatial extent. The panels are mounted on metal structures which are fixed into the ground either through a concrete foundation or a deep seated screw. Central inverters are wired to sections of the PV field which can have a rated power of 500 - 1250kW each. The inverter is a pulse width mode inverter that converts Direct Current (DC) to Alternating Current (AC) at grid

frequency. A typical central inverter rated at 500kW has a size of approximately 3m x 2.5m x 1m and an Output voltage of 480V AC.

The grid connection requires transformation of the voltage from 480V to between 22,000V and 400,000V depending on the existing infrastructure. The normal components and size of a distribution rated electrical substation will be required. Tracking Arrays (Figure 3-2) comprises of one (single axis) or two (dual –axis) motors and a sun sensor used to track the sun. The motors usually contain gears and moving parts that will need greasing from time to time.

The solar power generation facility is proposed to accommodate and array of photovoltaic (PV) panels with a generation capacity of over 100MW to be developed in phases the first of which will be a 20 MW PV facility and subsequently increased in a second phase that is being investigated as part of a scoping and environmental impact assessment. Approximately 1.5-2 hectares are required per installed MW of PV panels. The following infrastructure is required for PV solar facilities:

- Foundations to support the PV panels.
- Where the plant consists The first phase is proposed to consist of arrays of photovoltaic (PV) panels: The panels are placed in number rows with a buffer from the boundary fenceand access roads in between the each row. Panels will have a junction box located below the rows where all connections between rows meet up. Underground cables run from this box to the inverter/ transformer house at 400V-1000V Direct Current (DC).
- Access and inside roads/paths – already existing paths to be used were possible, turning circle of trucks to be taken into consideration, use of roads /paths minimal when plant is in operation.
- Trenching – all DC and AC wiring within the PV plant must be buried underground. Trenches will have a river sand base, space for pipes, backfill of sifted soil and soft sand and concrete layer where vehicles will pass. Cable trenches will be approximately 600mm (0.6m) deep and 400mm (0.4m) wide and backfilled with sand. Manhole covers will be placed every 40m or each direction change. A concrete slab will be placed where vehicles pass over cable trenches.
- Inverter/ transformer building –6mX3m brick buildings located within the PV array each containing an inverter and a step up transformer will be constructed in the plant. The number of buildings will be dependent on the size of plant and inverters chosen. Alternatively a prepackaged inverter/transformer housed in a concrete substation for outdoor can be utelised.
- Combined guard house/ control room – One (1) brick building of approximately 100m^2 on the perimeter of the plant. Guardhouse will include a small kitchen and toilet. Building will include a storeroom for spare parts kept onsite. Control room will contain switchgear and monitoring equipment for the PV plant. The buildings will be a standard height of approximately 3m high.
- Connection to grid: The grid connection requires transformation of the voltage from 480V to between 22,000V and 400 000V depending on the available infrastructure.. The normal components and size of a distribution rated electrical substation will be required.
- Small substation for the plant will be located on the outside of the control room.

3.2 ALTERNATIVES

Alternatives were introduced into South Africa's 'environmental' legislation to encourage developers, 'industry' and 'mining' to consider different ways of doing things that would

have different environmental impacts, whilst still achieving the development goal. Going through the process of identifying and comparing alternatives, through cost-benefit analysis, will likely yield improvements to the original concept proposal. The ultimate goal of consideration of alternatives is to both reduce negative environmental impacts and to increase or introduce positive environmental impacts.

3.2.1 SITE ALTERNATIVES

At present there are no alternative sites being considered in this particular project, but the optimum location within the existing study area will be selected based on the best opinion location based primarily on environmental considerations for placement of all components of the solar facility will be determined based on a detailed environmental impact assessment phase. Once assessment has concluded the exact locations suitable for development an effective design of the solar facility and associated infrastructure can commence. A preliminary layout will be determined during the EIA phase.

The placement of these types of renewable energy facility is dependent on various factors including the solar irradiation, site topography, and extent of the site, site access, local labour and economic factors and transmission considerations. This site was identified by APS as being very desirable based on above characteristics.

3.2.2 TECHNOLOGY ALTERNATIVES

As discussed, there will be no separate sites alternatives assessed which are different to the proposed site. Only a technology alternative will be assessed, however it should be noted that both these technologies can be implemented on site in combination. The technology which is proposed to be assessed as opposed to the proposed technology use of PV arrays is Concentrated Photo-voltaic (CPV). CPV systems are very unique because they concentrate sunlight though a lens onto high performance solar cells and by doing so increases the electricity generated. These CPV panels are mounted on tracking systems as to maximise the collection of energy from the sun. .

The concentrated light improves the efficiency of the cells and reduce amount of expensive solar cell material needed to produce a certain amount of electricity required. Some of these CPV panels can generate twice as much power per hectare in comparison with conventional solar panel technology. In comparison to normal PV panels certain designs of CPV uses 23.5 meter wide panels with more than 1000 pairs of lenses and solar cells on each (See Figure 3-3). These panels are all mounted on a single axis installed with tracking systems to maintain 0.8 degree angles with the sun thought out the day (Bullis, 2011).

Figure 3-3: Example of Concentrated Photo-voltaic technologies (Bullis, 2011).

The materials used to construct these CPV panels are 95 % recyclable due to the two main materials used are glass and aluminium (Lozanova, 2009).

Table 3-1: Comparison between PV and CPV

CPV	PV
Higher Efficiency	Lower Efficiency
Tracing Systems	Fixed and Tracking
Lenses/Mirrors/Panels	Panels
More Electricity	Less Electricity
Utility (Commercial)	All Markets

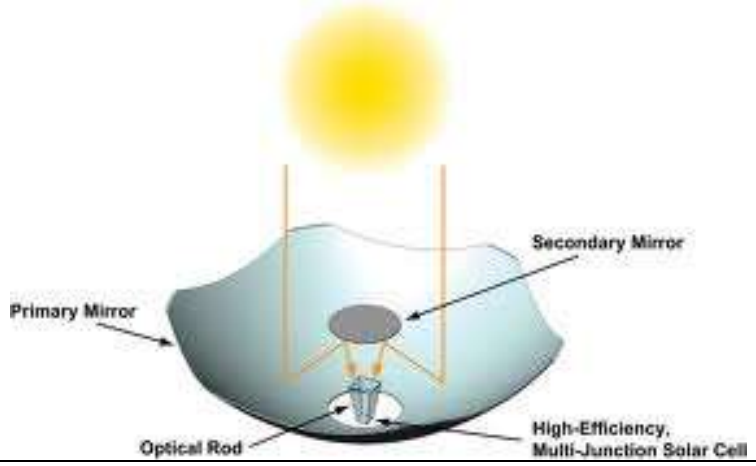

Figure 3-4: Diagram showing how Concentrated Photo-voltaic (CPV) works (Lozanova, 2009).

3.2.3 NO-GO ALTERNATIVE

The no-go option refers to the alternative of the proposed development not going ahead at all. This alternative will avoid potentially positive and negative impacts on the environment, and the *status quo* of the area would remain. The implications of the no-go option will be evaluated as part of the EIA, focussing on comparing potential impacts from the proposed project with the *status quo*, and will be particularly relevant should it be found that detrimental impacts cannot be managed to an acceptable level.

Should this alternative realize the socio-economic and environmental benefits of renewable energy will not be realised. These benefits include the following and are

explored in further detail in South Africa REFIT regulatory guideline by NERSA (March 2009 and include:

- Increased energy security:
- Resource savings
- Exploitation of our significant renewable energy resources
- Climate friendly development
- Pollution reduction
- Support for international agreements
- Acceptability to society
- Employment creation

3.3 ACTIVITIES PROPOSED DURING DEVELOPMENT STAGES OF THE PROJECT

3.3.1 CONSTRUCTION PHASE

The physical construction of the PV facility will take place in phases with the first phase proposed to be approximately 20 hectares in special extent and producing approximately 20 MW as applied for in a separate basic assessment process. Subsequent phases will be determined by the extent of the allocation provided by the DoE via the IPP procurement programme with the potential of the facility covering the entire feasible area of the site.

Details on the amount of construction workers required during construction phases, ex percentage skilled ex 30 % skilled, 30 % will have low level skills and 40% will have semi level skills. These low and semi level skills will be supplied from towns Kathu and Hotazel in the area and will be house on site or will be housed within Kathu/hotazel. The procedures typically for the construction phase would be as follows:

Details on the amount of construction workers required during construction phase (for example percentage skilled employees: 20 %; low level skills employees: 30 % and 50% of employees will have semi level skills). These low level skills will be sourced from towns local communities in the area and will either be housed on site or will be housed within the existing towns and transported to the site during construction. The exact detail on this is presently not known but will be investigated and determined as part of the detail environmental assessment phase. The procedures typically for the construction phase of the PV facility would be as follows:

- The establishment of access roads: During the construction period internal roads would need to be established, these roads will however only be temporary. There are a number of permanent road that would need to be established that would need to be established for operation and will be gravel based.
- Preparation of the site: Vegetation would need to be clearance for the footprint of the infrastructure as well as for the access roads. Topsoil would also need to be stripped from these areas and stockpiled.
- Transportation of equipment and component to the site: The main component of the proposed facility would be transported by road to the site. Excavators, graders, trucks and compacting equipment will need to be brought to the site
- Establishment of workshops, temporary laydown areas and construction camps: Once all the equipment etc. have been brought to the site a dedicated laydown and equipment camps will be established. Fuel will be stored on site during construction appropriate mitigation measure must be employed to ensure no pollution occurs as a result.

- Construction of the PV array: the foundations for the PV panel will be excavated. Another option would be to use a ramming system for the support structure which does not require excavation but is dependent on the geotechnical conditions of the ground. Concrete and aggregates would need to be brought to the site. Trenches would also need to be excavated for underground connection of the panels to the inverters and subsequently to the plant's substation.
- Undertake site rehabilitation: Removal of all construction equipment from the site and rehabilitation of areas where reasonable and practical.

3.3.2 OPERATIONAL PHASE

The facility operational lifespan is estimated at approximately 25 years. The typical activities during the operational phase would be as follows:

- Operation of the electrical infrastructure and PV panels: Incoming solar radiation will be converted by the PV panels into electrical energy; associated inverters will convert this electrical energy into alternating current. This alternating current will be stepped up via transformers to grid voltage and transmitted via overhead cables to the Dougnor. The major maintenance of the PV plant is that it requires cleaning quarterly with water to remove dust from the panels. It is proposed that the water will either be tapped from the Vaal Gamagara water scheme or a water use licence will be applied for groundwater abstraction. This water will temporary be stored in tanks on site. The option of sourcing water from a water services provider in the area is also available. Electrical and mechanical routine maintenance will also be carried out.
- Site security: Security will be stationed on site.

4. LEGAL REQUIREMENTS

4.1 EIA & ENVIRONMENTAL AUTHORISATION

4.1.1 NATIONAL ENVIRONMENTAL MANAGEMENT ACT (NEMA), 1998 (ACT 107 OF 1998)

NEMA is South Africa's overarching environmental legislation, and contains a comprehensive legal framework to give effect to the environmental rights contained in section 24 of The Constitution. Section 2 of NEMA contains environmental principles that form the legal foundation for sustainable environmental management in South Africa. NEMA introduces the principle of integrated environmental management that is achieved through the environmental assessment process in Section 24, which stipulates that certain identified activities may not commence without an Environmental Authorisation from the competent authority, in this case DEA. Section 24(1) of NEMA requires applicants to consider, investigate, assess and report the potential environmental impact of these activities. The requirements for the investigation, assessment and communication of potential environmental impacts are contained in the so-called 2010 amendment EIA Regulations (GN R.543, R.544, R.545 and R.546; 18 June 2010).

Based on the potential significance of impacts, the Regulations identify specific activities that are either subject to a Basic Assessment process, or more comprehensive Scoping and EIA process. The proposed Solar Facility project includes activities that require a Scoping and EIA, but some others only require a Basic Assessment. All activities are however included in the Scoping and EIA assessments, i.e. a single application procedure. The activities that would be (or are likely to be) associated with the proposed Solar facility are listed below. It should be noted that the two lists below are comprehensive, but some

of the activities may eventually not proceed. The activities ultimately undertaken by Aurora Power Solution will be based on the findings and recommendations of the future detailed EIA investigation and final project infrastructure design, including certain capacity thresholds and the feasibility of identified alternatives.

Table 4-1: Listed activities applied for in terms of the NEMA 2010 EIA regulations		
Listing	Activity number	Description of each listed activity
Government Notice no 545 of 18 June 2010. "Listing Notice 2"	Activity 1	The construction of facilities or infrastructure for the generation of electricity where the electricity output is 20 megawatts or more. Reason: The proposed Solar facility will have a power generation capacity of more than 20 MW.
Government Notice no 545 of 18 June 2010. "Listing Notice 2"	Activity 8	The construction of facilities or infrastructure for the transmission and distribution of electricity with a capacity of 275 kilovolts or more, outside an urban area or industrial complex. Reason: The proposed solar facility may transmit and distribute more than 275 kilovolts as they propose to connect to the national energy grid via the Dougnor substation
Government Notice no 545 of 18 June 2010. "Listing Notice 2"	Activity 15	Physical alteration of undeveloped, vacant or derelict land for residential, retail, commercial, recreational, industrial or institutional use where the total area to be transformed is 20 hectares or more; except where such physical alteration takes place for: (i) linear development activities; or (ii) agriculture or afforestation where activity 16 in this Schedule will apply. Reason: The Proposed Solar facility will be developed in phases and on completion the facility will be more than 20 hectares in spatial extent.
Government Notice No 546 of 18 June 2010. "Listing Notice 3"	Activity 4	Road wider than 4m with reserve less than 13.5m
Government Notice No 546 of 18 June 2010. "Listing Notice 3"	Activity 14	The clearance of an area of 5ha or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation

The process of applying for Environmental Authorisation includes a requirement to conduct an initial Scoping phase, followed by a detailed EIA as part of the application process. The assessment process (Figure 2-3) is comprehensive and detailed where appropriate, aimed at identifying potential positive and negative impacts on the environment (biophysical, socio-economic, and cultural), in order to:

- Examine alternatives / management measures to minimise negative and optimise positive consequences;

- Prevent substantial detrimental impact to the environment;
- Improve the environmental design of the proposal;
- Ensure that resources are used efficiently; and
- Identify appropriate management measures for mitigation and the monitoring thereof.

4.1.2 DUTY OF CARE – SECTION 28 OF NEMA

The National Environmental Management Act, Act 107 of 1998, (NEMA) places a duty to care on all persons who may cause significant pollution or degradation of the environment. Specifically, Section 28 of the Act states:

"28 (1) Every person who causes, has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environment is authorised by law or cannot reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment.

(2) Without limiting the generality of the duty in subsection (1), the persons on whom subsection (1) imposes an obligation to take reasonable measures, include an owner of land or premises, a person in control of land or premises or a person who has a right to use the land or premises on which or in which-

(a) any activity or process is or was performed or undertaken; or

(b) any other situation exists, which causes, has caused or is likely to cause significant pollution or degradation of the environment.

(3) The measures required in terms of subsection (1) may include measures to-

(a) investigate, assess and evaluate the impact on the environment;

(b) inform and educate employees about the environmental risks of their work and the manner in which their tasks must be performed in order to avoid causing significant pollution or degradation of the environment;

(c) cease, modify or control any act, activity or process causing the pollution or degradation;

(d) contain or prevent the movement of pollutants or the causant of degradation;

(e) eliminate any source of the pollution or degradation; or

(f) remedy the effects of the pollution or degradation."

Consequently, in the context of this assessment, the owner/operator of the Solar Facility must take "reasonable steps" to prevent pollution or degradation of the environment which may result from the proposed activities and related activity. These reasonable steps include the investigation and evaluation of the potential impact and identification of means to prevent an unacceptable impact on the environment, and to contain or minimise potential impacts where they cannot be eliminated.

4.2 BIODIVERSITY

4.2.1 NATIONAL ENVIRONMENTAL MANAGEMENT: BIODIVERSITY ACT (ACT 10 OF 2004)

The National Environmental Management: Biodiversity Act (Act 10 Of 2004) (NEMBA) is the primary legislation governing biodiversity management in South Africa.

Section 2: "Objectives of the Act", states the following:

Objectives of Act
2. The objectives of this Act are-
a) within the framework of the National Environmental Management Act, to provide for-
(i) the management and conservation of biological diversity within the Republic and of the components of such biological diversity.
(ii) the use of indigenous biological resources in a sustainable manner; and
(iii) the fair and equitable sharing among stakeholders of benefits arising from bioprospecting involving indigenous biological resources;
b) to give effect to ratified international agreements relating to biodiversity which are binding on the Republic;
c) to provide for co-operative governance in biodiversity management and conservation; and
d) to provide for a South African National Biodiversity Institute to assist in achieving the objectives of this Act.

The objectives of this Act will be upheld and promoted during the development of the EIR and EMP. The specialist who will be undertaking the biodiversity assessment will include this legislation in the development of their management and monitoring recommendations.

4.2.2 REQUIREMENTS FOR BIODIVERSITY ASSESSMENTS

It is acknowledged that there are no National guidelines for biodiversity assessments, however, in November 2009, the Department of Agriculture and Rural Development: Directorate of Nature Conservation published the "GDARD requirements for biodiversity assessments" (Version 2). Although these guidelines are specific for Gauteng Province, the essence of reporting on biodiversity issues and the minimum requirements for biodiversity studies can be adapted and used in any situation.

These guidelines will act as reference documentation for the reporting of biodiversity aspects on the Proposed PV Solar Project.

4.2.3 CONSERVATION OF AGRICULTURAL RESOURCES ACT (ACT 43 OF 1983)

As defined by the Conservation of Agricultural Resources Act (CARA) (Act 43 of 1983), **Conservation** is defined as: "in relation to the natural agricultural resources, includes the protection, recovery and reclamation of those resources;"

The objectives of the CARA, as stated in section 2 of the Act, entitled "Objects of Act", are:

"The objects of this Act are to provide for the conservation of the natural agricultural resources of the Republic by the maintenance of the production potential of land, by the combating and prevention of erosion and weakening or destruction of the water sources, and by the protection of the vegetation and the combating of weeds and invader plants."

Furthermore, Regulation 5 of CARA entitled: "Prohibition of spreading weeds", states:
No person shall-

(a) sell, agree to sell or offer, advertise, keep, exhibit, transmit, send, convey or deliver for sale, or exchange for anything or dispose of to any person in any manner for a consideration, any weed; or

(b) in any other manner whatsoever disperse or cause or permit the dispersal of any weed from any place in the Republic to any other place in the Republic.

Regulation 5 is noted, and the solar facility will strive to meet this requirement of CARA, and the management and mitigation measure to achieve this will be defined in the EIA.

Furthermore, Government Notice Regulation (GNR) 1048 of 25 May 1984 are the regulations which have been promulgated under the Conservation of Agricultural Resources Act (CARA). Amongst others, GNR 1048 defines the following key aspects:

"flood area: in relation to a water course, means the area which in the opinion of the executive officer is flooded by the flood water of that water course during a 1-in-10 years flood";

Utilisation and protection of vlei, marshes, water sponges and water courses

7.(1) Subject to the provisions of the Water Act, 1956 (Act 54 of 1956), and subregulation (2) of this regulation, no land user shall utilise the vegetation in a vlei, marsh or water sponge or within the flood area of a water course or within 10 metres horizontally outside flood area in a manner that causes or may cause the deterioration of or damage to the natural agricultural resources.

(2) Every land user shall remove the vegetation in a water course on his farm unit to such an extent that it will not constitute an obstruction during a flood that could cause excessive soil loss as a result of erosion through the action of water.

(3) Except on authority of a written permission by the executive officer, no land user shall-

(a) drain or cultivate any vlei, marsh or water sponge or a portion thereof on his farm unit; or
(b) cultivate any land on his farm unit within the flood area of a water course or within 10 metres horizontally outside the flood area of a water course.

(4) The prohibition contained in subregulation (3) shall not apply in respect of-

(a) a vlei, marsh or water sponge or a portion thereof that has already been drained or is under cultivation on the date of commencement of these regulations provided it is not done at the expense of the conservation of the natural agricultural resources; and
(b) Land within the flood area of a water course or within 10 metres horizontally outside the flood area of a water course that is under cultivation on the date of commencement of these regulations, provided it is already protected effectively in terms of regulation 4 against excessive soil loss due to erosion through the action of water.

(5) The provisions of regulation 2 (2), (3) and (4) shall apply mutatis mutandis with regard to an application for a permission referred to in subregulation (3).

These regulations will be adhered to as far as possible, and addressed accordingly in the EIA phase, where impacts and mitigation measures are tabled and discussed. The management of high potential agricultural soils (such as those currently under intensive centre-pivot irrigation) will be discussed during the EIA phase.

4.3 WATER

4.3.1 NATIONAL WATER ACT (NWA), 1998 (ACT 36 OF 1998)

The National Water Act (NWA), 1998 (Act 36 of 1998), aims to manage national water resources in order to achieve sustainable use of water for the benefit of all water users. This requires that the quality of water resources is protected, and integrated management of water resources takes place.

In terms of section 21 of the National Water Act, Act No. 36 of 1998 (NWA) a water use licence is required for:

(a) taking water from a water resource;

(b) storing water;

(c) impeding or diverting the flow of water in a watercourse;

(d) engaging in a stream flow reduction activity contemplated in section 36;

(e) engaging in a controlled activity identified as such in section 37 (1) or declared under section 38 (1);

(f) discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit;

(g) disposing of waste in a manner which may detrimentally impact on a water resource;

(h) disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generation process;

(i) altering the bed, banks, course or characteristics of a watercourse;

(j) removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people; and

(k) using water for recreational purposes.

Other provisions of the NWA have been taken into account, specifically relating to Part 4 (Section 19), which deals with pollution prevention, in particular situations where pollution of a water resource occurs or might occur as a result of activities on land. A person who owns controls, occupies or uses the land in question is responsible for taking measures to prevent pollution of water resources. If these measures are not taken, the catchment management agency concerned may itself do whatever is necessary to prevent the pollution or to remedy its effects, and to recover all reasonable costs from the persons responsible for the pollution.

Depending on the exact process that will be undertaken by the Solar facility, which will be further investigated during the EIA phase of the project, if one or more of the uses listed above are triggered a water use licence is required by the Department of Water Affairs (DWA).

Section 19 of the NWA also places a general duty to care in so far as the pollution of water resources is concerned. This will need to be taken into consideration during the WUL application.

4.4 HERITAGE

Aspects concerning the conservation of cultural resources are dealt with mainly in two acts. These are the National Heritage Resources Act (Act 25 of 1999) and to a lesser extent, the National Environmental Management Act (Act 107 of 1998).

4.4.1 NATIONAL HERITAGE RESOURCES ACT (NHRA) (ACT 25 OF 1999)

According to the above-mentioned act the following is protected as cultural heritage resources:

a. Archaeological artefacts, structures and sites older than 100 years
b. Ethnographic art objects (e.g. prehistoric rock art) and ethnography
c. Objects of decorative and visual arts
d. Military objects, structures and sites older than 75 years
e. Historical objects, structures and sites older than 60 years
f. Proclaimed heritage sites
g. Grave yards and graves older than 60 years
h. Meteorites and fossils
i. Objects, structures and sites or scientific or technological value.

A Heritage Impact Assessment (HIA) is the process to be followed in order to determine whether any heritage resources are located within the area to be developed as well as the possible impact of the proposed development thereon. An Archaeological Impact Assessment (AIA) only looks at archaeological resources. An HIA must be done under the following circumstances:

i. The construction of a linear development (road, wall, power line, canal etc.) exceeding 300m in length
ii. The construction of a bridge or similar structure exceeding 50m in length
iii. Any development or other activity that will change the character of a site and exceed 5 000m^2 or involve three or more existing erven or subdivisions thereof
iv. Re-zoning of a site exceeding 10 000 m^2
v. Any other category provided for in the regulations of SAHRA or a provincial heritage authority

Structures

Section 34 (1) of the NHRA states that no person may demolish any structure or part thereof which is older than 60 years without a permit issued by the relevant provincial heritage resources authority.

A structure means any building, works, device or other facility made by people and which is fixed to land, and includes any fixtures, fittings and equipment associated therewith.

Alter means any action affecting the structure, appearance or physical properties of a place or object, whether by way of structural or other works, by painting, plastering or the decoration or any other means.

Archaeology, palaeontology and meteorites

Section 35(4) of this act deals with archaeology, palaeontology and meteorites. The act states that no person may, without a permit issued by the responsible heritage resources authority (national or provincial):

a) destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or paleontological site or any meteorite;
b) destroy, damage, excavate, remove from its original position, collect or own any archaeological or paleontological material or object or any meteorite;

c) trade in, sell for private gain, export or attempt to export from the Republic any category of archaeological or paleontological material or object, or any meteorite; or
d) bring onto or use at an archaeological or paleontological site any excavation equipment or any equipment that assists in the detection or recovery of metals or archaeological and paleontological material or objects, or use such equipment for the recovery of meteorites.
e) alter or demolish any structure or part of a structure which is older than 60 years as protected.

The above mentioned may only be disturbed or moved by an archaeologist, after receiving a permit from the South African Heritage Resources Agency (SAHRA). In order to demolish such a site or structure, a destruction permit from SAHRA will also be needed.

Human remains

Graves and burial grounds are divided into the following:

A. ancestral graves
B. royal graves and graves of traditional leaders
C. graves of victims of conflict
D. graves designated by the Minister
E. historical graves and cemeteries
F. human remains

In terms of Section 36(3) of the National Heritage Resources Act, no person may, without a permit issued by the relevant heritage resources authority:

a) destroy, damage, alter, exhume or remove from its original position of otherwise disturb the grave of a victim of conflict, or any burial ground or part thereof which contains such graves;
b) destroy, damage, alter, exhume or remove from its original position or otherwise disturb any grave or burial ground older than 60 years which is situated outside a formal cemetery administered by a local authority; or
c) bring onto or use at a burial ground or grave referred to in paragraph (a) or (b) any excavation, or any equipment which assists in the detection or recovery of metals.

Human remains that are less than 60 years old are subject to provisions of the Human Tissue Act (Act 65 of 1983) and to local regulations. Exhumation of graves must conform to the standards set out in the Ordinance on Excavations (Ordinance no. 12 of 1980) (replacing the old Transvaal Ordinance no. 7 of 1925).

Permission must also be gained from the descendants (where known), the National Department of Health, Provincial Department of Health, Premier of the Province and local police. Furthermore, permission must also be gained from the various landowners (i.e. where the graves are located and where they are to be relocated) before exhumation can take place.

Human remains can only be handled by a registered undertaker or an institution declared under the Human Tissues Act (Act 65 of 1983 as amended).

Unidentified/unknown graves are also handled as older than 60 until proven otherwise.

Following the completion of the AIA and HIA the coordinates of the entities identified will be added to the location map. The entities will be classified in terms of the ranking afforded to each in the report, and the Applicant will aim to minimise the impact on any identified entities throughout the detail design phase, and prior to finalising permits for destruction and/or exhumation, which will only be considered in circumstances where mitigation is impossible.

4.5 VISUAL

4.5.1 WESTERN CAPE DEPARTMENT OF AND DEVELOPMENT PLANNING: GUIDELINE FOR INVOLVING VISUAL AND AESTHETIC SPECIALISTS IN EIA PROCESSES

A guideline document was developed by the Provincial Government of the Western Cape: Department Of Environmental Affairs and Development Planning (WCDEADP), which is entitled: "Guideline for Involving Visual and Aesthetic Specialists in EIA Processes".

This guideline document, which deals with specialist visual input into the EIA process, has been organised into a sequence of sections, following a logical order covering the following:'

- the background and context for specialist visual input;
- the triggers and issues that determine the need for visual input;
- the type of skills and scope of visual inputs required in the EIA process;
- the methodology, information and steps required for visual input;
- Finally, the review or evaluation of the visual assessment process.

4.5.1.1 PRINCIPLES AND CONCEPTS UNDERPINNING VISUAL INPUT

The following key principles and concepts will be considered during visual input into the EIA process (WCDEADP, 2005):

- An awareness that 'visual' implies the full range of visual, aesthetic, cultural and spiritual aspects of the environment that contribute to the area's sense of place.
- The consideration of both the natural and the cultural landscape, and their inter-relatedness.
- The identification of all scenic resources, protected areas and sites of special interest, together with their relative importance in the region.
- An understanding of the landscape processes, including geological, vegetation and settlement patterns, which give the landscape its particular character or scenic attributes.
- The need to include both quantitative criteria, such as 'visibility', and qualitative criteria, such as landscape or townscape 'character'.
- The need to include visual input as an integral part of the project planning and design process, so that the findings and recommended mitigation measures can inform the final design, and hopefully the quality of the project.

4.6 NATIONAL PLANNING AND POLICY CONTEXT ON ENERGY

4.6.1 WHITE PAPER ON THE ENERGY POLICY OF SOUTH AFRICA, 1998

The water paper ion South African energy policy governs the development of South Africa energy sector (DME, 1998). This document identifies key objectives for energy supply such as managing energy related environmental impacts, access to affordable energy services and securing energy supply though diversity.

4.6.2 RENEWABLE ENERGY POLICY IN SOUTH AFRICA, 1998

The white paper in renewable energy (DME, 2003) supplements the energy Policy and sets out government's strategic goals, vision, policy principles and objectives implement ting and promoting renewable energy in South Africa. South Africa various sources of renewable resources in particular solar and wind and therefore this policy supports this rational and that from a fuel resource perspective renewable application is proven to ne the least costly especially from an environmental and social perspective. Meeting technical and economic as well other constrains one of the major concerns of governmental policy on renewable energy.

South Africa has set a 10 year 10 000 GWH target for renewable energies by 2013 to be produced mainly from solar, wind and biomass as well small scale hydro. This amounts to approximately 4% of the country's estimated demands by 2013.

4.6.3 FINAL INTEGRATED RESOURCE PLAN, 2010 -2030

Minister of energy is obligated as per the Energy Act of 2008 to publish and develop an integrated resource plan for energy. The department of Energy (DOE) in partnership with the National Energy Regulator of South Africa (NERSA) has published the Integrated Resource Plan (IRP) for the time period 2010 to 2030. The main objective of the IRP develops an electricity investment strategy that is sustainable for the transmission infrastructure and generation capacity for South Africa for the next 20 years.

The white paper on renewable energies states that it is of global/national importance to supplement existing energy demand with renewable forms of energy as to combat climate change. The outcome of this IRP acknowledged that coal fired power generation facilities is still required over the next 20 years. The DOE released the final IRP in March 2011 and accepted by parliament at the end of March. In addition to all existing and committed power plants the IRP includes 6.3 GW of coal, 9.6 GW for Nuclear, 17.8 GW for renewables (including 8.4 GW for solar) and 8.9 from other sources.

4.7 OTHER RELEVANT LEGISLATION AND GUIDELINES

4.7.1 GUIDELINES PUBLISHED IN TERMS OF NEMA EIA REGULATIONS:

- Guideline 3: General Guide to Environmental Impact Assessment Regulations, 2006 (DEAT, June 2066).
- Guideline 4: Public Participation in support of the Environmental Impact Assessment Regulations, 2006 (DEAT, June 2006)
- Guideline 5: Assessment of alternatives and impact in support of the Environmental Impacts Assessment Regulations, 2006 (DEAT, June 2006)
- Integrated Environmental Management Information series

4.7.2 GUIDELINES ON THE INVOLVEMENT OF SPECIALISTS IN THE EIA PROCESS

The Western Cape Department of Environmental Affairs and Development Planning (WC DEADP) have developed policy guidelines around specialist involvement in EIA processes. The guidelines aim to improve the quality of specialist input and facilitate informed decision-making. The guidelines clarify the roles and responsibilities of all role players with regard to specialist input in the EIA process. These guidelines have been derived to help practitioners draft appropriate terms of reference for specialist input and assist role players to evaluate the appropriateness of specialist input in individual cases. Although these guidelines have been developed by the Western Cape, they can be adopted for use anywhere in the country.

Hence, the EIA process will endeavour to adhere to these set of guidelines, in order to be in line with provincial guidelines relevant to EIA's.

These guidelines include:

- Guideline for Determining the Scope of Specialist involvement in EIA processes (June 2005)
- Guideline for the Review of Specialist input in EIA processes (June 2005)
- Guideline for involving Biodiversity specialists in EIA processes (June 2005)
- Guideline for involving Heritage specialists in EIA processes (June 2005)
- Guideline for involving Visual and Aesthetic specialists in EIA processes (June 2005)
- Guideline for Environmental Management Plans
- Guideline for Involving Social Assessment Specialists in EIA Processes

The full versions of these reports can be downloaded from: http://www.capegateway.gov.za/eng/pubs/guides/G/103381

5. PUBLIC PARTICIPATION

5.1 INTRODUCTION

Public participation provides the opportunity for Interested and Affected Parties (I&APs) to participate on an informed basis, and to ensure that their needs and concerns are considered during the impact assessment process. In so doing, a sense of ownership of the project is vested in both the project proponent and interested or affected parties. The Public Participation Process is aimed at achieving the following:

- Provide opportunities for I&APs and the authorities to obtain clear, accurate and understandable information about the expected environmental and socio-economic impacts of the proposed development.
- Establish a formal platform for the public with the opportunity to voice their concerns and to raise questions regarding the project.
- Utilise the opportunity to formulate ways for reducing or mitigating any negative impacts of the project, and for enhancing its benefits.
- Enable project proponent to consider the needs, preferences and values of I&APs in their decisions.
- Clear up any misunderstandings about technical issues, resolving disputes and reconciling conflicting interests.
- Provide a proactive indication of issues which may inhibit project progress resulting in delays, or which may result in enhanced and shared benefits.
- Ensure transparency and accountability in decision-making.

The public participation process is discussed below: (Appendix 4 – Public participation information will be added and updated before the FINAL scoping report is submitted to the authorities)

- The project Background Information Document (BID);
- Proof of notifications to IAPs of the application to DEA for Environmental Authorization;
- Proof of press advertisements and site notices;
- List of I&APs; and
- Comments and Responses Report (C&RR).

5.2 IAP NOTIFICATION & CONSULTATION

The first step in the public participation process was to advertise the project as required by the 2010 EIA Regulations, in order to inform potential I&AP's of the proposed project and EIA process. This was done by means of the following:

- A Background Information Document (BID) was compiled giving detail on the applicant, the Environmental Assessment Practitioner (EAP), the scope and locality of the proposed project, the EIA process, purpose and process of public participation, and included an invitation to register as I&AP and provide comment, as well as an open invitation to the first public meeting.
- Pre-identification of interested and affected parties (I&APs), including adjacent landowners, using existing databases, and distributing the BID to these stakeholders. The BID was also sent to any other I&APs who responded to site or press notifications.
- Advertising the proposed project and associated EIA process in "The Business Day" on Wednesday 15th February 2012, "Kalahari Bulletin" on Thursday 16 February 2012, "Noothwester Messenger" on Friday 17 February 2012 as well as the "The Gemsbok" newspaper on Wednesday 17th February 2012. The advertisements indicated where written comments may be directed to and were placed in English.
- A2-size site notices were erected on the site

Proof of these advertisements, sending of the BID, proof of site notices, communications with I&AP's and others are contained in the Public participation report attached as Appendix 4 to this report.

5.3 COMMENTS & ISSUES RAISED BY I&APs

Interested and affected parties were given 30 days to register and comment on the proposed application. To date there were no comments or issues raised by any I&Aps. Interested and affected parties were given 30 days to register and comment on the proposed application. A 30 day comment period was given to all register I&Ap and 40 days was given to all the relevant commenting authorities on the draft scoping report.

6. DESCRIPTION OF THE ENVIRONMENT AND POTENTIAL IMPACTS

6.1 REGIONAL LOCATION

The site for the proposed facility lies within the John Taolo Gaetsewe (formerly Kgalagadi) District Municipality and the Joe Morolong Local Municipality approximately 21Km's South of Hotazel and about 40km's North of Kathu in the Northern Cape. (See Figure 6-1 & Figure 6-2)

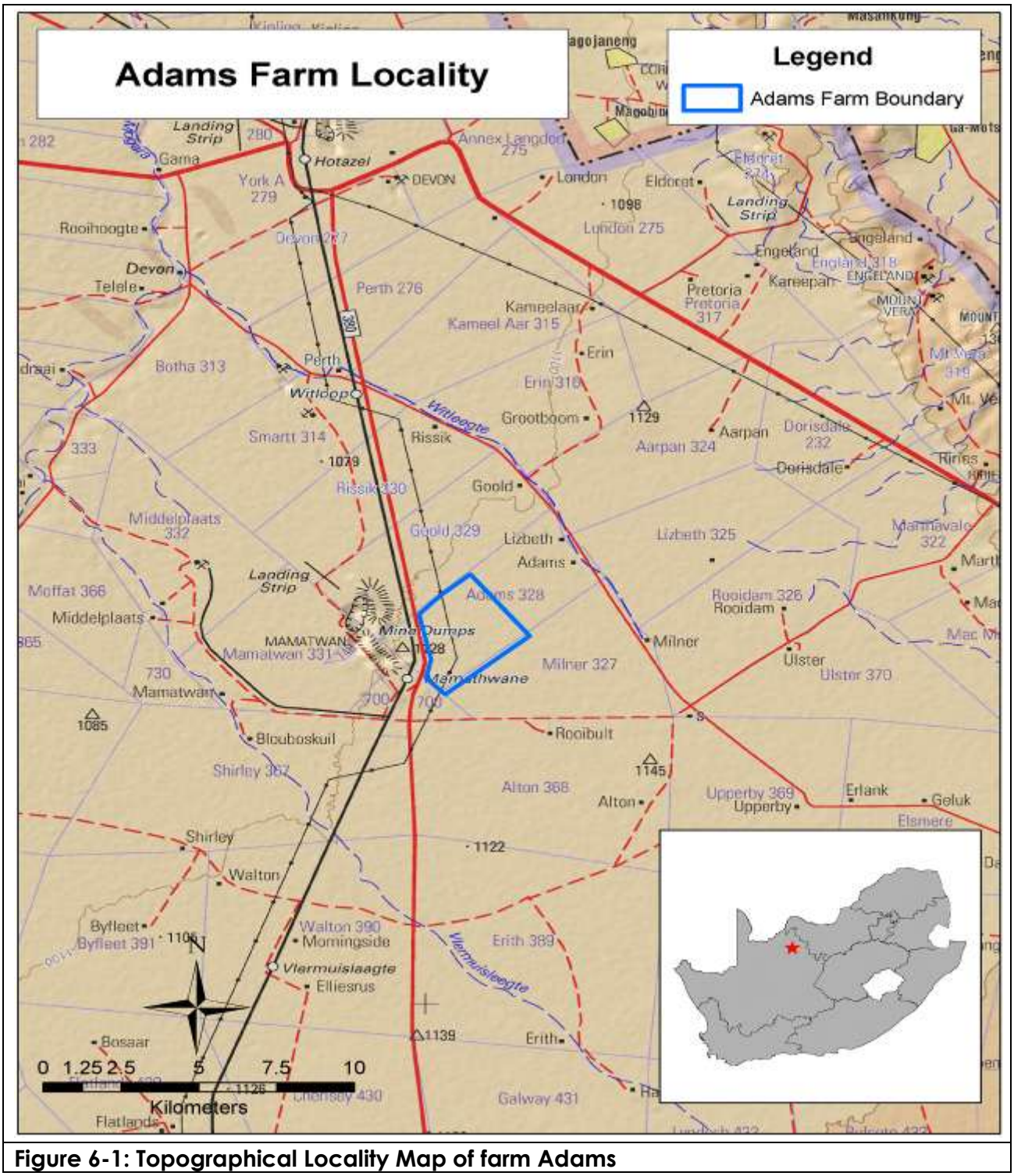

Figure 6-1: Topographical Locality Map of farm Adams

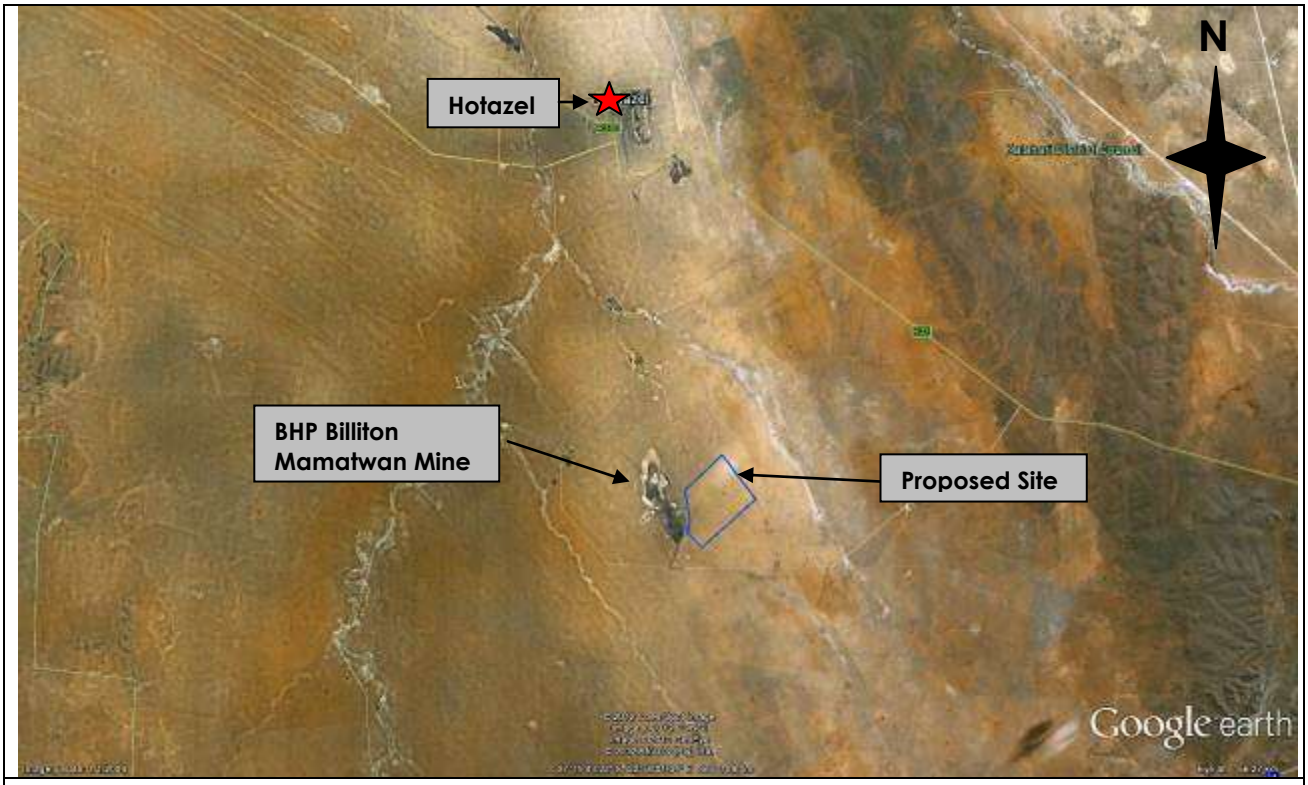

Figure 6-2: Google Earth Locality Map of Adams.

6.1.1 LAND-USE AND LAND-COVER OF THE STUDY AREA

The predominant land use activities within the Northern Cape are mining and goat, sheep, cattle and game farming. The site is also characterised by mostly cattle farming, with the surrounding land uses being mostly mining to the west and farming. The surrounding land cover is mostly scrubland and low fynbos. The main issues identified as being key issues relating to land resources in the Northern Cape Province are desertification, land degradation, land ownership and land use. The province is classified to be 30.3% moderately degraded and 24.2% of the land classified as extremely degraded. These results in approximately 50% of the province land falls into these two categories and therefore is very susceptible to desertification and measure should be put in place to ensure sustainable land management.

The Adams site is directly across the road from the currently operating Mamatwan Manganese mine, which is owned by BHP Billiton.

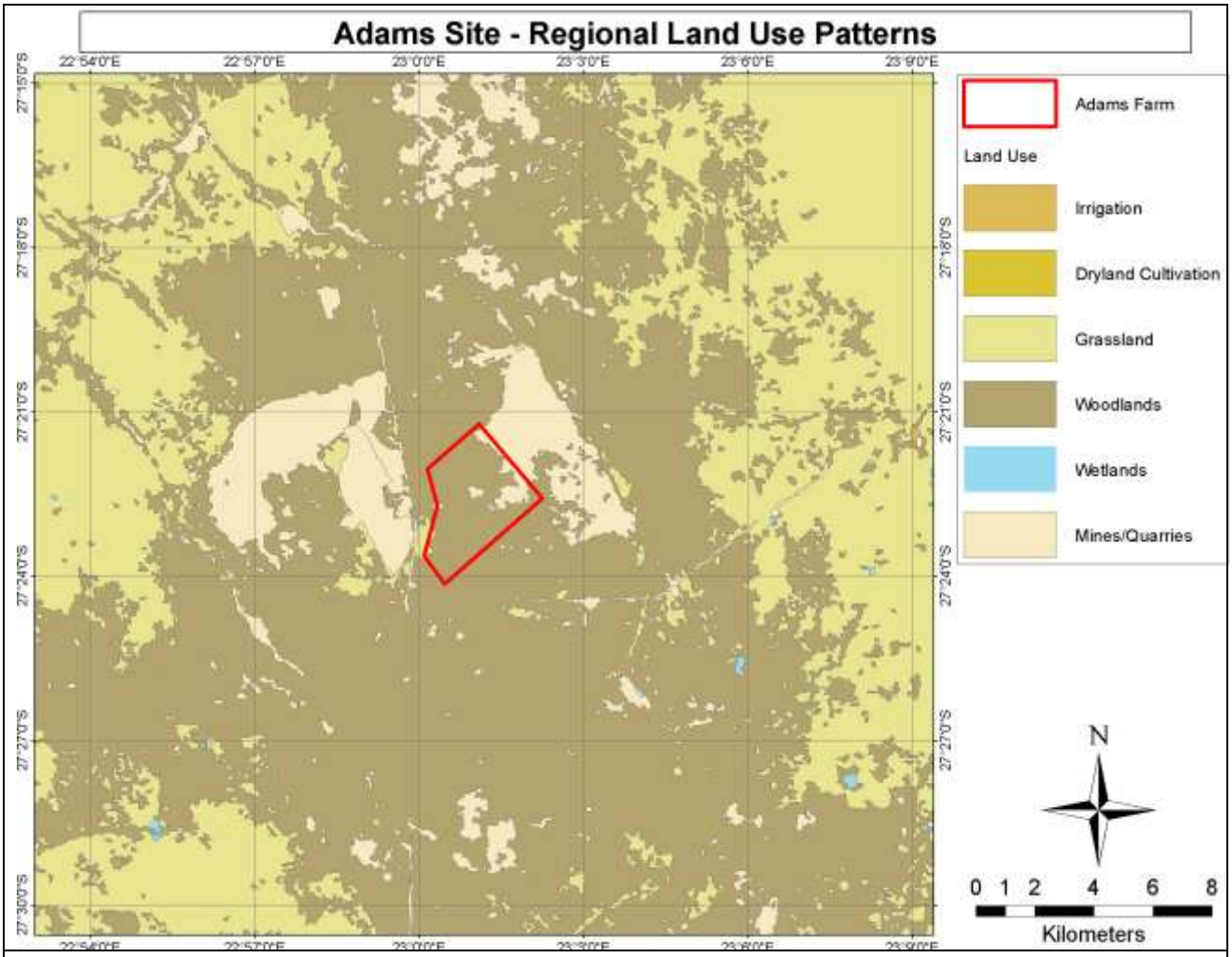

Figure 6-3: Regional Land Use Patterns surrounding the study area

6.2 CLIMATE

The Northern Cape region is semi-arid and receives an annual rainfall of between 250 to 500 millimetres, with the majority of rain falling in the summer months between October and March. On average the heaviest rains fall in mid to late summer, with February and March being the wettest months. Thunder storms are a common feature of the summer climate and hail may accompany summer storms. Data were obtained from the S.A. Weather Services for the Kuruman station.

6.2.1 TEMPERATURE

Daily maximum temperatures are between 30 and 40 degrees Celsius in January and between 17 degrees Celsius in July, with an average minimum temperature of 15 degrees (Table 6-2).

Table 6-1: Average Monthly Temperature (°C)

	J	F	M	A	M	J	J	A	S	O	N	D
Maximum	31,9	28,7	28,0	23,7	21,9	16,8	31,9	28,7	28,0	23,7	21,9	16,8
Minimum	17,2	15,3	13,5	9,7	5,7	1,4	0,2	4,2	6,5	9,6	13,1	15,1

6.2.2 RAINFALL

Mean monthly and annual rainfall (Past 50 years)

The mean annual rainfall in the Kuruman area is 460 millimetres, of which the majority falls in summer (Table 6-2).

Table 6-2: Rainfall Record (Average Monthly Rainfall in Millilitres)											
J	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
48	111	102	50	5	7	0	1	18	29	32	54

The predicted rainfall for the quaternary catchment however is only 352mm per annum, which is likely to be a closer approximation of rainfall at the mine site.

Maximum rainfall intensities per month
The recorded maximum rainfall intensities (Kuruman Weather Station) are indicated in (Table 6-3).

Table 6-3: Rainfall Intensity	
Duration / time period	**Rainfall (mm)**
60 minutes	56.0
24 hours	99
24 hours/50 years	92,9
24 hours/100 years storm events	104,6

6.2.3 WIND

Mean monthly wind direction and speed
The winds are usually north-westerly and south-westerly, attaining maximum speed in the afternoon (Table 6-4).

Table 6-4: Average Wind Direction and Wind Speed												
	J	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Direction	NW	NW	NW	NW	NW	NW	NW	NW	NW	NW	NW	NW
Speed (m/s)	4,0	3,9	4,2	4,1	4,7	4,3	4,9	5,2	4,9	4,7	4,5	4,0

6.3 TOPOGRAPHY

The average height above sea level over the site is approximately 1035 meters. The regional topography is generally flat, with the Kalahari plains intersected by a few river beds. Figure 6-4 below shows the regional topography of the study area. The figure indicated that the study area is relatively flat with no major topological constraints to the proposed development.

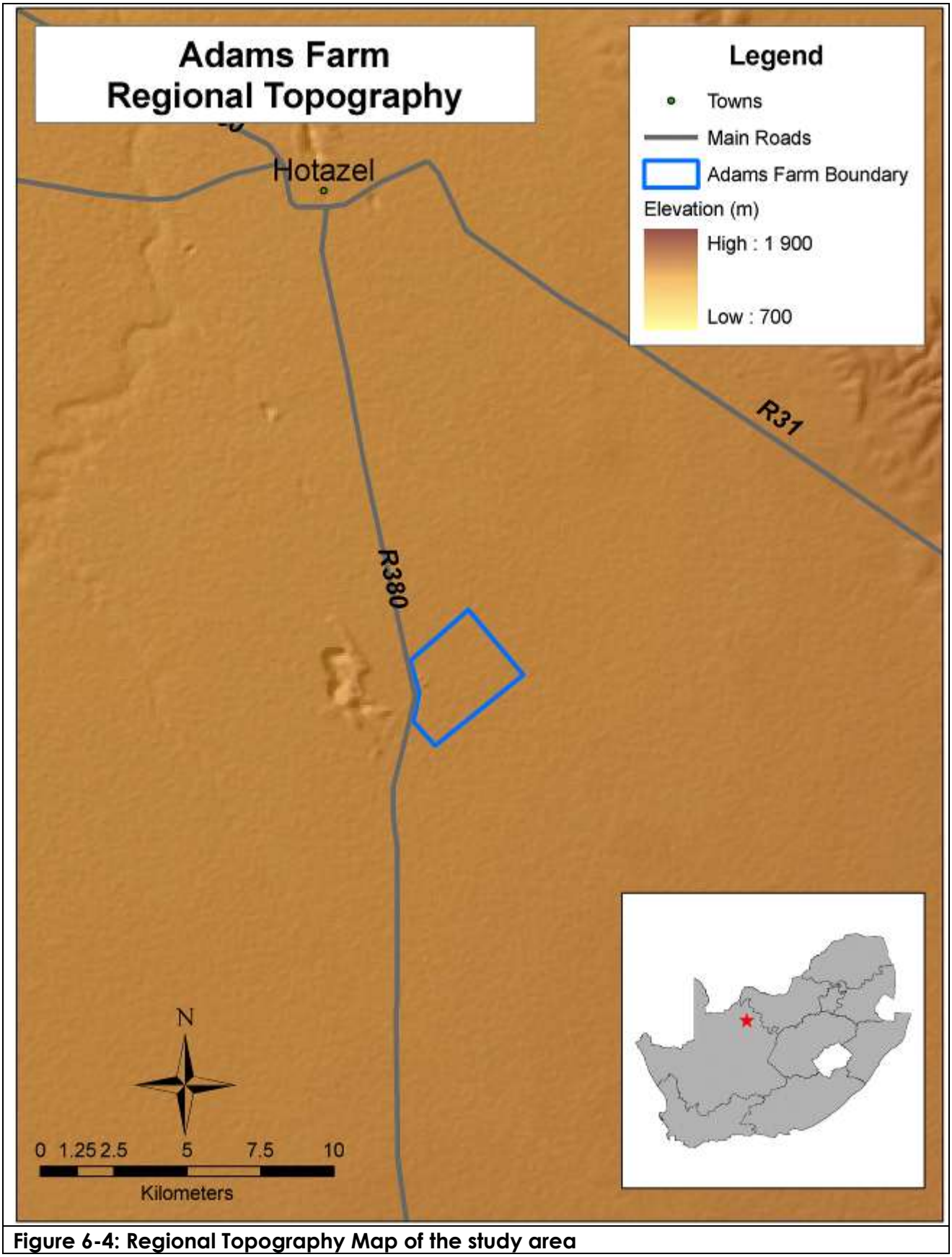

Figure 6-4: Regional Topography Map of the study area

6.4 GEOLOGY

The Adams site is located just east of the Mamatwan Manganese mine and located on the southern tip of the Kalahari manganese field in the Griqualand West region of the Northern Cape Province. The morphology is dominated by flat plains intersected by generally N-S striking ranges of the Gamagara Ridge, Klipfontein Hills and the Asbestos Hills. These plains are characterised by thick calcretes and wind-blown Kalahari sands (Preston, 2001). Figure 6-5 shows the relative location of the site located within the Griquialand west region as well the location of the Kalahari Manganese field just west of the Adams site located next to the Mamatwan Manganese mine.

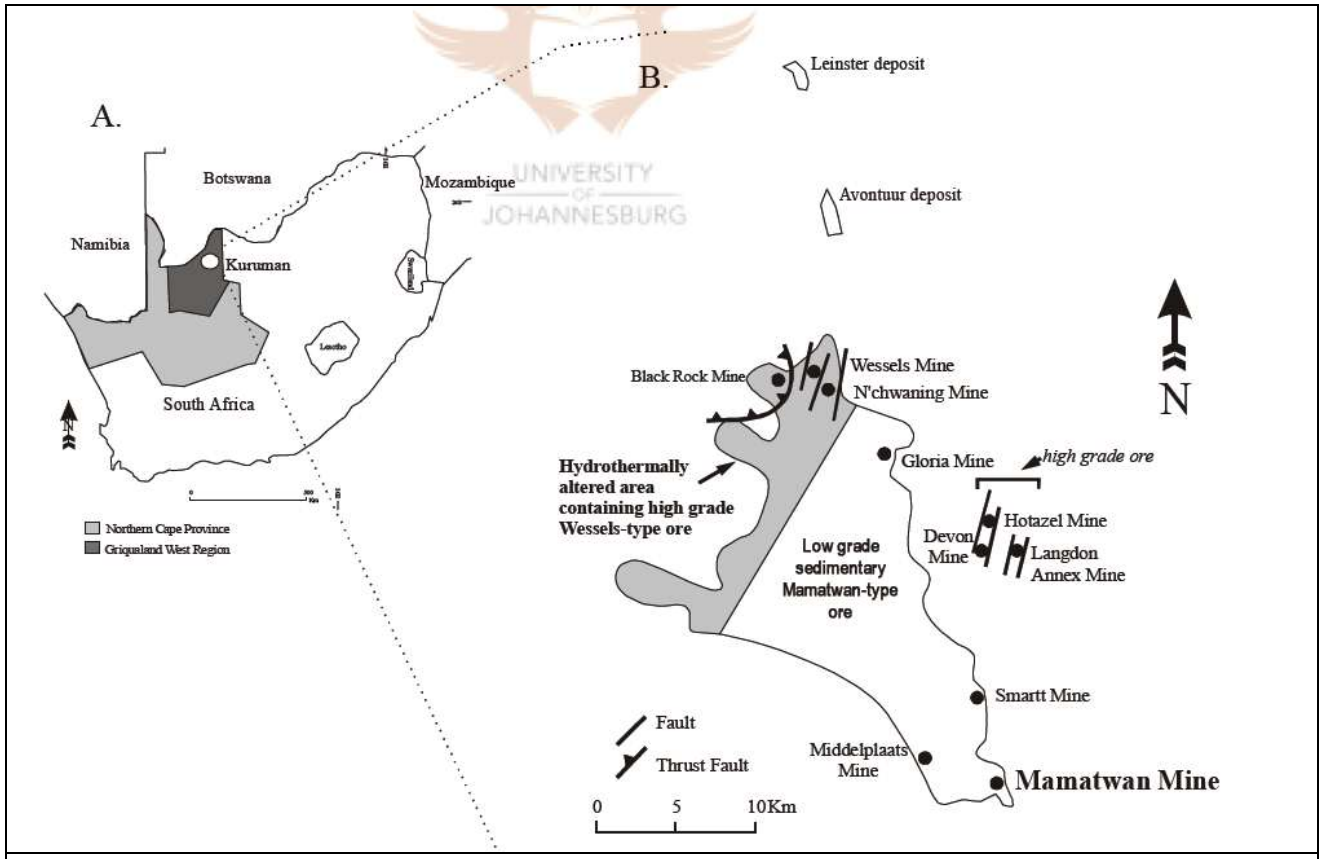

Figure 6-5: Location of the Griqualand West Region in the Northern Cape Provinces well as enlarge view of the Kalahari Manganese field (Preston, 2001).

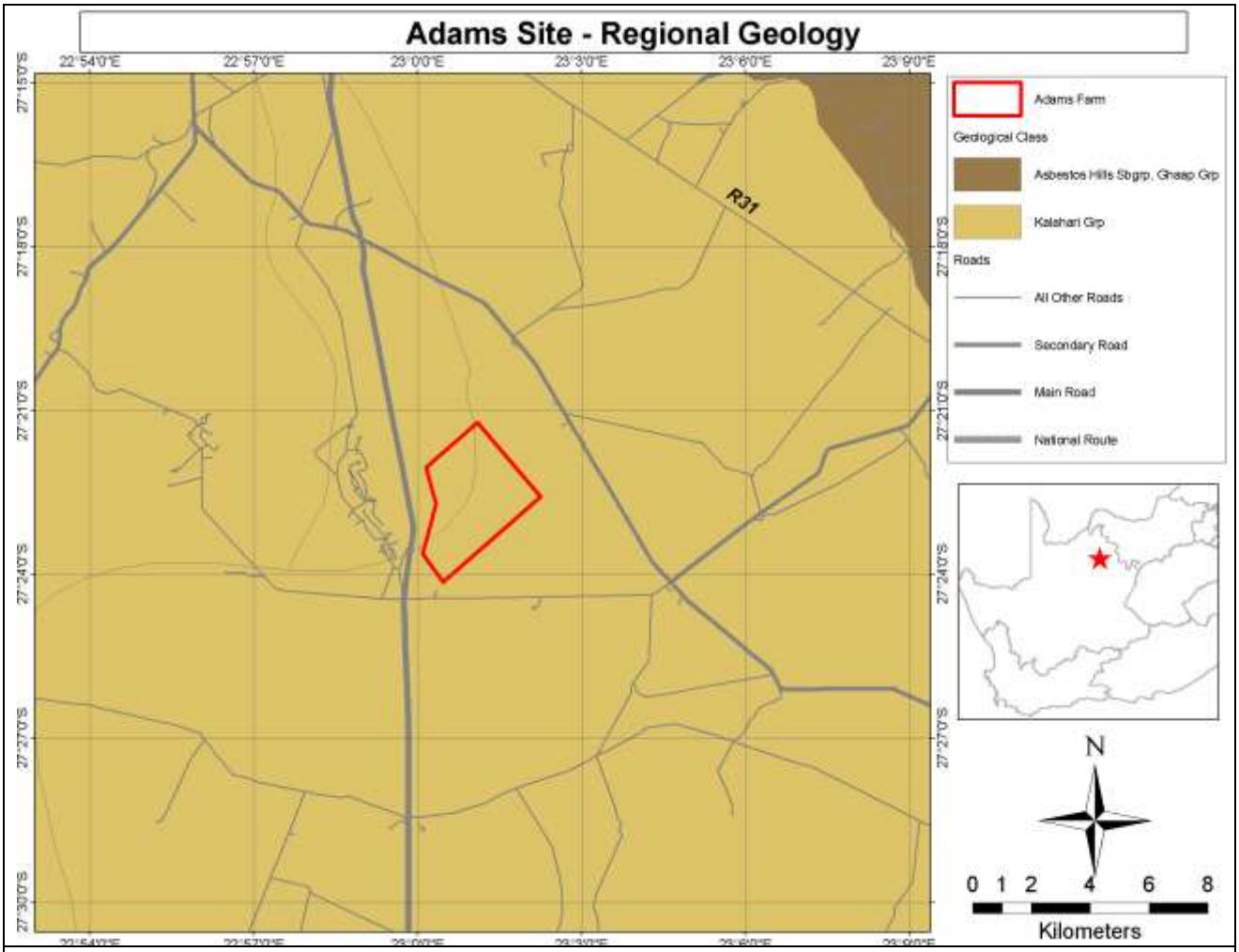

Figure 6-6: Regional Geology of the site and surrounding.

6.5 SOIL

The soils in the region are, however, typical of the Kalahari with fine-grained sands dominating the physical structure of the soils. As expected in a sandy, semi-desert, environment the organic carbon status of the soils is low (± 0.1 %). Soil pH is neutral to slightly basic (pH 7.5 – 8.5). Although no recent soil analyses for soil from the area are available, the soil fertility is likely to be moderate to low. The clay content of soils directly associated with the river bed increases to the south of the mine site. The soils on which the mine infrastructure has been established are however Kalahari sands.

6.6 VEGETATION

Figure 6-7 indicates that the study area falls within the Kathu Bushveld vegetation type, It mostly characterised by deep sandy to loamy sands of Aeolian origin. These sand types are usually underlain by calcrete. This vegetation type is characterised by dense bush, with a well-developed tree layer. Most predominant tree types occurring in the surrounding area are *Boscia albitrunca, Acacia erioloba, Acacia heamatoxylon* and *Terminalia sericea*. Typical grases found in this vegetation types are typically sweer grasslands such as *E. pallens, Eragrostis lehmanniana, chmidtia pappophoroides, Schmidtia kalihariensis and Stripagrostis uniplumis* are only some of the typical grasses occurring within this vegetation type. Kathu Bushveld is considered to have a moderately developed shrub layer mostly dominated by *Rhigozum trichotmum, Tarchonanthus camphoratus, Acacia mellifera, Grewia flava and A. hebeclada. Acacia erioloba* (Camel

Thorn) which is a protected tree has also been identified as occurring within the study area (du Preez, 2007).

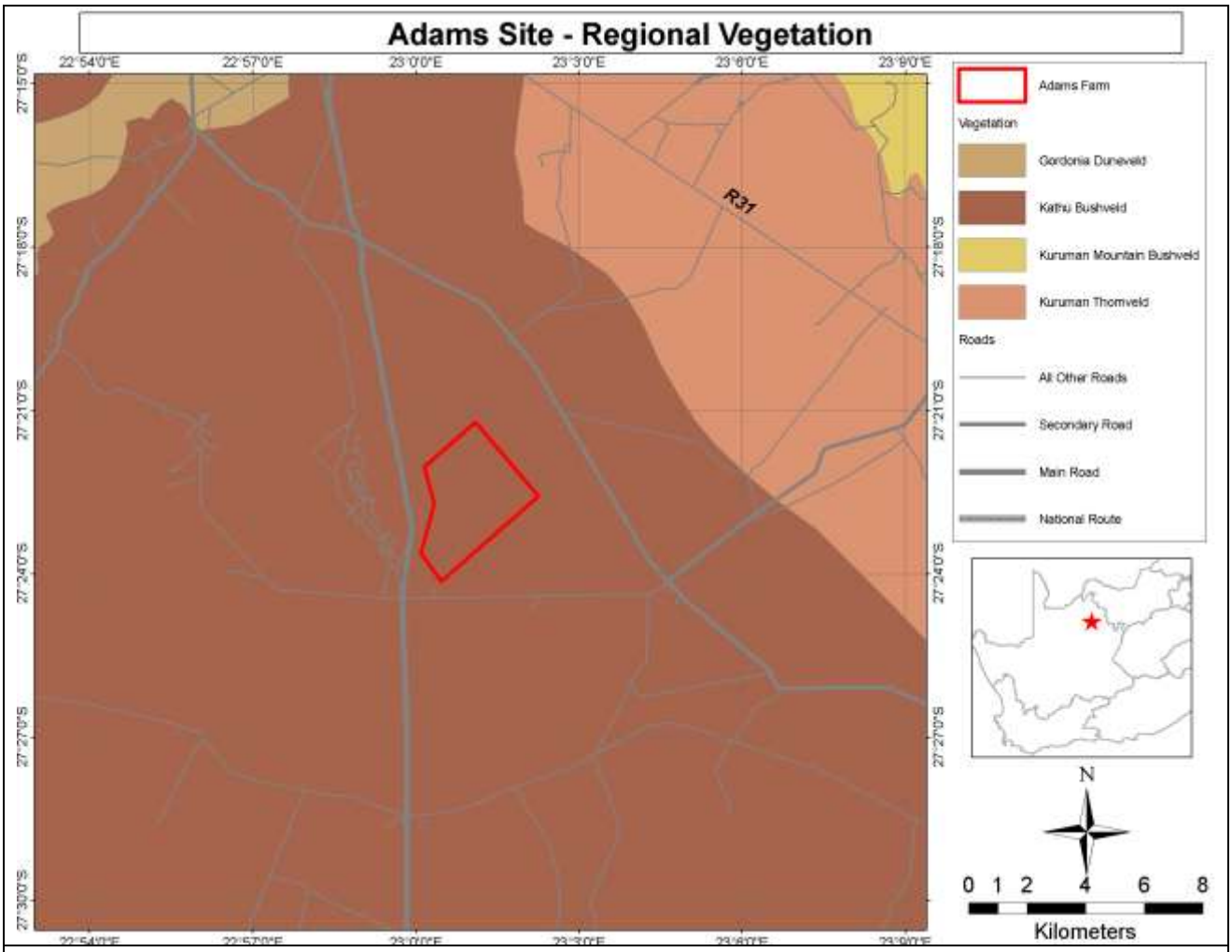

Figure 6-7: Regional Vegetation of the site and surroundings

6.7 SURFACE WATER

6.7.1 CATCHMENT DESCRIPTION

The Adams site is located approximately 2.6km from the eastern extent of the Witleegte River and approximately 5.3km from the south western extent of the Vlermuisleegte River. The site falls within quaternary catchment D41K. The local topography is largely flat, dipping to the east into the Gamagara river bed. The Gamagara river catchment comprises both quaternary catchments D41k and D41J that cover an area of 8094km^2. Within this catchment only 5182km^2 is considered to drain to a surface drainage feature due to the flat and sandy nature of the area.

Annual average run off in catchment area

A sizeable proportion of the Gamagara River Catchment does not yield run-off to any surface drainage feature due to the flat sandy nature of the region. The estimated run-off for the region is in the order of 1.5mm.

Normal flow of water in catchment area

The Gamagara River only flows at surface in very wet years. The last record of flow in the river system was in the summer of 1988.

6.7.2 SURFACE WATER QUALITY

There was no surface water observed within the study area.

6.7.3 DRAINAGE DENSITY OF DISTURBED AREA

No streams are present within the study area. The area is largely flat. Figure 6-8 shows the relative drainage networks of the surrounding areas in proximity to the study area.

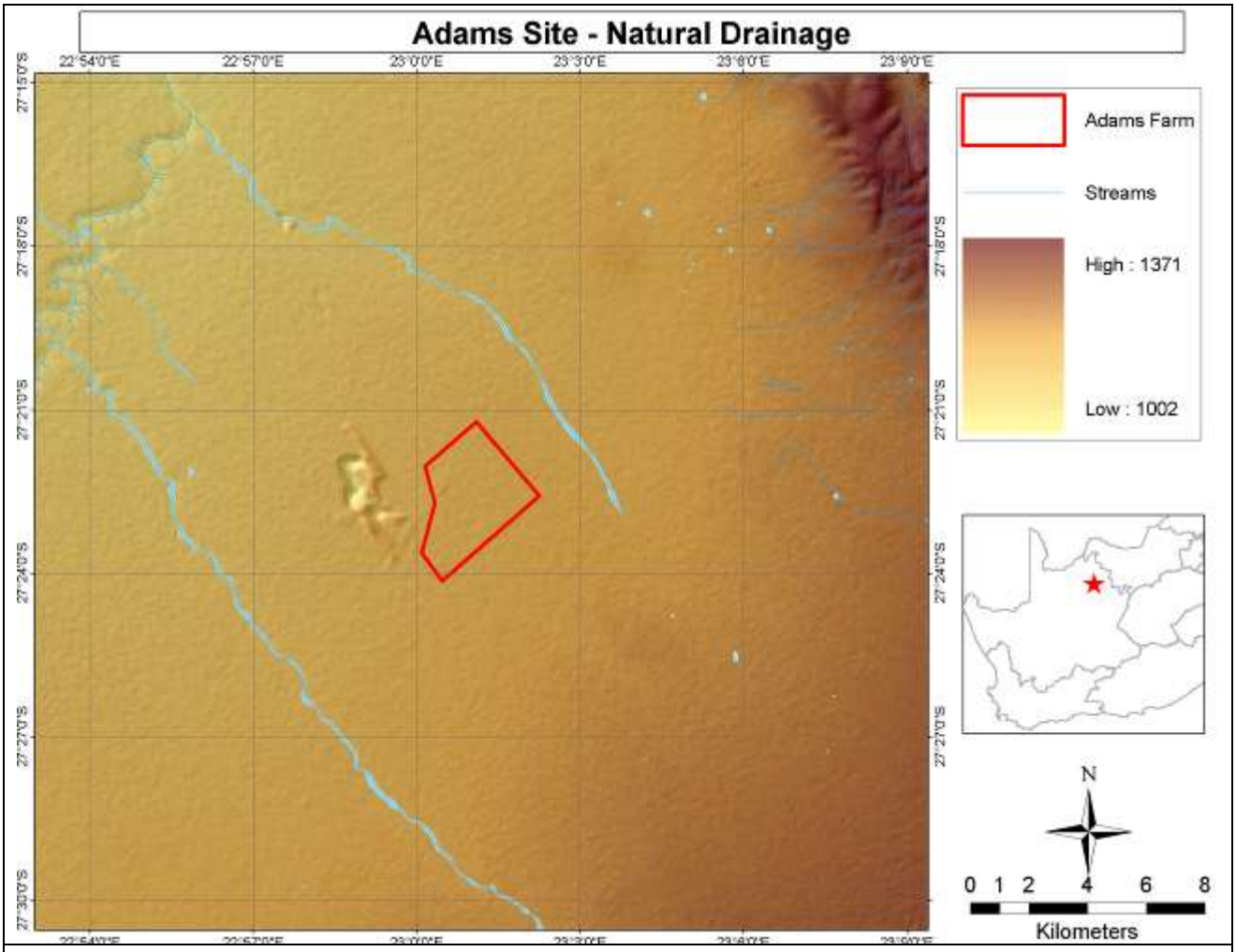

Figure 6-8: Regional map showing the relative drainage lines in the surrounding area.

6.7.4 SURFACE WATER USAGE

No surface water resources are available for use.

6.8 GROUNDWATER

6.8.1 DEPTH OF WATER TABLE

The regional water table is estimated to lie at a depth of approximately 75 metres below surface.

6.8.2 WATER BOREHOLES

There is one borehole located on the old mine compound within the study area; however this borehole is not in operation presently. Water used for cattle watering is piped from a borehole on the BHB Billiton site to the Adams farm.

6.9 NOISE

The surrounding land is however largely rural in nature and base noise levels can be expected to be low. The BHP Billiton mine Mamatwan is located on the western boundary of the site; this noise source is a major contributor to the static noise levels in the area. The areas surrounding the site are mostly rural in character and contribute to low levels of background noise. The principal sources of noise are at the BHP Mamatwan sinter plant operations, mining surface environment include ore transport by conveyor, vehicle movement of ore on the stack floors, crushing and screening of ore, road noise associated with service and labour transport and rail noise from ore trains.

6.10 VISUAL AESTHETICS

The general appearance of the farm Adams is dominated by flat Karoo landscapes. The general "sense of place" of the area is a particular kind of openness. As the area is dominated by open land of the Karoo, the visual and aesthetic feeling of the area is pleasant. There are however some visual intrusions existing around the proposed site; various power lines going in to the Dougnor substation as well as the BHP Mamatwan mine to the west of the site.

6.11 ARCHAEOLOGY, HERITAGE & CULTURE

The semi-arid Karoo region is rich in archaeological sites (rock arts and engravings found throughout the Karoo region) even though the region is regarded marginal pre-colonial human settlement. A short, general, background to archaeology in general is given in this section, a detailed heritage/archaeological impact assessment will be undertaken as part of the EIA process.

6.11.1 THE STONE AGE

The Stone Age is the period in human history when lithic (stone) material was mainly used to produce tools (Coertze & Coertze 1996: 293, as referenced by Pelser, 2011). In South Africa the Stone Age can be divided in three periods. It is however important to note that dates are relative and only provide a broad framework for interpretation. The division for the Stone Age according to Korsman & Meyer (1999: 93-94, as referenced by Pelser, 2011) is as follows:

- Early Stone Age (ESA) 2 million – 150 000 years ago
- Middle Stone Age (MSA) 150 000 – 30 000 years ago
- Late Stone Age (LSA) 40 000 years ago – 1850 - A.D.

There is a possibility Stone Age artefacts to potentially be located within the study area (dating right from the Early to the Later Stone Age).

6.11.2 THE IRON AGE

The Iron Age is the name given to the period of human history when metal was mainly used to produce artefacts (Coertze & Coertze 1996: 346), as referenced by Pelser, 2011. In South Africa it can be divided in two separate phases according to Van der Ryst & Meyer (1999: 96-98), as referenced by Pelser, 2011, namely:

- Early Iron Age (EIA) 200 – 1000 A.D.
- Late Iron Age (LIA) 1000 – 1850 A.D.

Huffman (2007: xiii), as referenced by Pelser, 2011 however indicates that a Middle Iron Age should be included. His dates, which now seem to be widely accepted in archaeological circles, are:

- Early Iron Age (EIA) 250 – 900 A.D.
- Middle Iron Age (MIA) 900 – 1300 A.D.
- Late Iron Age (LIA) 1300 – 1840 A.D.

6.12 SOCIO-ECONOMIC ENVIRONMENT

The population density in the Northern Cape region is generally low and is frequently congregated around towns. The surrounding resident population largely limited to land owners and farm labour. Samancor has a mine village at Hotazel that predominantly serves the Samancor manganese mines. The largest town of any size is Kuruman.

The population in the District Management Area comprises approximately 26,700 people (March 1999) constituted as follows:

White	6 505
Coloured	7 694
Asian	22
Black	12 500

6.12.1 ECONOMIC ACTIVITIES AND SOURCES OF EMPLOYMENT

Within the Northern Cape the relative contribution of different sectors of the economy to the local economy (gross geographic product) are listed below. Data are presented in millions of Rands (R million):

Agriculture	50,0
Mining	319,6
Manufacturing	9,2
Energy	5,6
Construction	6,0
Trade and Commerce	43,4
Transport	32,6
Finance	31,2
Services	52,4

6.12.2 EMPLOYMENT

The levels of unemployment in the Northern Cape region are high. Only 34 percent of the male population and 13 percent of the female population in the region are economically active.

6.12.3 SOCIAL INFRASTRUCTURE

There are a number of schools in the region. Primary schools exist in Hotazel and Black Rock, and secondary schools are found in Kuruman, Kathu and Wrenchville.

Hospitals are located in Kuruman and Kathu. There are clinics, staffed by trained nurses, in Hotazel and Black Rock. The clinics are staffed and under the control of Life medical care. A doctor is available in Hotazel and Assmang Black Rock Mining Operations.

6.12.4 WATER SUPPLY

All domestic water needs are sourced from the Vaal Gamagara water scheme.

6.12.5 POWER SUPPLY

The mines and associated villages and service infrastructure are supplied with electrical power by Eskom.

7. IMPACT ASSESSMENT

7.1 IMPACT ASSESSMENT METHODOLOGY

The following criteria and methodology is proposed to determine the significance of environmental impacts caused by the proposed project.

7.1.1 TYPE OF IMPACTS

Potential environmental impacts may either have a positive or negative effect on the environment, and can in general be categorised as follows:

a) Direct/Primary Impacts

Primary impacts are caused directly due to the activity and generally occur at the same time and at the place of the activity.

b) Indirect/Secondary Impacts

Secondary impacts induce changes that may occur as a result of the activity. These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken.

c) Cumulative Impacts

Cumulative impacts are those that result from the incremental impact of the proposed activity on common resources when added to the impacts of the other past, present or reasonably foreseeable future activities. Cumulative impacts can occur from the collective impacts of individual minor actions over a period of time, and can include both direct and indirect impacts.

7.1.2 DETERMINING SIGNIFICANCE

The following criteria will be used to determine the significance of an impact. The scores associated with each of the levels within each criterion are indicated in brackets after each description [like this].

Nature

Nature (N) considers whether the impact is:

- positive [- ¼]
- negative [+1].

Extent

Extent (E) considers whether the impact will occur:

on site [1]
locally: within the vicinity of the site [2]
regionally: within the local municipality [3]
provincially: across the province [4]
nationally or internationally [5].

Duration

Duration (D) considers whether the impact will be:

very short term: a matter of days or less [1]
short term: a matter of weeks to months [2]
medium term: up to a year or two [3]
long term: up to 10 years [4]
very long term: 10 years or longer [5].

Intensity

Intensity (I) considers whether the impact will be:

negligible: there is an impact on the environment, but it is negligible, having no discernable effect [1]
minor: the impact alters the environment in such a way that the natural processes or functions are hardly affected; the system does however, become more sensitive to other impacts [2]
moderate: the environment is altered, but function and process continue, albeit in a modified way; the system is stressed but manages to continue, although not with the same strength as before [3]
major: the disturbance to the environment is enough to disrupt functions or processes, resulting in reduced diversity; the system has been damaged and is no longer what it used to be, but there are still remaining functions; the system will probably decline further without positive intervention [4]
severe: the disturbance to the environment destroys certain aspects and damages all others; the system is totally out of balance and will collapse without major intervention or rehabilitation [5].

Probability

Probability (P) considers whether the impact will be:

unlikely: the possibility of the impact occurring is very low, due either to the circumstances, design or experience [1]
likely: there is a possibility that the impact will occur, to the extent that provisions must be made for it [2]
very likely: the impact will probably occur, but it is not certain [3]
definite: the impact will occur regardless of any prevention plans, and only mitigation can be used to manage the impact [4].

Mitigation or Enhancement

Mitigation (M) is about eliminating, minimising or compensating for negative impacts, whereas enhancement (H) magnifies project benefits. This factor considers whether –

- A negative impact can be mitigated:

unmitigated: no mitigation is possible or planned [1]
slightly mitigated: a small reduction in the impact is likely [2]
moderately mitigated: the impact can be substantially mitigated, but the residual impact is still noticeable or significant (relative to the original impact) [3]
well mitigated: the impact can be mostly mitigated and the residual impact is negligible or minor [4]

- A positive impact can be enhanced:

un-enhanced: no enhancement is possible or planned [1]
slightly enhanced: a small enhancement in the benefit is possible [2]
moderately enhanced: a noticeable enhancement is possible, which will increase the quantity or quality of the benefit in a significant way [3]

well enhanced: the benefit can be substantially enhanced to reach a far greater number of receptors or recipients and/or be of a much higher quality than the original benefit [4].

Reversibility

Reversibility (R) considers whether an impact is:

irreversible: no amount of time or money will allow the impact to be substantially reversed [1]

slightly reversible: the impact is not easy to reverse and will require much effort, taken immediately after the impact, and even then, the final result will not match the original environment prior to the impact [2]

moderately reversible: much of the impact can be reversed, but action will have to be taken within a certain time and the amount of effort will be significant in order to achieve a fair degree of rehabilitation [3]

mostly reversible: the impact can mostly be reversed, although if the duration of the impact is too long, it may make the rehabilitation less successful, but otherwise a satisfactory degree of rehabilitation can generally be achieved quite easily [4].

7.1.3 CALCULATING IMPACT SIGNIFICANCE

The table below summarises the scoring for all the criteria.

Table 7-1: Scoring for Significance Criteria

CRITERION	SCORES					
	- ¼	1	2	3	4	5
N-nature	positive	negative	-	-	-	-
E-extent	-	site	local	regional	provincial	national
D-duration	-	very short	short	moderate	long	very long
I-intensity	-	negligible	minor	moderate	major	severe
P-probability	-	very unlikely	unlikely	likely	very likely	-
M-mitigation	-	none	slight	moderate	good	-
H-enhancement	-	none	slight	moderate	good	-
R-reversibility	-	none	slight	moderate	good	-

Impact significance is a net result of all the above criteria. The formula proposed to calculate impact significance (S) is:

For a negative impact: $S = N \times (E+D) \times I \times P \div \frac{1}{2}(M+R)$; and
For a positive impact: $S = N \times (E+D) \times I \times P \times (H)$.

Negative impacts score from 2 to 200. Positive impacts score from – ½ to -200.

7.1.4 UNDERSTANDING IMPACT SIGNIFICANCE

The following is a guide to interpreting the final scores of an impact (for negative impacts):

Table 7-2: Final Significance Scoring

Final score (S)	Impact significance	
0 – 10	negligible	the impact should cause no real damage to the environment, except where it has the opportunity to contribute to cumulative impacts

Table 7-2: Final Significance Scoring		
Final score (S)	Impact significance	
10 – 20	Low	the impact will be noticeable but should be localized or occur over a limited time period and not cause permanent or unacceptable changes; it should be addressed in an EMP and managed appropriately
20 – 50	moderate	the impact is significant and will affect the integrity of the environment; effort must be made to mitigate and reverse this impact; in addition the project benefits must be shown to outweigh the impact
50 – 100	High	the impact will affect the environment to such an extent that permanent damage is likely and recovery will be slow and difficult; the impact is unacceptable without real mitigation or reversal plans; project benefits must be proven to be very substantial; the approval of the project will be in jeopardy if this impact cannot be addressed
100 – 200	severe	the impact will result in large, permanent and severe impacts, such as local species extinctions, minor human migrations or local economic collapses; even projects with major benefits may not go ahead with this level of impact; project alternatives that are substantially different should be looked at, otherwise the project should not be approved

Two examples will help illustrate this system:

SCENARIO 1 – An industrial facility proposes discharging effluent containing a high salt content into a nearby stream. These salts will cause temporary problems for the ecosystem, but are washed downstream, diluted and will have no long term effects. The short term damage to the stream can be reversed fairly easily, but only if the ecosystem has not been seriously damaged by the salts over a long time. A mitigation measure is also proposed whereby during low flow periods (dry season) a pulse of clean water is discharged into the stream after the saline effluent, diluting the salts and pushing them downstream faster, so that the salts become so dilute as to have little or no effect.

From this scenario, the criteria are:
nature = negative = 1
extent = local = 2
duration = medium = 3
intensity = moderate = 3
probability = very likely = 4
mitigation = moderate = 3
reversibility = moderate = 3,

and therefore impact significance is:
$S = N \times (E+D) \times I \times P \div \frac{1}{2}(M+R)$
$= 1 \times (2+3) \times 3 \times 4 \div \frac{1}{2}(3+3)$
$= 60 \div 3$
$= 20.$

Note that the impact prior to mitigation is major, but that due to the mitigation and the fact that the ecosystem can recover easily from the effects of salt (high reversibility), the residual impact becomes minor/moderate.

SCENARIO 2 – The above scenario applies, except that the effluent contains metals. These metals become adsorbed onto clay and organic matter in the stream bed and are accumulative toxins within the ecosystem, getting into the food chain and concentrating upwards into predator species. Fresh water flushing will only very slightly mitigate this and ecosystem recovery will not be easy or fast.

From this scenario, the criteria are:
nature = negative = 1
extent = local = 2
duration = very long = 5
intensity = moderate = 3
probability = very likely = 4
mitigation = slight = 2
reversibility = slight = 2,

and therefore impact significance is:
S = N x (E+D) x I x P ÷ ½(M+R)
= 1 x (2+5) x 3 x 4 ÷ ½(2+2)
= 84 ÷ 2
= 42.

Note that in this case, the original impact (of the metals) is more serious than the salt, but it is the limited mitigation and reversibility that also act on the residual score and result in this score being moderate.

7.2 PRELIMINARY ENVIRONMENTAL ASPECTS & IMPACTS

This section provides an overview and initial assessment of the main environmental aspects and their associated impacts related to the proposed project, the expected impact are regarded as the potential impacts resulting from the proposed project without appropriate mitigation measures employed. These expected impacts will be assessed in more detail during the detailed Environmental Impact Assessment (EIA) phase of the project and appropriate mitigation measures will be implemented to ensure these impacts are mitigated to acceptable environmental status.

Table 7-3: Environmental Impact Assessment Priority					
Construction Phase Impacts					
Environmental and/or cultural effects		***Location/ Extent***	***Timing / Duration***	***Expected Impact (+/-) & Importance***	
Impact on Fauna, Flora and Ecology	Due to Construction related activities such as land clearing, establishment of borrow pits, temporary construction camps storage of material for construction, construction of access roads and chemical contamination of soil though machinery or vehicles. The potential impact on fauna, flora and ecology include the following: • Loss of indigenous vegetation, threatened plant/trees • Loss of habitat for animals or threatened species • The proposed establishment cause spread of alien invader plants and declared weeds.	Local	Very long term	–	High
Soils	The soil contamination or physical soil disturbances due to construction activities. Two types of impact could potentially result from the construction phase firstly direct impacts resulting from soils along PV panel construction sites as well as the construction roads. Indirect impacts due to soil degradation and erosion due to inadequate storm water management, soil contamination due to soils, concrete and other chemicals during construction activities. The potential impact on soils therefore include the	Local	Very long term	-	Moderate

Table 7-3: Environmental Impact Assessment Priority					
Construction Phase Impacts					
	following: • Soil degradation due to erosion • Soil pollution • Excavation causing soil degradation				
Land Use	The area mostly consists of natural vegetation and historical human activities. Impact on the temporary disturbance to grazing land use during the construction period	On Site	Temporary	-	Low
Animal Life	Displacement of faunal species due to the near compete removal of natural vegetation / habitat destruction.	Site & Edge Effects	Very Long Term	-	Moderate
Ground and surface water	The impact on groundwater due to construction activities. There are no natural surface water sources in the area except man made sources on site. The PV facility has the potential to impact on groundwater quantity, but is not expected to have an impact on quality. The water use required for cleaning of the PV panels could potentially impact on the groundwater quantity on a localised level.	local	Medium Term	–	Moderate
Aesthetics/ Visual	Visual impact due to new Solar facility construction / infrastructure. Mostly from commuters traveling on the R380	Local	Life of facility	–	Low
Socio-Economic	Job creation, skills development and economic development. Negative impact increase security risk to farmers and livestock due to influx of job seekers.	Local	Construction and Life of facility	+ and -	Moderate
Archaeology, Heritage & Culture	Disturbance to potential cultural and or historical features onsite	Site	Potentially permanent	-	Low
Traffic	Increase in traffic on local roads	Locally	Medium term during construction	-	Moderate

Table 7-4: Environmental Impact Assessment Priority					
Operation Phase Impacts					
Environmental and/or cultural effects		***Location/Extent***	***Timing / Duration***	***Expected Impact (+/-) & Importance***	
Fauna, Flora and Ecology	Operational related activities such as maintenance (removal and trimming vegetation) and the presence of impermeable surfaces could potentially impact on fauna, flora and Ecology. The potential impact on fauna, flora and ecology include the following: • Habitat transformation could cause loss of protected plant and animals species this is however limited to the access road, PV panels and associated infrastructure.	Local (Development footprint)	Permanente	–	High
Soils	Exposed areas such as the areas where vegetation was removed as part of construction ex below PV panels surfaces etc. could be susceptible to water and wind erosion in absence of soil management and control measures.	Local	Temporary	-	Moderate
Land Use	The area mostly consists of natural vegetation and historical human activities. Impact on the temporary disturbance to grazing land use during the construction period	On Site	Temporary	-	Low
Surface and Groundwater	The area surrounding the site does not have any natural sources of flowing surface water. The PV facility will also not negatively impact the Ground water although the facility might need to use groundwater for cleaning of the PV panels and therefore cause impact on the quantity of available water resources. The major impact resulting	Local	Very Long term	-	High

Table 7-4: Environmental Impact Assessment Priority					
Operation Phase Impacts					
	is on the quantity of water available and proper measures must therefore be employed as to use water efficiently.				
Aesthetics/ Visual	The solar facility and associated infrastructure is expected to be quite visible to commuters traveling on the R380. The potential impact associated with the establishment include: change in visual character of the site and therefore affects general sense of place of the region as well as light pollution due to security lighting and safety lighting of the facility at night, however the sight is already quite visually impaired as the existence of various power lines intersecting the site as well the presence of the BHP Billiton Mamatwan Mine to the West of the site on the other side of the R380.	Local – regional	Life of facility	–	Low
Socio-Economic	Employment opportunities will be created although the PV facility does not require large number of employees during operations lifespan however the employment opportunities will create long term sustainable employment to these individuals and in return the country. The presence of the PV facility could increase criminal activity to enter the site from surrounding farms, however the facility will be fence and security measures implemented to prevent these impact from occurring.	Local	Construction and Life of facility	+ and -	Moderate

8. PLAN OF STUDY FOR EIA

This plan of study has been formulated to meet the requirements for a Plan of Study for Environmental Impact Assessment (POSEIA) as set out in regulation 28(n)(i-iv) of GN R.543, promulgated in terms of chapter 5 of the National Environmental Management Act (Act No. 107 of 1998), which states:

"28(1) A scoping report must contain all the information that is necessary for a proper understanding of the nature of issues identified during scoping, and must include:

28(n)(i-iv) a plan of study for environmental impact assessment which sets out the proposed approach to the environmental impact assessment of the application, which must include

(i) a description of the tasks that will be undertaken as part of the environmental impact assessment process, including any specialist reports or specialised processes, and the manner in which such tasks will be undertaken;

(ii) an indication of the stages at which the competent authority will be consulted;

(iii) a description of the proposed method of assessing the environmental issues and alternatives, including the option of not proceeding with the activity; and

(iv) particulars of the public participation process that will be conducted during the environmental impact assessment process;"

8.1 SPECIALIST STUDIES AND REPORTING

The identification and initial assessment of environmental aspects revealed the following potentially significant environmental aspects which require further detailed assessment, to be conducted during the EIA-phase:

- Biodiversity study and impact assessment
- Archaeology and heritage impact assessment
- Visual impact Assessment
- Cumulative impact assessment study
- Soil impact assessment

8.1.1 LIST OF SPECIALISTS AND SPECIALIST STUDIES PROPOSED TO BE UNDERTAKEN

A brief list of specialists and specialist studies which are proposed to be undertaken are shown in Table 8-1below**:**

Table 8-1: List of Specialists and Specialist Studies

Specialist Study		Specialists
1	Environmental Legal Review	Theo Fisher, Bradley Thorpe and Roelof Letter (ESA)
2	Biodiversity and wetland assessments	Willem de Frey, EkoInfo
3	Archaeology and Heritage Impact assessment	Mr Anton Pelser (Archaetnos Consultants)
4	Visual Impact Assessment / GIS / 3-D visualizations	Emmanuel Tshuma (ESA) and Kotie Geldenhuys (Propaganda Studios)

5	Soil Impact Assessment	Prof. A. Claassens (Soil science and plant nutrition consultant)
6	Cumulative impact assessment	Brian Gardner, Theo Fisher and Roelof Letter (ESA)
7	Environmental reporting, public participation, project management	Brian Gardner, Theo Fisher and Roelof Letter (ESA)

8.1.2 BIODIVERSITY ASSESSMENT

A biodiversity studies and impact assessments will be conducted by EkoInfo. As part of the Environmental Impact Assessment (EIA) for this proposed project, the impacts of all aspects of the proposed activity will need to be assessed.

The following aspects of biodiversity will be covered in the study:

- Land clearing
- Vegetation
- Fauna (focusing on mammals and birds)
- Ecology

Qualified specialists in each of the identified fields will undertake detailed baseline environmental investigations of the proposed site. The baseline investigations will involve both desktop (existing information) and field investigations and will describe the current condition of the site. Where applicable, maps and species lists (Red Data species and all observed species) will be included in the report.

Based on the findings from the baseline studies, impact assessments will be undertaken on all expected impacts. Descriptions of proposed mitigation, management and monitoring measures will be provided (where appropriate and practically feasible) for all impacts during the construction, operation and decommissioning/closure phases of the proposed solar plants activities.

All the information and recommendations from the various specialist reports will be collated and summarised in one final baseline environmental report which will include the findings of this study. In this way, the final baseline environmental report will constitute a document which covers the entire area to be affected by the proposed facility.

The following are the main objective/plan of study for the biodiversity impact assessment (BIA) going to take place:

1. Objective one (1) – Literature and Desktop Review: Do a total literature and desktop review to get to the comprehensive.
2. Objective two (2) – Complete a detailed onsite study using the national minimum standard for spatial biodiversity assessments. Verify and analyse the data collected, compile vegetation maps and describe the vegetation units
3. Objective three (3) – Information dissemination: This objective involves report compilation and integration/feedback meetings. The detail EIA information will be incorporated into the newly generate scoping report to provide a comprehensive document which provides baseline information on a regional and local scale, with impact assessment and mitigation.

8.1.3 VISUAL IMPACT ASSESSMENT

It is the intent of the visual specialist, Mr. Kotie Geldenhuys of Propaganda Studios, to execute the Visual Impact Assessment. Adequate explanations of the processes and their subsidiary components will be presented, accompanied by clear and palatable graphs, for stakeholders who might be less familiar with the methodology of Visual Impact Assessment (VIA).

It is proposed that 2 sets of guidelines will be used for undertaking the VIA, namely:

- Department of Environmental Affairs' Environmental Management Guidelines in 2010 (DEA, 2010), and,
- "*Guideline for involving visual & aesthetic specialists in EIA processes: Edition 1*", published for the CSIR, particularly pertaining to sensitive areas in the Western Cape Province, but also applicable throughout (and not limited to) the Republic of South Africa.

It is the intent of the visual specialist to focus on the following principles, requirements and evaluation criteria in the execution of a comprehensive Visual Impact Assessment**:**

- An awareness that 'visual' implies the full range of visual, aesthetic, cultural and spiritual aspects of the environment that contribute to the area's sense of place;
- The consideration of both the natural and the cultural landscape, and their inter-relatedness;
- The identification of all scenic resources, protected areas and sites of special interest, together with their relative importance in the region;
- The nature and location of any cultural heritage sites, and areas of special or historical interest;
- An understanding of the landscape processes, including geological, vegetation and settlement patterns, which give the landscape its particular character or scenic attributes;
- The need to include both quantitative criteria, such as 'visibility', and qualitative criteria, such as landscape or townscape 'character';
- The need to include visual input as an integral part of the project planning and design process, so that the findings and recommended mitigation measures can inform the final design, and hopefully the quality of the project.

It is proposed that the following evaluation criteria will be employed to evaluate the Visual Impact Assessment process:

- Provision of a full description of the environment and the project;
- Consideration of the project within its wider context;
- Provision of a clear methodology using accepted conventions for visual assessment;
- Presentation of all sources of information and references;
- Clear presentation of graphics, including maps and visual simulations;
- Inclusion of both quantitative and qualitative criteria;
- Consideration of cumulative visual impacts;
- Determination of the relative compatibility or conflict of the project with the surroundings;

- Evaluation and consideration of alternatives;
- Explanation of significance ratings, related to bench-marks;
- Inclusion of long term sustainable development objectives;
- Practical and sensible recommendations for visual mitigation;
- Identification and description of monitoring programme recommendations;
- Consideration of the best practicable environmental options;
- The addressing of all the visual issues raised in the scoping;
- Provision of a clear summary of mitigation measures, including essential and optional measures.

In addition to the above, a cumulative impact assessment will be done, as well as mitigation measures suggested with regards to layout of surface structures and suggestions with regards to rehabilitation.

The full VIA will encompass the following components:

- Background research and quantification modelling: This includes an onsite photographic audit, as well as
- identification of landscape types, landscape character and sense of place, generally based on geology, landforms, vegetation cover and land use;
- Identification of viewsheds and view catchment areas (based on the degree to which topography will impact on rendering the proposed development visible or invisible);
- Identification of important viewpoints and view corridors within the affected environment (including sensitive receptors, high traffic areas and places of interest);
- Indication of distance radii from the proposed project to the various view points and receptors;
- Determination of the visual absorption capacity (VAC) of the landscape, usually based on vegetation cover or urban fabric in the area;
- Determination of the relative visibility, or visual intrusion, of the proposed project.
- Determination of the relative compatibility or conflict of the project with the surroundings;
- 3 dimensional modelling and texturing of surface infrastructures
- View Simulations of potential visual impacts, including rendering elevations and 3 vantage points.
- Immersed Imagery.
- Reporting on the visual impacts predicted will include:
    - A summary impact assessment table, using the defined impact assessment and significance rating criteria;
    - Indications of whether impacts are irreversible or result in an irreplaceable loss to the environment and/or society;
    - Statement of impact significance for each issue specifying whether a level of acceptable change has been exceeded and whether the impact presents a potential fatal flaw;
    - Identification of beneficiaries and losers from the proposed development;
    - Summary of key management actions that fundamentally affect impact significance;

- Identification of the best practicable environmental option, providing reasons;
- Identification of viable development alternatives not previously considered
- Landscape end use planning (alternative options) and rehabilitation proposal

8.1.4 HERITAGE AND ARCHAEOLOGY IMPACT ASSESSMENT

Heritage specialist input in the EIA process is essential to ensure that management of development conserves our heritage. It plays a positive role in the development process by enriching our understanding of the past and recognizing its contribution to the present it's also a legal requirement for certain categories of development in relevant heritage legislation. The heritage impact assessment (HIA) is undertaken as part of this EIA to determine whether the proposed site consist of any heritage resource whether aesthetic, historical, architectural, social, scientific, spiritual or technological in order to effectively concern these valuable resources.

The HIA will fulfil the requirements of Section 38 (3) of the National Heritage Resources Act, namely the identification and mapping of heritage resources and the assessment of the significance thereof, an assessment of the positive and negative impacts of the proposals, the results of consultation with I&APs, the consideration of alternatives and plans for the mitigation of any adverse impacts.

The purpose of the HIA report is to verify and assess the absence and/or presence of features of heritage significance that may be affected, to recommend mechanisms to manage impacts and thereby to enable the relevant heritage resources authorities to consider and approve the proposed project, based on the information contained in the report.The plan of study for the HIA will consist of the following as part of the comprehensive EIA phase to be conducted:

1. Identify all objects, sites, occurrences and structures of an archaeological or historical nature (cultural heritage sites) located in the areas of development.
2. Assess the significance of the cultural resources in terms of their archaeological, historical, scientific, social, religious, aesthetic and tourism value.
3. Describe the possible impact of the proposed developments on these cultural remains, according to a standard set of conventions.
4. Propose suitable mitigation measures to minimize possible negative impacts on the cultural resources.
5. Review applicable legislative requirements.

The methodology that will be followed to conduct the HIA is as follows:

Survey of literature

A survey of literature will be undertaken where still required in order to obtain background information regarding the cultural (archaeological and historical) heritage of the different development areas.

Field survey

The surveys will be conducted according to generally accepted HIA/AIA practices and will aim at locating all possible objects, sites and features of cultural (archaeological and historical) heritage significance in the areas of proposed development. The location/position of any site will be determined by means of a Global Positioning System (GPS), while photographs will also be taken where needed.

Surveys will be conducted mainly on foot, although certain portions will be travelled by vehicle.

Oral histories
People from local communities are sometimes interviewed in order to obtain information relating to the surveyed area. It needs to be stated that this is not applicable under all circumstances. When applicable, the information is included in the text and referred to in the bibliography.

Documentation
All sites, objects, features and structures identified are documented according to the general minimum standards accepted by the archaeological profession. Co-ordinates of individual localities are determined by means of the Global Positioning System (GPS).The information is added to the description in order to facilitate the identification of each locality.

8.1.1 SOIL IMPACT ASSESSMENT

A desktop soil assessment of the site will be undertaken, and will include the following:

- Identification of the soil form present on site
- The size of the area where a particular soil form is found
- A detailed map indicating the locality of the soil forms within the specified area
- Size if the site
- Exact locality of the site
- Possible land use options for the site
- Detailed description of why agriculture should or should not be the land use of choice
- Impact of the change in land use on the surrounding area

8.1.2 CUMULATIVE IMPACT ASSESSMENT STUDY

8.1.2.1 LEGAL REQUIREMENT

NEMA 2010 Regulations, R543 states: "cumulative impact", in relation to an activity, means the impact of an activity that in itself may not be significant but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area;

8.1.2.2 INTERPRETATION

A cumulative impact is an instance where that occurs as a result of the addition of many similar smaller impacts. These smaller impacts may occur from similar or very different developments and individually they may each be within the assimilative capacity of the environment, but together they reach a threshold that then cause serious damage.

8.1.2.3 METHODS

Cumulative impacts will be explicitly assessed in instances where additional burden/ impact will be caused by the proposed development.
Several considerations apply to CEA and some of these are discussed below:

- Cumulative effects are not only calculated from those currently occurring, but also past impacts that still have an effect. An area that is already degraded must not be evaluated from that degraded state, but must be evaluated from its pristine state, even if that was centuries ago.

- Cumulative effects are both direct and indirect impacts – anything that will add to the effect being considered. However, the number of effects being considered will generally have to be limited. For example, every species in a given area cannot be assessed for the effect that the impact will have on it. A decision must be taken to select perhaps a few species including the most likely to be affected species, the rarest species, iconic species or those that are well understood for which baseline or dose-response data exists.
- Cumulative effects may occur across political and ownership boundaries. The assessment must not stop at those boundaries and should rather use natural boundaries, such as catchments or changes in vegetation type, and so on.
- Cumulative effects can be of many types. Every attempt must be made to incorporate and, if possible, synthesize these impacts and effects where they may occur.
- Cumulative effects must be forecast as far as possible into the future to try and sense the possibility of severe effects that may only occur in the long term.

Cumulative Environmental Assessment can be done using various methods, some of which are explained below in Table 8-2 below.

Table 8-2: Cumulative Effects Assessment

analysis method	description
checklist	common projects with easily anticipated impacts can be assessed using a checklist
questionnaire	systematic interviewing with experts or locals with good knowledge of the area and environment
network	diagrams illustrating flows and other relationships between components; good for illustrating cause and effect
interactive analysis	assessment of additive and synergistic effects of various configurations of multiple projects
biogeographical analysis	ecosystem analysis at landscape and larger levels, emphasizing patterns, processes and structure of the ecosystem
carrying capacity analysis	determination of the total resource base that can be used by humans whilst maintaining a sustainable natural environment in the long term
ecological modelling	mathematical modelling using computers, where areas are data rich and ecosystems are well understood
GIS (geographic information system)	computerized mapping system for spatial data allowing sophisticated spatially related querying and presentation

The outputs of a CEA can be the identified sources of cumulative impacts, the sequence of events from source to effect, or the resultant effects. Ideally all three of these should be mentioned, but in some cases it may not be necessary for the aim of the study to investigate all three aspects in detail. For instance, if it is known that air quality in a certain area is dangerous to human and environmental health, it is probably more important to quantify the sources and try and limit these, than to go doing a detailed study of the exact health effects and environmental risks from the poor air quality. The latter may be interesting, but will not really attack the cause of the problem.

8.2 PROPOSED SCOPING AND EIA TIMELINE INCLUDING KEY AUTHORITY CONSULTATION (DEA)

EScience proposes that the following course of action is followed:

1) Submit five (5) copies of draft scoping report to DEA and make draft Scoping report available to all registered I&AP's.
2) Comments will then be collated from public and from DEA (and other government departments), and then a final scoping report will be submitted to DEA and public (as per the regulations requirement)
3) If there are SUBSTANTIVE changes that need to be made to the report, then the process will start from point 1 (as above) again.
4) However, if no substantive changes are needed, the reports should be processed accordingly – a meeting on the need for these "substantive changes" may be required.

Please refer to Figure 2-3

Table 8-3: Anticipated Key Dates

Process Phase	Details	Estimated Date
Application	Lodge application and declaration of interest to DEA	Submitted on 12 September 2011.
	Receive confirmation of application from DEA	Received on 17 November 2011.
Scoping phase	Submit draft scoping report to DEA and to public for review	17 April 2011
	Consideration by DEA of draft Scoping Report and PoSEIA, as well as review of scoping by public	28 May 2012
	Submit final scoping report to DEA	10 June 2012
	Review of draft Environmental Impact Assessment Report (EIR) by DEA	10 July 2012
EIA phase	Lodge final EIR with DEA	20 September 2012
	Decision on application by DEA	16 January 2013

8.3 PUBLIC PARTICIPATION PROCESS FOR EIA PHASE

The proposed public participation process for the remainder of the Environmental Impact Assessment will consist of:

8.3.1 ADVERTISING AND REPORT COMMENT PERIODS

- Advertise the process as per the EIA regulations (GNR 543 of 18 June 2010)
- Presenting al registered Interested and Affected Parties, stakeholders and government departments with the opportunity to read and comment on environmental impact assessment reports, including all specialist reports;
- Presenting registered Interested and Affected Parties, stakeholders and government departments with the opportunity to read and comment on draft environmental management plans;

- Presenting registered Interested and Affected Parties and stakeholders with the opportunity to read and comment on the final reports submitted to DEA.

8.3.2 PUBLIC MEETINGS AND OPEN DAYS

- A public meeting if required to present and discuss the findings of the Environmental Impact Assessment and related specialist reports (if deemed necessary);
- Various focus-group meetings with selected focus groups. These meetings include meeting with focus-group meetings with farmers in the area will be undertaken. This is however not a legislative requirement but will be undertaken if deemed necessary.

9. CONCLUSIONS

Based on the independent evaluation and assessment of the proposed project during the Scoping Phase by the Environmental Assessment Practitioner (EAP), a Plan of Study for Environmental Impact Assessment (PoSEIA) has been developed. The POSEIA includes the scope of further specialist studies to be conducted, which would inform the accurate assessment and mitigation of potential environmental impacts that may arise from the proposed project. This would result in the compilation of a detailed EIA Report, which would allow the competent authorities (DEA) to make an informed decision regarding the authorisations needed for the proposed Photo-voltaic Solar Power generation project and components thereof.

In conclusion, it is felt that the scoping study has highlighted numerous areas that will need to be properly evaluated during the EIA phase due to the sensitivity of the site that will need to be addressed at EIA phase. It is felt that the scoping study has been undertaken thoroughly and that authorization be granted to continue with the full Environmental Impact assessment to adequately quantify and assess the impacts of the proposed Solar Facility on the receiving environment.

10. REFERENCES

Bullis, K., 2011: Big solar: Massive solar panels like the 24-meter-wide ones shown here will be installed at a 30-megawatt solar farm being supported by the U.S. Department of Energy. [Retrieved on March, 13, 2012 from http://www.technologyreview.com/energy/37561].

CSIR, 2004: Northern Cape State of the Environment Report: Overview. Produced by the CSIR Division of Water, Environment & Forestry Technology for the Northern Cape Department

Department of Energy, 2011: Integrated Resource Plan for Electricity 2010-2013.

Dr. Johann du Preez, 2007: Environmental Impact Assessment report y for the proposed construction of a 400 kV transmission power line between Ferrum substation and Garona Substation, Fauna and flora specialist study. [Retrieved on March, 29, 2012 from http://recruitment.eskom.co/content/Ch%207_Flora_FG%20_24.07.07_Final.pdf]

http://www.capegateway.gov.za/eng/pubs/guides/G/103381 (Accessed various times between 1 and 14 June 2011)
Integrated Reousrce Plan (IRP) for South Africa (2010 – 2030)

Lozanova, S., 2009: Surprising Facts about Concentrated Photovoltaic. [Retrieved on March, 13, 2012 at http://www.triplepundit.com/2009/01/5-surprising-facts-about-concentrated-photovoltaics.].

Mucina, L., Rutherford, MC. And Powrie, I.W., 2005: Vegetation Map of South Africa, Lesotho and Swaziland. Strelitzia 19. South Africa National Biodiversity Institute, Pretoria

Mucina, L., Rutherford, MC., Palmer, A.R., Milton, S.J., Scott, L., Van Der Merwe, B., Hoare, D.B., Bezuidenhout, H., Vlok, J.H.J., Euston-Brown, D.I.W., Powrie, L.W. & Dold, A.P, 2006: Nama – Karoo Biome.

National Department of Environmental Affairs, Limpopo Department of Economic Development, Environment and Tourism and Waterberg District Municipality, 2010: Waterberg District Environmental Management Framework Report. Compiled by NRM Consulting.

National Energy Regulator of South Africa, 2009: South Africa Renewable feed in tariff (FIT), Regulating guidelines.

P.J. Aucamp, 2010: Environmental Impact Assessment; a practical guide for the discerning practitioner, Van Schaik, Pretoria

Preston, P.C.C.R, 2001: Physical and chemical characterization of the manganese ore bed at the Mamatwan mine, Kalahari Manganese field, Faculty if Science at the Rand Afrikaans University.

Republic of South Africa, 1998: White Paper on Energy Policy.

Republic of South Africa, 2003: White paper on Renewable Energy.

Republic of South Africa, 2008: The National Energy Act

Ubuntu Local Municipality, 2010: Integrated Development Plan

UKEA 2004 Environmental Risk Management and Strategic Environmental Assessment Guidance Note, United Kingdom Environmental Agency, version 6, 07/09/2004. www.environment-agency.gov.uk/commondata/103599/risk_man_v6_850000.doc

Western Cape Department of Environmental Affairs and Development Planning, 2005: Visual And Aesthetic Specialists Guideline: Guideline For Involving Visual And Aesthetic Specialists in EIA Processes.

11. APPENDIX 1: LOCALITY PLANS AND MAPS

12. APPENDIX 2: DEA ACKNOWLEDGMENT OF RECEIPT OF EIA APPLICATION & DRAFT SCOPING REPORT

13. APPENDIX 3: PUBLIC PARTICIPATION REPORT

14. APPENDIX 4: SITE PHOTO REPORT

15. APPENDIX 5: CV'S OF LEAD ENVIRONMENTAL CONSULTANTS