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DRAFT Environmental Impact Assessment Report for the proposed Arriesfontein Concentrated Solar Power Plant on the farm 267, near Danielskuil in the Northern Cape

DEA Reference: 12/12/20/2646

Part 2 - Appendices

260380 PWE – 08 - 003

19 July 2012

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Appendix A–Department of Environmental Affairs Scoping Acceptance Letter

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

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DEA Reference: 12/12/20/2646
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Mr. Francois Humphries
WorleyParsons RSA (Pty) Ltd
PO Box 36155
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PER FACSIMILE / MAIL

Dear Mr. Humphries

APPLICATION FOR ENVIRONMENTAL AUTHORISATION: THE PROPOSED CONSTRUCTION OF ARRIESFONTEIN 100MW CONCENTRATED SOLAR POWER (CSP) PLANT ON THE FARM ARRIESFONTEIN 267, KGATELOPELE LOCAL MUNICIPALITY, NORTHERN CAPE PROVINCE

The Final Scoping Report (FSR) and Plan of Study for Environmental Impact Assessment dated March 2012 and the additional information dated 25 June 2012 and received by the Department on 26 June 2012 refers.

The Department has evaluated the submitted FSR, the Plan of Study for Environmental Impact Assessment dated March 2012, and the additional information dated 26 June 2012 and is satisfied that the documents comply with the minimum requirements of the Environmental Impact Assessment (EIA) Regulations, 2010. The FSR is hereby accepted by the Department in terms of regulation 30(1)(a) of the EIA Regulations, 2010.

You may proceed with the environmental impact assessment process in accordance with the tasks contemplated in the Plan of Study for Environmental Impact Assessment as required in terms of the EIA Regulations, 2010.

Please ensure that comments from all relevant stakeholders are submitted to the Department with the Final Environmental Impact Report (EIR). This includes but is not limited to the Northern Cape Provincial Department of Environmental Affairs and Nature Conservation, the Department of Agriculture (Provincial and National), the Department of Water Affairs, the South African Heritage Resource Agency (SAHRA), the Department of Mineral Resources (should permits for borrow pits be required), and the relevant aviation authorities. Proof of correspondence with the various stakeholders must be included in the Final EIR. Should you be unable to obtain comments, proof should be submitted to the Department of the attempts that were made to obtain comments.

In addition, the following amendments and additional information are required for the EIR:

a) Details of the future plans for the site and infrastructure after decommissioning and the possibility of upgrading the proposed infrastructure to more advanced technologies.
b) The total footprint of the proposed development should be indicated. Exact locations of the CSP Plant and associated infrastructure (including pipelines) should be mapped at an appropriate scale.
c) Should a Water Use License be required, proof of application for a license needs to be submitted.
d) The EIR should include information on the following:
   - Environmental costs *vs* benefits of the CSP; and
   - Economic viability of the facility to the surrounding area and how the local community will benefit.
e) Information on services required on the site, e.g. sewage, refuse removal, water and electricity. Who will supply these services and has an agreement and confirmation of capacity been obtained?
f) A construction and operational phase EMP to include mitigation and monitoring measures.
g) Should blasting be required, appropriate mitigation measures should be provided.

The applicant is hereby reminded to comply with the requirements of regulation 67 with regard to the time period allowed for complying with the requirements of the Regulations, and regulations 56 and 57 with regard to the allowance of a comment period for interested and affected parties on all reports submitted to the competent authority for decision-making. The reports referred to are listed in regulation 56(3a-3h).

Please ensure that the Final EIR includes at least one A3 regional map of the area and the locality maps included in the final EIR illustrate the different proposed alignments and above ground storage of fuel. The maps must be of acceptable quality and as a minimum, have the following attributes:

- Maps are relatable to one another;
- Cardinal points;
- Co-ordinates;
- Legible legends;
- Indicate alternatives;
- Latest land cover;
- Vegetation types of the study area; and
- A3 size locality map.

Further, it must be reiterated that, should an application for Environmental Authorisation be subject to the provisions of Chapter II, Section 38 of the National Heritage Resources Act, Act 25 of 1999, then this Department will not be able to make nor issue a decision in terms of your application for Environmental Authorisation pending a letter from the pertinent heritage authority categorically stating that the application fulfils the requirements of the relevant heritage resources authority as described in Chapter II, Section 38(8) of the National Heritage Resources Act, Act 25 of 1999.

You are requested to submit five (5) copies of the Environmental Impact Report (EIR) to the Department as per regulation 34(1)(b) of the EIA Regulations, 2010. Please submit at least one electronic copy (CD/DVD) of the complete final report with the hard copy documents.

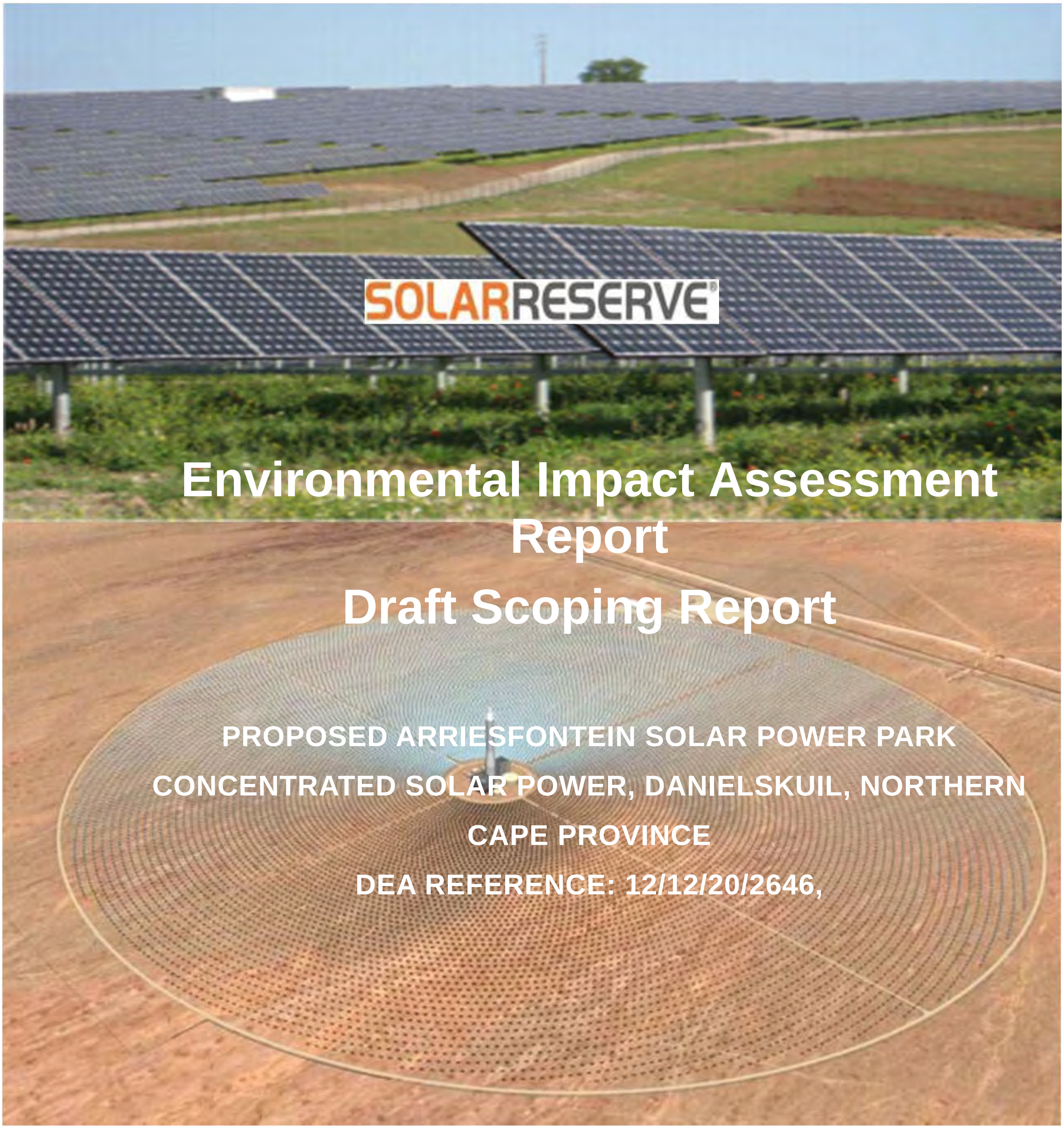
You are hereby reminded of Section 24F of the National Environmental Management Act, Act No 107 of 1998, as amended, that no activity may commence prior to an environmental authorisation being granted by the Department.

Yours sincerely

Mr Ishaam Abader
Deputy Director-General: Legal, Authorisations and Compliance Inspectorate
Department of Environmental Affairs
Letter signed by: Mr. Danie Smit
Designation: Acting Director: Integrated Environmental Authorisations
Date: 28/06/2012

CC:	Mr. Terence Govender	SolarReserve SA (Pty) Ltd	Tel: 011 784 7539	Fax: 011 784 7549
	Ms. N Ramuhulu	Northern Cape DE & NC	Tel: 053 807 7430	Fax: 053 831 3530

Appendix B–Final Scoping Report



Environmental Impact Assessment Report

Draft Scoping Report

PROPOSED ARRIESFONTEIN SOLAR POWER PARK CONCENTRATED SOLAR POWER, DANIELSKUIL, NORTHERN CAPE PROVINCE

DEA REFERENCE: 12/12/20/2646,

COMPILED FOR:

SOLARRESERVE

COMPILED BY:

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Incorporating KV3 ENGINEERS

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Disclaimer

This report has been prepared on behalf of and for the exclusive use of SolarReserve, and is subject to and issued in accordance with the agreement between SolarReserve and WorleyParsons RSA. WorleyParsons RSA accepts no liability or responsibility whatsoever for it in respect of any use of or reliance upon this report by any third party.

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PROJECT 260380PWE - ARRIESFONTEIN SOLAR POWER PLANT: PHOTOVOLTAIC PHASE 1 - 3

REV	DESCRIPTION	ORIG	REVIEW	WORLEY-PARSONS APPROVAL	DATE	CLIENT APPROVAL	DATE
A	Issued for internal review	Author	A Reviewer	N/A	2012-03-05	N/A	

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ACRONYMS

ARC-ISCW	Agricultural Research Council Institute for Soil, Climate and Water
ARI	Acute Respiratory Infections
BID	Background Information Document
CAGR	Compounded Annual Growth Rate
CAR	Co-ordinated Avifaunal Road-count
COPD	Chronic Obstructive Pulmonary Disease
CSP	Concentrated Solar Power
CWAC	Co-ordinated Waterbird Count
DEA	Department of Environmental Affairs
DNI	Direct Normal Irradiance
DTEEA	Department of Economic Development, Tourism and Environmental Affairs
EC	Electrical Conductivity
ECO	Environmental Control Officer
EDI	Electro-deionization
EHS	Environmental, Health and Safety
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EMP	Environmental Management Programme
ERM	Environmental Resources Management
GDP	Gross Domestic Product
GHG	Green House Gas
GN	Government Notice
GRU	Groundwater Resource Units

I&APs	Interested & Affected Parties
IDP	Integrated Development Plan
IPP	Independent Power Producer
NEMA	National Environmental Management Act
NERSA	National Energy Regulator of South Africa
NGOs	Nongovernmental Organizations
NGDB	National Groundwater Database
QDGS	Quarter Degree Square
RO	Reverse Osmosis
SAHRA	South African Heritage Resources Agency
SANBI	South African Biodiversity Institute
SDF	Spatial Development Framework
ToR	Terms of Reference
WUL	Water Use License

ABBREVIATIONS

%	Percent
cm	Centimetres
CO_2	Carbon Dioxide
GWh	Giga Watt Hour
ha	Hectares
kg	Kilograms
km	Kilometres
km^2	Square kilometres
kV	Kilovolt
m	Metres
mamsl	Meters above mean sea level
mbgl	Meters below ground level
MW	Mega Watts
m^2	Square meters
R	South African Rand
$	US Dollar

DEFINITIONS AND TERMINOLOGY

Alternative:

A possible course of action, in place of another, that would meet the same purpose and need (of the proposal). Alternatives can refer to any of the following but are not limited to: alternative sites for development, alternative projects for a particular site, alternative site layouts, alternative designs, alternative processes and alternative materials.

Cumulative Impacts:

Impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities (e.g. discharges of nutrients and heated water to a river that combines to cause algal bloom and subsequent loss of dissolved oxygen that is greater than the additive impacts of each pollutant). 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.

Direct impacts:

Impacts that are caused directly by the activity and generally occur at the same time and at the same place of the activity (e.g. noise generated by blasting operations on the site of the activity). These impacts are usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable.

'Do nothing' alternative:

The 'does nothing' alternative is the option of not undertaking the proposed activity or any of its alternatives. The 'do-nothing' alternative also provides the baseline against which the impacts of other alternatives should be compared.

Environment:

The surroundings within which humans exist and that are made up of:

- the land, water and atmosphere of the earth;
- micro-organisms, plant and animal life;
- any part or combination of (i) and (ii) and the interrelationships among and between them; and

- the physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and well-being. This includes the economic, social, cultural, historical and political circumstances, conditions and objects that affect the existence and development of an individual, organism or group.

Environmental Assessment:

The generic term for all forms of environmental assessment for projects, plans, programmes or policies. This includes methods/tools such as environmental impact assessment, strategic environmental assessment, sustainability assessment and risk assessment.

Impact:

The positive or negative effects on human well-being and / or on the environment.

Environmental Management:

Ensuring that environmental concerns are included in all stages of development, so that development is sustainable and does not exceed the carrying capacity of the environment.

Environmental Management Programme:

An operational programme that organizes and coordinates mitigation, rehabilitation and monitoring measures in order to guide the implementation of a proposal and its on-going maintenance after implementation.

Indirect impacts:

Indirect or induced changes that may occur as a result of the activity (e.g. the reduction of water in a stream that supplies water to a reservoir that supplies water to that activity). These types if impacts include all of the potential impacts that do not manifest immediately when the activity is undertaken or which occur at a different place as a result of the activity.

Interested and Affected Parties (I&APs):

Individuals, communities or groups, other than the proponent or the authorities, whose interests may be positively or negatively affected by the proposal or activity and/or who are concerned with a proposal or activity and its consequences.

Lead Authority:

The environmental authority at the national, provincial or local level entrusted in terms of legislation, with the responsibility for granting approval to a proposal or allocating resources and for directing or coordinating the assessment of a proposal that affects a number of authorities.

Mitigate:

The implementation of practical measures to reduce adverse impacts or enhance beneficial impacts of an action.

Scoping:

The process of determining the spatial and temporal boundaries (i.e. extent) and key issues to be addresses in an environmental assessment. The main purpose of scoping is to focus the environmental assessment on a manageable number of important questions. Scoping should also ensure that only significant issues and reasonable alternatives are examined.

Significance:

Significance can be differentiated into impact magnitude and impact significance. Impact magnitude is the measurable change (i.e. magnitude, intensity, duration and likelihood). Impact significance is the value placed on the change by different affected parties (i.e. level of significance and acceptability).

It is an anthropocentric concept, which makes use of value judgments and science-based criteria (i.e. biophysical, social and economic).

Stakeholder engagement:

The process of engagement between stakeholders (the proponent, authorities and I&APs) during the planning, assessment, implementation and/or management of proposals or activities.

Arriesfontein Solar Thermal Energy Power Plant

SCOPING REPORT

1. EXECUTIVE SUMMARY

SolarReserve SA (Pty) Ltd., proposes to construct and operate the proposed Arriesfontein Solar Power Park in the proximity of Danielskuil in the Northern Cape. As such, SolarReserve has appointed the independent WorleyParsons RSA to conduct the scoping and the EIA for the proposed project. The general project details are contained in table 1 below.

Although this report provides a description of both the PV and CSP developments, this report is focused on the CSP development.

Table 1: Project Overview

Requirement	Details
General Solar Power Park Information	
Description of all affected farm Portions	The Farm Arriesfontein 267 Barkley Wes RD
Geographical Co-ordinates	S28.28808 E23.78031
Photos of areas that give a visual perspective of all parts of the site	Site photographs contained in **Appendix A**
Generation capacity of the facility as a whole at delivery points	Generation capacities estimated around 75 MW as per the IPP application lodged with Eskom for grid connection. The final plant capacity will be determined during the detailed design stage. 3 Phases of PV Plants are proposed for the development.
Solar Power Generation Technology	The Solar Power Park will incorporate Photovoltaic Power Generation technology.
Solar Park Development	The project will be developed in four phases as follow : – Phase 1: PV Development 1: 75 MW – Phase 2: PV Development 2: 75

Requirement	Details
	MW – Phase 3: PV Development 3: 75 MW This Application – Phase 4: CSP Development 100MW **The phases will not be developed in chronological order. This report only pertains to the PV development.**
Photovoltaic (PV) Developments (Separate Scoping Report)	
PV design specifications	Three 75 MW PV blocks (phases) with a panel surface area of approximately 150 ha each that converts sunlight to electrical DC currant. The DC currant will be distributed to an inverter and transformer which will feed power into the grid network. The final design specifications will be finalised prior to the EIAR phase.
Type of technology	PV panel technology will be determined during EIA phase
Structure heights	PV panels will be 3 m high from the ground.
Surface area to be covered	Each PV block (phase) will require 150 Ha .Approximately and 450 ha in total for all three PV block (phases).
Structure orientation	Three rectangular 75 MW PV power blocks with inverter and transformer collection.
Laydown area dimensions	This will be concluded during the EIA Phase.
PV Generation capacity	The total generation capacity for the PV will be 225 MW. For scoping purposes estimation was used. A more accurate capacity to be provided when plant designs have been finalised.
The Concentrated Solar Plant (CSP) Development (separate Scoping Report)	
Power park design specifications	A circular heliostat field with a mirror reflective surface area of approximately 1 100 000 m3, that reflects the sunlight to the approximately 200 m high central receiver tower, where the heat transfer fluid, molten salts, is heated up. A thermal energy collection and storage system with molten salt loop and hot and cold salt storage tanks harnesses the

Requirement	Details
	heat utilised in the steam generation system, which drives the steam turbine generator. The final design specifications will be finalised prior to the EIAR phase. The power plant will be dried cooled.
Type of technology	CSP, Central Receiver Tower, with molten salt as heat transfer fluid
Structure heights	Tower/receiver approximately 200 m high, heliostats between 12 and 15 m, pylons approximately 32 m high.
Surface area to be covered	Approximately 600 ha / 6 km2 for the CSP
Structure orientation	Central tower and power block with a circular heliostat field and three PV blocks.
Laydown area dimensions	This will be concluded during the EIA Phase.
Assembly Plant Dimensions	Approximately 3 000 m2 (200 m x 15 m)
Generation capacity	325 MW For scoping purposes estimation was used. A more accurate capacity to be provided when plant designs have been finalised.

An Environmental Impact Assessment (EIA) application was lodged with the Department of Environmental Affairs (DEA) in terms of the National Environmental Management Act (Act 107 of 1998) (NEMA) and the EIA Regulations. The EIA process will determine the potential impact of the facility and whether it can be sustainably constructed and operated by negating potential negative impacts through the identification and implementation of suitable mitigation measures.

The proposed project aims to utilise the abundant and renewable solar resource to generate electricity and effectively create Green House Gas emission saving, whilst creating employment, skills development opportunities and stimulating the local and national economies. The experience and expertise of the proponent and the successes with similar projects worldwide will introduce new technology and create knowledge and develop new skills in the country.

This Scoping Report provides the background to the project, describes the site, introduces the proposed technology and alternatives and identifies possible impacts on the environment. It also outlines the Public Participation Process that was followed, presents the Plan of Study for EIA that will be adopted during the EIAR phase and makes recommendations to be considered during the EIAR process.

2. INTRODUCTION

The ever increasing and growing demand for energy as well the need to find more sustainable and environmentally friendly energy resources have prompted developers to explore new energy generation options.

In an effort to utilise renewable energy resources, SolarReserve SA (Pty) LTD is proposing to construct a 325 MegaWatt (MW) Solar Power Park on the Farm Arriesfontein 617, Gordonia RD, Siyanda District Municipal Region, comprising of both Photovoltaic (PV) and Concentrated Solar Power (CSP) Technology. This report only deals with the PV developments. The proposed development site is situated an approximate 32 kms outside of the town Danielskuil (refer to Figure 2). The development site is located within the institutional boundaries of the Kgatelopele Local and Siyanda District Municipalities.

In terms of the Environmental Impact Assessment ("EIA") Regulations (August 2010) promulgated under Sections 24 and 24D of the National Environmental Management Act (Act No. 107 of 1998) [NEMA] various aspects of the intended development are considered listed activities which may have an impact on the environment, therefore requiring authorisation from the National Department of Environmental Affairs (DEA) prior to the commencement of such activities.

SolarReserve SA (Pty) LTD (the applicant) has appointed Worley Parsons RSA as independent Environmental Assessment Practitioners to the project in fulfilment of legislative requirements in support of an application for Environmental Authorisation

2.1 Project Overview

SolarReserve SA (Pty) Ltd. (hereafter referred to as SRSA), intends to construct and operate a Photovoltaic (PV) technology in the Kgatelopele Local Municipality, in the Northern Cape. The proposed Arriesfontein Solar Power Park entails the construction and operation of one CSP development, three PV developments, associated infrastructure and services for the provision of renewable electricity to the national power grid. This report relates to the PV Phase 1 development.

This Greenfields project entails the transformation of agricultural land to accommodate the proposed plant, associated infrastructure and services. The infrastructure and structures for the proposed project includes but is not limited to inter alia:

- A collector field consisting of approximately between 10 300 and 17 500 dual-axis tracking heliostats, each approximately between 64 m2 - 116 m2, providing approximately 1 200 000 m2 of reflective surface area;
- An approximately 200 meter tall slip-form concrete tower and thermal receiver rated at approximately 565 MW thermal (MWt);
- A thermal to electric power block with an approximately 115 MW reheat and multiple extractions high temperature subcritical steam turbine and generator;
- Two molten salt thermal storage tanks;
- An air-cooled condenser and/or a cooling tower for the steam cycle in order to minimise the consumption of water;
- Water reticulation and purification works. This includes water reticulation from the Sedibeng Bulk Water Supply Pipeline for industrial water use, and a water treatment and purification system to provide water for both domestic and process use;
- Sewer reticulation and treatment works;
- An evaporation pond consisting of three compartments with a combined area of approximately 8.0 ha, to completely contain all rejected water from the water treatment system and the steam cycle;
- Roads and storm water infrastructure;
- Two liquid gas auxiliary burners for start-up;
- Two emergency diesel generators;
- Substation of approximately 100 m x 100 m and overhead power lines;
- Construction camp - accommodation and sanitation facilities for approximately 600 people ;
- Administrative and office buildings;

- Visitors centre;
- Equipment and materials lay down area;
- Assembly Plant;
- Concrete batching plant;
- Vehicle workshops and wash bays;
- Fuel storage area;
- Temporary general waste storage facility; and
- Hazardous material storage facility.
- Three 75 MW PV Developments of 150 ha each
- DC-AC current inverters and transformers

Prior to the commencement of any construction activities it is required that all required environmental authorizations be obtained in relation to all the relevant national legislation.

2.2 Purpose of this Report

This Scoping Report has been compiled as part of the EIA process in accordance with the regulatory requirements stipulated in the EIA Regulations (2010), promulgated in terms of Section 24(5) of the National Environmental Management Act (NEMA) (Act No. 107 of 1998), as amended. This document serves to:

- Provide a description of the proposed activity.
- Provide possible alternatives for the proposed activity.
- Outline the legislative context.
- Provide a background study into the environmental setting of the proposed activity.
- Need and desirability
- Identify possible impacts of the proposed activity – positive and/or negative –on:
    - The natural environment;

- The social environment;
- The economic environment;

- Identify issues/concerns/alternatives through a Public Participation Process; and
- Provide a Plan of Study for EIA.

A number of specialist assessments were conducted specifically for this scoping report but available and applicable specialist reports were also used to identify the impacts and to determine the additional specialist studies required to address/mitigate impacts.

The following assumptions and limitations underpin the during the EIA phase.

2.3 Assumptions and Limitations

The following assumptions and limitations underpin the approach to this EIA study:

- The information received from the stakeholders, specialist assessments are current and valid at the time of the study;
- A precautionary approach was adopted in instances where baseline information was insufficient or unavailable;
- Mandatory timeframes will apply to the review and adjudication of the reports by the competent authority and other government departments; and
- No land claims have been registered for the proposed site at the onset and registration of the study.
- Due to the complexity of the technology to be implemented the Scoping Report will provide preliminary estimations on sizes and proposed infrastructure and or components. These items will only be finalised during the Environmental Impact Phase of the project. For this reason it needs to be kept in mind that all technical specifications will only be finalised during the EIAR Phase.

2.4 Structure of this Report

The Scoping Report comprises the following aspects:

- The background and description of the various elements of the project;
- The legislative context of the study;
- The details of the proponent and EAP;
- The need and desirability of the project;
- A description of the scope of the project;
- The property description of the proposed site;
- A discussion of the alternatives;
- Baseline descriptions of all the biophysical and socioeconomic aspects;
- A description of the Public Participation Process conducted for the Scoping Phase;
- Impact identification; and
- A plan of study for EIA giving a detailed impact assessment methodology and timeframes.

2.5 Details of the Environmental Assessment Practitioner

The Environmental Regulations require that relevant details and expertise of the independent Environmental Assessment Practitioners (EAP) be included in the scoping report. The appointed EAPs for this study are WorleyParsons RSA (Pty) Ltd. The latter was appointed only to conduct the specialist studies for the EIA process.

WorleyParsons RSA provides sustainable environmental solutions to challenges in all industry sectors. The group offers services covering the entire project life cycle from feasibility studies right through to maintaining environmental integrity during operations. With more than 33 years experience in South Africa, the group’s intimate knowledge of the region’s unique challenges enables it to tailor solutions to deliver maximum value to customers and apply this knowledge to the broader African and international customers. As a leading service provider to the resources and energy sectors, WorleyParsons delivers projects for its customers across the hydrocarbons, minerals & metals and power industries.

WorleyParsons employs over 1 100 people in South Africa with more than 20 offices countrywide. Our professionals also provide expertise in site assessments and audits, land use planning, environmental and social impact assessments, permitting and regulatory management, remediation planning, and environmental strategies to reduce risks and liabilities. Our international capabilities include 20 years ESHIA experience on major projects worldwide with 4 800 impact assessments worldwide.

2.6 Project Proponent

SolarReserve LLC is a Santa Monica, California-based developer and owner of utility-scale CSP projects utilizing exclusive, best-in-class technology with inherent storage capability. SolarReserve's primary focus is securing sites, transmission access, permitting, and power purchase agreements; engineering, procurement, and construction services; and securing financing for utility-scale CSP power projects.

The Company has developed a diverse portfolio of CSP projects and development opportunities that encompass 3 000 MW of project potential and approximately 25 individual sites of approximately 140 000 acres (56 000 ha), including some sites with multiple tower potential. SolarReserve holds an exclusive global license to the Molten Salt Power Tower technology developed by Rocketdyne, with the initial license term extending until 2027. SolarReserve has a development pipeline of more than 1 100 MW in Solar PV and a geographically diverse portfolio of more than 3 000 MW of CSP projects.

2.7 EIA Approach & Methodology

The proposed project entails the conducting of a mandatory EIA as required by the relevant legislation and requires four primary activities to be undertaken to ensure the successful completion of the process. These four activities form the Scope of Work for the study and are described as follow:

2.8 Background in CSP

The Molten Salt Power Tower technology, deployed by SolarReserve, has been demonstrated and refined in two demonstration projects in the late 1990s, Solar One and Solar Two. Both Solar One and Solar Two were developed jointly by the DOE, the Solar Energy Research Institute (now NREL), Rocketdyne, and a consortium of South Western Utilities.

Solar One, which operated from 1982 to 1986, was initially designed to operate as a direct-steam generation technology, similar to that being pursued by other CSP providers in the market today (i.e., solar energy is transferred directly to water circulating through the central receiver and the resulting steam flows directly to a steam turbine). Even with an oil and stone based thermocline storage tank, Solar One suffered from operational issues during periods of cloud cover and inclement weather. The thermal storage system could not respond fast enough to rapidly changing solar conditions and the loss of solar energy even during brief intermittent cloud cover degraded the steam quality enough to interrupt plant operation.

As researchers knew that certain high temperature liquids can efficiently and cost-effectively store thermal energy, it was proposed that the DOE support a successor named Solar Two to test a receiver using molten salts as the thermal transfer fluid. The thermal storage system would be tested for continuous operation over successive 24-hour periods and also to be “dispatched” during peak demand periods. In addition, the demonstration facility would target more effective operational performance compared to the operating challenges of the more weather affected direct-steam based Solar One facility.

The molten-salt receiver used in the Solar Two demonstration facility was designed and manufactured by the aerospace and advanced power system engineering teams at Rocketdyne, then an affiliate of The Boeing Company and subsequently acquired by UTC in 2005.

Following the successful demonstration of the Rocketdyne-designed and built CSP molten salt receiver and associated systems on Solar Two and its inclusion in UTC’s Pratt & Whitney division in 2005, Rocketdyne –via UTC’s Hamilton Sundstrand subsidiary, which took initial responsibility for Rocketdyne’s advanced energy activities following Rocketdyne’s entry into UTC – entered into negotiations with US Renewables Group on the establishment of a company focused on the commercial deployment of this key CSP technology. This culminated in the first Exclusive License Agreement between Hamilton Sundstrand and the newly formed SolarReserve, LLC in December of 2007.

In 2009, Rocketdyne's advanced energy activities were reorganized into Pratt & Whitney Rocketdyne, Inc. (joining Rocketdyne's propulsion systems activities already organized within Pratt & Whitney). As a result, SolarReserve, Hamilton Sundstrand, and Rocketdyne entered into negotiations on the transfer of SolarReserve's agreements with Hamilton Sundstrand to Rocketdyne, concurrently with the transfer of responsibility for Rocketdyne's CSP activities from Hamilton Sundstrand to Rocketdyne. These discussions culminated in the execution of the Amended and Restated Exclusive License Agreement (the "ELA") dated January 7, 2010 with Rocketdyne, whereby Rocketdyne licenses to the Company the rights to use, sell, and market the intellectual property of Rocketdyne associated with CSP technology using a molten salt thermal energy storage and delivery system following the assignment by Hamilton Sundstrand to Rocketdyne of the 2007 license agreement. The ELA also sets out the terms in which Rocketdyne grants SolarReserve the exclusive right to use, sell, market, and manufacture Rocketdyne's heliostat technology.

Since SolarReserve' formation in 2007, the Company has worked closely with Rocketdyne to advance the commercial-scale design and project implementations of the Molten Salt Power Tower technology, heliostat technology, collector system and balance of plant design.

As many as 100 Rocketdyne professionals – comprising engineers, technical specialists and other personnel – have been deployed at various times in support of this program on a full-time equivalent basis. This deep base of highly skilled technical expertise has considerably leveraged SolarReserve's access to advanced engineering and technological resources in advancing its CSP projects.

2.8.1 EIA Process Development and Initiation

It is required that proper planning be conducted in order to ensure that the EIA is conducted according to the legislative requirements and that the process is sound. In order to develop a sound EIA process it is required that an extensive legal gap analysis is conducted and a proper program developed, scheduling all the required activities. The initiation of the EIA process must involve consultation with institutional stakeholders in order to identify potential impacts, alternatives and key burning points relating to the project early in the process. During the initiation of the EIA it is important that the project alternatives are identify and assessed.

2.8.2 The Scoping Process

The Scoping process must involve the identification of key issues, concerns, alternatives and impacts, over and above what was identified and assessed during the initiation phase. The vehicle for this process is the public participation process (PPP), whereby Interested and Affected Parties (I&APs) has to be identified and engaged with to exchange information and to establish a platform of engagement. The information needs to form the basis from which to prepare the Scoping Report (SR) as well as the various terms of reference for the required Specialist Studies. The environmental baseline needs to be determined from which to assess the likely impacts of the proposed development. Issues raised in the course of scoping must be presented in both the Scoping Report and the Issues and Response Report (I&RR).

2.8.3 Detailed Impact Assessment

The impacts, alternatives and issues identified during the scoping needs to be assessed during this phase of the process by means of the identified specialist assessments. Mitigation measures must be proposed and the likely residual impacts highlighted in the Environmental Impact Assessment Report (EIAR). It is crucial that the PPP be continued throughout this phase as well in order to involve I&APs and ensure transparency in the reporting.

2.8.4 Environmental Management Programme

A crucial aspect of the EIA process is the formulation of the Environmental Management Programme (EMP). This programme must be contained within the Environmental Impact Assessment Report and is a concurrent activity to the Detailed Impact Assessment phase of the project. It must state the actions to be implemented during the construction, operation and decommissioning phases of the proposed project in order to achieve the mitigation targets.

2.8.5 Approach to the Study

A systematic approach will be adopted for the successful completion of the EIA in line with the regulated process. The diagram in Figure1 below indicates the sequential process that will be followed for this study.

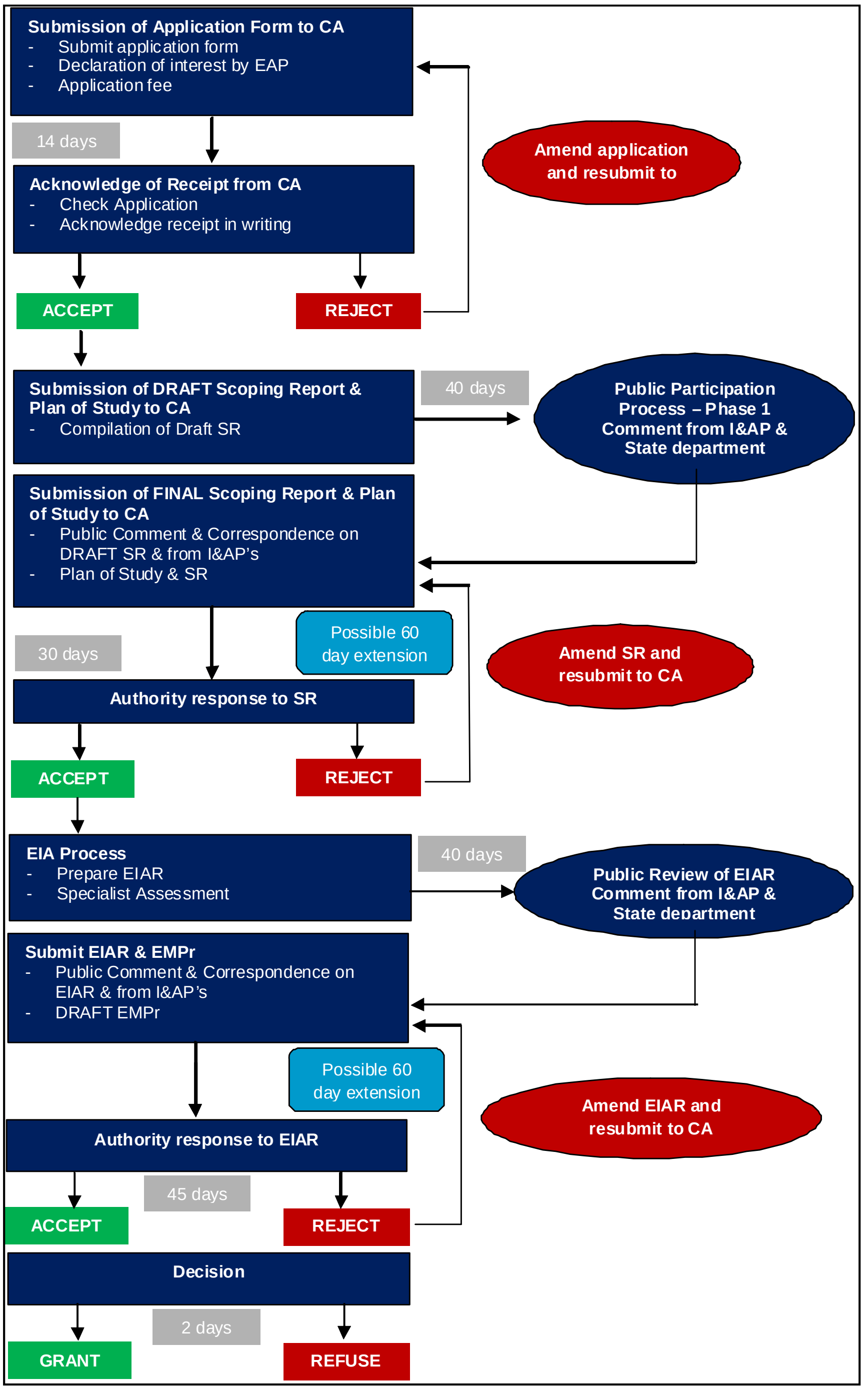


Figure 1: EIA Process

3. Project Description

The proposed development of Renewable Energy (RE) projects aims to introduce both PV and CSP technology to the area. The proposed PV Plant development will entail the installation and operation of three 75 MW (megawatts) photovoltaic (PV) power blocks with a combined projected output of approximately 225 MW, whereas, the proposed CSP plant, will entail the construction and operation of a central receiver tower plant with a projected output of up to 100 MW. This report only relates to the PV Phase 1 Plant although the potential development is described.

The site for the proposed project is the Farm Arriesfontein 267 Barkley Wes RD, approximately 32 km southeast of the town of Danielskuil, as indicated in **Figure 2**, and falls within the jurisdiction of the Kgatelopele Local Municipality of the Siyanda District. The project will be capable of producing approximately 325 MW). It is envisaged that the Solar Park will be operated as a mid-merit or base load plant. The power plant will utilise either hybrid or dry cooled technology, dependent on the detail design of the project the project will be developed in three phases as follows:

- Phase 1: PV Development 1: 75 MW
- Phase 2: PV Development 2: 75 MW
- Phase 3: PV Development 3: 75 MW
- Phase 4: CSP Development 100MW

The above phases will not be developed in chronological order but will be developed as determined by the applicant.

The CSP Technology proposed for the Solar Park is the use of a central receiver tower which is equipped with an integrated thermal storage system. The proprietary receiver and storage components are provided through an exclusive license with United Technologies Corporation's subsidiary Hamilton Sundstrand Rocketdyne ("UTC" or "Rocketdyne"). The integrated salt storage technology proposed was demonstrated successfully at the SolarReserve LLC's Solar

Two facility in Barstow, CA (built and operated jointly by the US Department of Energy and Rocketdyne) in the late 1990's.

SolarReserve's CSP technology generates power from sunlight by focusing the sun's thermal energy from the heliostat field i.e. sun tracking mirrors onto a central receiver tower. The liquid salt is circulated through tubes in the receiver, collecting the energy of the sun. Once the liquid salt has been heated to a temperature of 560 degrees Celsius it is routed to an insulated storage tank i.e. the "hot" tank, where it can be stored with minimal energy losses. The heated, molten salt is routed from the "Hot" tank to a heat exchanger for the production of energy. Steam is produced by the heat exchanger and expanded through the standard Rankin cycle steam turbine which rotates a generator to produce electricity.

The molten salt is hereafter circulated back to the "cold" storage tank and the cycle repeated. Due to the energy storage ability of the proposed technology, a CSP plant of this nature, sized at 100 MW, can generate electricity for up to 24 hours a day during the summer months and between 12 to 16 hours a day in the spring, autumn and winter months. The proposed plant will utilise hybrid cooling technology to condense the water used during the steam cycle. Implementing this cooling technology allows for the use of considerably less water compared to that of a wet cooled solar thermal power plant.

SolarReserve's photovoltaic (PV) systems produce energy by converting solar irradiation into electricity. PV facilities use PV panels comprising many individual cells which absorb solar energy. The PV cells are commonly constructed from silicon and linked together behind a glass sheet (for protection) and they operate as a single combined PV panel.

This excites electrons inside the cells and produces DC electricity no emissions. In fact they are just larger versions of the cells used in solar calculators. The front surface of the solar Panel is toughened glass with an anti-reflective coating to maximise the light captured by the solar cells. From the front, the Panels look predominantly black in appearance, though from close-up a grid of silver contacts is visible. Panels are framed with anodised aluminium, and will be mounted as sub-arrays on frames of anodised aluminium and hot-dipped galvanised steel. Please refer to **Section 3.2** bellow for the detailed description of how the PV technology produces electricity.

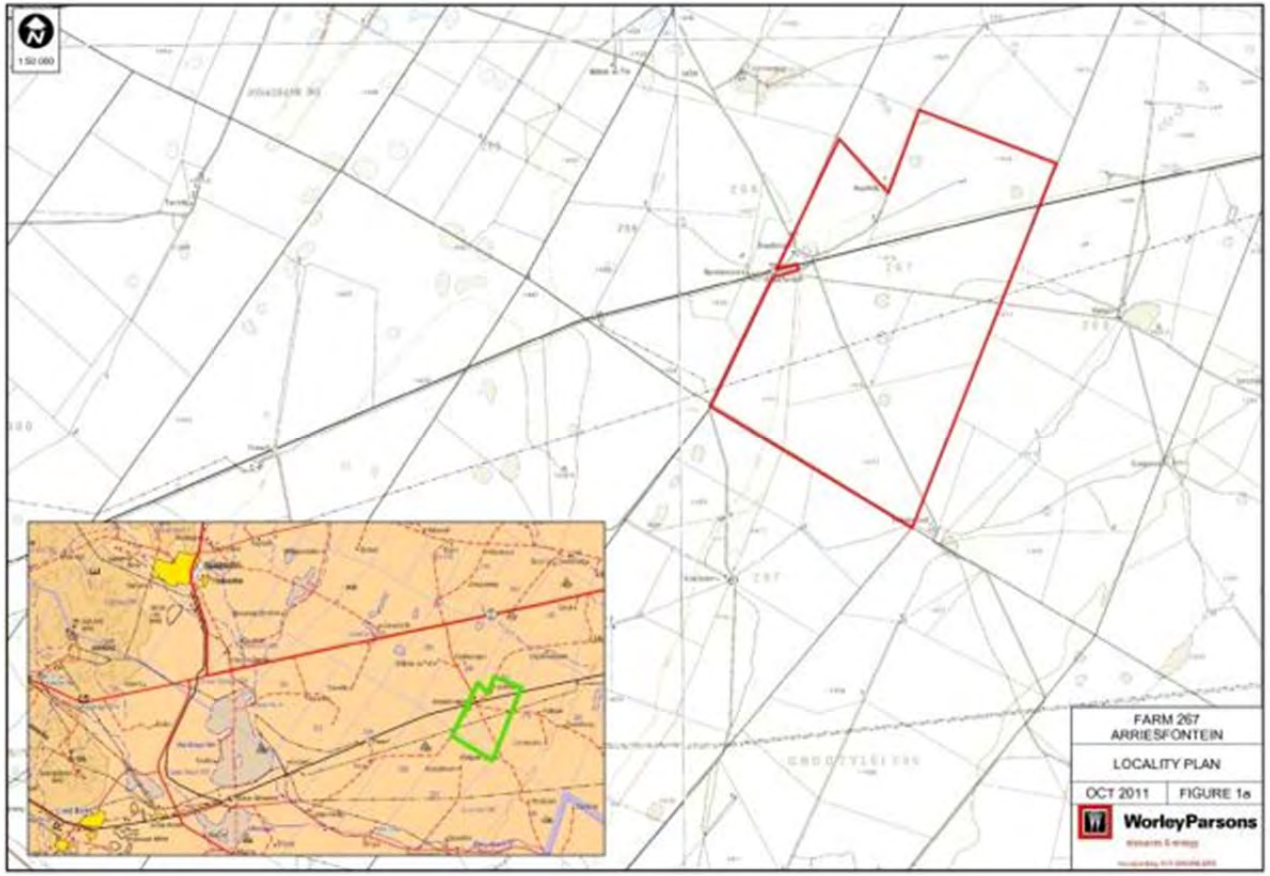


Figure 2: Locality Map

3.1 The Concentrated Solar Thermal Power Plant

The CSP plant (**Figure 3**) primarily comprises of four subsystems as summarised below:

- Solar Field - consists of all services and infrastructure related to the management and operation of the heliostats;
- Molten Salt Circuit - includes the thermal storage tanks for storing the hot and cold liquid salt, a concentration tower, pipelines and heat exchangers;
- The Power Block – consists of inter alia the steam turbine is where the electricity is generated; and
- Auxiliary facilities and infrastructure - includes the condenser-cooling system, electricity transmission lines, a grid connection, access routes, water supplies and facility start-up energy plant (gas or diesel generators).

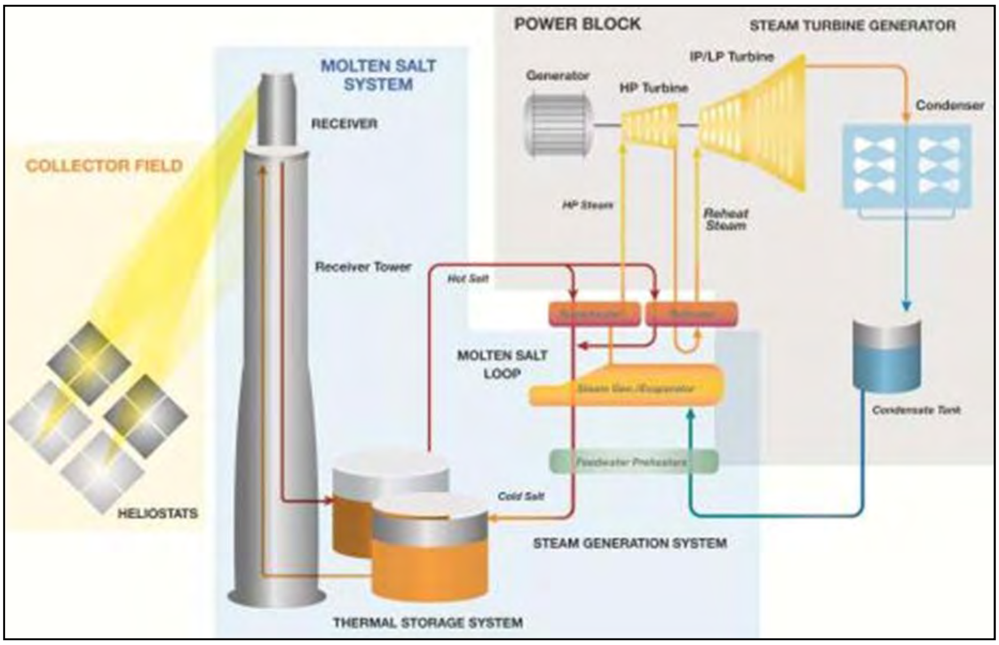


Figure 3: Process flow of a typical Solar Thermal Energy Power Plant operation

It is anticipated that the construction of the plant would stretch over a 30 month period and that more than half of the total capital project costs could potentially be spent in South Africa on procurement of local materials, services, and labour. It is envisaged that the project will make a notable contribution towards the achievement of the job creation targets set in the

New Growth Path by creating employment opportunities throughout the country during the peak of construction and sustainable employment opportunities during operations.

3.2 The Solar photovoltaic (PV) systems

The Solar Photovoltaic (PV) systems produce energy by converting solar irradiation into electricity. The PV system consists of PV panels that hold the Solar Cells. Solar Cells are solid-state semiconductor devices that convert light into direct-current electricity. The top layer of the silicon portion of a solar panel is made from a mixture of this silicon and a small amount of phosphorous, which gives it a negative charge. The inner layer, which constitutes the majority of the panel, is a mix of silicon and a little bit of boron, giving it a positive charge. The place where these two layers meet creates an electric field called a junction. When light (or photons) hits the solar cell, before it gets to the silicon crystal to make electricity it passes through a glass cover on the panel and an anti-reflective coating, which stops photons from reflecting off of the panel and being lost. The photons are absorbed into the junction, which pushes electrons in the silicon out of the way (See **Figure 4** below). If enough photons are absorbed, the electrons are pushed past the junction and flow freely to an external circuit.

To convert the Direct Currant (DC) to Alternating Current (AC) an inverter will be used. The AC energy can then be used to power anything that uses electricity. In fact they are just larger versions of the cells used in solar calculators. The front surface of the solar panel is toughened glass with an anti-reflective coating to maximise the light captured by the solar cells and reduce glare back towards the atmosphere. The PV panels are predominantly black in appearance – when viewed directly from the front; however from close-up, a grid of silver contacts is clearly visible. Panels are framed with anodised aluminium, and will be mounted as sub-arrays on frames of anodised aluminium and hot-dipped galvanised steel. **Figure 5** bellow is a diagram of typical PV development.

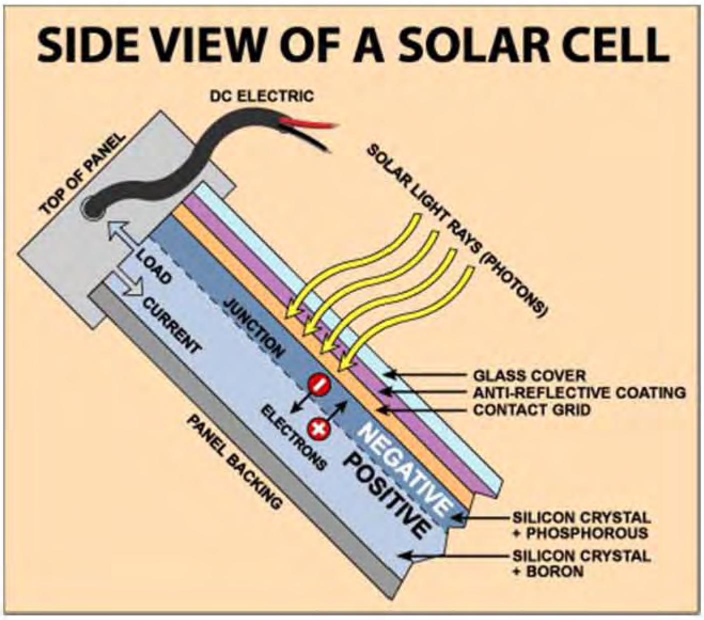


Figure 4: Illustration of a Typical PV Cell

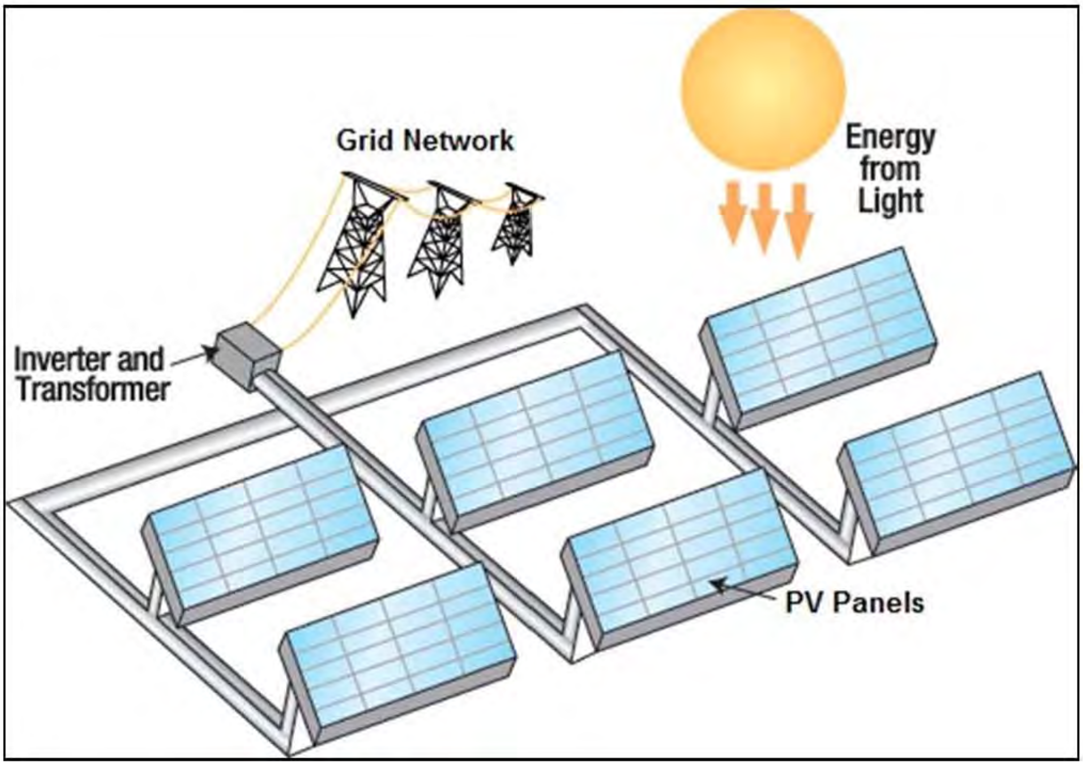


Figure 5: Diagram Typical PV Development

In large solar parks the solar panels are configured in banks of sub-arrays. These blocks are spaced both to allow access and to ensure that one sub-array does not cast a shadow over the arrays behind. The electricity generated is connected to the national grid through various switchgear, and protection devices.

3.2.1 Principal PV Components

The PV development will consist of three 150 ha PV blocks (phases) that will occupy a total of 450 ha of the site area. Each PV block (phase) will produce 75 MW of power. The panels will be situated in long rows extending across the site. It is anticipated that as each phase of the facility is completed, it will feed electricity into the national power grid. Once all three phases are constructed, the PV development will have an installed capacity of 225 MW.

The key components of the proposed solar power park include the following:

- PV solar Panels and arrays;
- PV Panel mountings;
- DC-AC current inverters and transformers; and
- Underground cabling / overhead power lines.

This is subject to change through the EIA process based on environmental constraints.

PV panels are typically up to 6 m2 in size and the rows will be approximately 1 km in length, made up of approximately 100 m sections depending on the optimal final design and layout of the development. The panels will be mounted on metal frames with a maximum height of approximately 3 m above the ground, supported by rammed, concrete or screw pile foundations, and they will face north in order to capture the optimum amount of sunlight.

Figure 6: PV Panel Foundation Construction

The facility will either be a fixed PV plant where the solar panels are stationary; or a tracking PV plant where the solar panels rotate to track the sun's movement (the exact type of PV plant system will be determined following on-site solar resource modelling and detailed development design). **Figure 8** shows a typical array of PV panels.

Figure 7: Completed PV Panel Mounting

Figure 8: Completed PV Panel Structures

The inverters, switchgear and other electrical equipment are standard items as used for a wide range of industrial applications.

The other major operating component of the system is the inverter, which converts the DC power produced by the solar modules into AC power before being sent to the grid. Each PV Park will have approximately 40 separate inverters, each handling a part of the overall solar array.

Figure 9: PV Panel Inverters

3.2.2 Ancillary PV Infrastructure

Additional infrastructure that will be required for the project includes the following:

- one or more meteorological stations to collect data on the solar resource;
- a small site office and storage facility, including security and associated facilities;
- security system- closed circuit video-surveillance system;
- site fencing;
- temporary construction camp (to house up to 300 people); and
- a lay-down area for the temporary storage of materials during the construction activities.

3.3 Construction Overview

It is anticipated that a temporary contractor's housing facility will be utilised for the duration of the PV and CSP construction period. It is estimated that in total approximately 600 persons will be employed by the facility – over the estimated 30 month construction period. Habitation will be staggered over this period and the maximum number of persons housed at any given time will not accrue to 600 but the estimated numbers will be confirmed during the detailed EIA phase. It is proposed that temporary/portable housing, ablution and sewer treatment facilities be procured from external service providers.

Potable water for domestic use at the facility will be sourced from Vaal Gamagara Pipeline. Wastewater and sewage will be treated with the use of a modular sewer treatment plant with capacities to be confirmed during the EIAR phase.

Primarily construction will entail amongst other the following activities:

- Site establishment and the construction of access roads and services;
- Site clearing and heavy earthworks; and
- Construction and assembly of the tower, buildings, heliostats and infrastructure
- Construction and assembly of the PV Systems, inverters and transformers

3.4 Operation Overview

3.4.1 The CSP Development

In simplified terms operation entails the production of power through the conversion of solar energy to electricity. The inputs into the CSP plant during operations include:

- Solar radiation;
- Water;
- Salt; and
- Consumables, including but not limited to:
    - Diesel;
    - spare parts and equipment;
    - hydraulic fluids;
    - chemicals;
    - lubricants; and
    - detergents.

The products/outputs from the plant includes inter alia:

- Power;
- Solid waste (hazardous and non hazardous); and
- Liquid waste or effluent (hazardous and non hazardous).

The four primary subsystems of the plant each comprises of a number of activities, systems and cycles and has to work in unison to produce power and each of these subsystems has to be kept and maintained in good working order to ensure that the power production is constant without any downtime during crucial operating hours. Although much of the plant and operations are automated operators and maintenance staff will be required to ensure that the plant is well maintained and functions optimally.

Operation of the facility will entail the regular maintenance of the site and infrastructure, management of waste facilities and the replacement of consumable items and/or damaged equipment to ensure that the plant operates optimally. This maintenance will as far as possible be scheduled to times that the plant is not operational to improve productivity. Unscheduled repairs and maintenance will likely occur as a result of breakdowns and emergency situations.

3.4.2 The PV Developments

In simplified terms operation entails the production of power through the conversion of solar energy to electricity. The inputs into PV phase during operations include:

- Solar radiation;
- Water;
- Consumables, including but not limited to:
    - spare parts and equipment;
    - detergents.

The products/outputs from the plant includes inter alia:

- Power;
- Solid waste (hazardous and non hazardous); and
- Liquid waste or effluent (non hazardous).
- Waste water from washing of PV panels.

Operation of the facility will entail the regular maintenance of the site and infrastructure, management of waste facilities and the replacement of consumable items and/or damaged equipment to ensure that the plant operates optimally. This maintenance will as far as possible be scheduled to times that the plant is not operational to improve productivity. Unscheduled repairs and maintenance will likely occur as a result of breakdowns and emergency situations.

3.5 Technology Overview

SolarReserve LLC has the exclusive world-wide license with Rocketdyne for the molten salt, central power tower technology that was demonstrated at the 'Solar Two' power plant in California. **Figure 10** below indicates the central receiver technology.

The DOE made the following statement shortly after Solar Two was decommissioned:

"The 10 megawatt Solar Two power tower pilot plant near Barstow, California, successfully completed operations in April, 1999, having met essentially all of its objectives. Over the three-year operating lifetime, daily operation of Solar Two became relatively routine, with various performance records broken on a fairly regular basis". US Department of Energy" - Sunlab Snapshot, March 2000. The project is a 'Central Receiver Tower' design, consisting of "heliostats" (large mirrors) which reflects the rays of the sun onto a receiver at the top of a central tower.

The Solar farm will consist of the following main components:

- Three 75 MW PV power blocks
- DC-AC Inverters and Transformers
- Central 200 meter concrete slip-form tower;
- 24 Panel Receiver with thermal rating of 530 MW;
- Circular field of approximately 17 150 dual-tracking heliostats, each approximately 65 m2, creating a 1 100 000m2) reflection surface area ;
- A 105 MW Rankin Cycle condensation turbine with a reheating cycle and with an axial exhaust and uncontrolled extractions for generating electricity;
- Thermal storage tanks for storing the hot and cold molten salts;
- A system of air-cooled condensers designed to minimise the consumption of water;
- Water reticulation from the Vaal Gamagara Pipeline for industrial water use, and a water treatment system to provide water that will be treated for both domestic and process use.

- One evaporation pond with three compartments with a combined area of approximately 7 ha, to process all wastewater discharge including but not limited to the water treatment system and oil water separator;
- Two emergency 3.0 MVA diesel generators;
- Two x 25 MW Liquid gas auxiliary burners(or one diesel boiler)for start up;
- Associated equipment such as: pumps, transformers, exchangers and construction buildings; and
- The associated electrical substation, an electrical connection line, road access and water supply pipes.

The general operation of the planned solar thermal power generation plant is summarised in the **Figure 3** above.

The receiver and the molten salt circuit will be provided through an exclusive licence with Rocketdyne. There are many benefits of this unique technology, listed below are only a few:

- This technology is in the early stages of commercialization, placing South Africa in the ideal position to capitalise on the opportunity to create a world leading business in the fields of Research and Development (R&D), support, manufacturing, implementation, construction, financing, equity participation, operation and maintenance;
- Achieving South Africa's commitment to reducing greenhouse gas emissions though the implementation of world leading technology;
- Have the opportunity to partner with a world leading technology developer and backed by one of the premier technology companies in the world; and

Because the molten salt stores energy, the energy collection and generation are de-coupled, so the stored energy can be extracted to produce electricity upon demand. The capability to store energy provides flexibility to generate electricity in large quantities for short periods of time or in smaller quantities over longer periods of time, thereby matching the seasonal and varying electricity demands of the state.

Figure 10: An example of a power plant using central receiver technology. This is the Solar Two 10MW demonstration plant that was built in the United States (image courtesy NREL).

3.6 Water Supply and Use

SRSA has made a conscience decision to ensure all of its power plants are either hybrid and or dried cooled. SRSA has investigated various options in securing water for its power plant. The sources of the water supply and water treatment requirements are outlined in this section.

SRSA has obtained permission to abstract water from the Vaal Gamagara Pipeline from the Sedibeng Water Authority.

The alternative will be investigated of utilising boreholes as a source of water. Geohydrological assessments will determine whether this is a viable option and determine the number of boreholes required based on their yields. It is required that each borehole should have sufficient capacity to supply water for the plant needs throughout the expected operational life of the plant.

Water will be delivered to a large raw water storage tank, also used to provide site fire protection water, and water for the potable water system. Raw water is pumped from the storage tank to the water treatment system for demineralized water production. The Solar Park will require approximately 380 000 m3 per annum of raw water. Most of the water will be utilised by the CSP Plant.

The water treatment process includes two multi-stage Reverse Osmosis (RO) units, and electro-deionization (EDI) equipment. Pure demineralized water from the process is pumped into a separate demineralized water storage tank. Demineralized water is added to the de-aerator for steam plant makeup, for steam cycle blowdown quench water, and for heliostat washing. Waste water from water treatment system, including 1st pass RO reject and EDI, as well as a portion of the steam cycle blowdown are discharged to the evaporation ponds.

The plant will have a raw water tank with an anticipated capacity of approximately 10 000 m3. The major portion of the raw water is for plant use while a smaller portion of the raw water (2 500 m3) will be reserved for fire water. The project will operate (generate electricity) an average of about 10-18hours per day, 7 days a week throughout the year, with the exception of scheduled shutdowns for maintenance. However, the water treatment plant will operate an average of approximately 60 percent of each day, in order to minimize water treatment system size and capital cost, and to use off-peak energy at night.

The required Water Use License (WUL) from the Department of Water Affairs (DWA), required in terms of Section 21 of the National Water Act (Act 36 of 1998) is in process of being applied for.

3.7 Waste management

Waste management is the process whereby all wastes produced at the proposed plant are firstly minimised or reduced, properly collected, treated (if necessary), re-used and disposed of as a final resort. Wastes include process and sanitary wastewater, nonhazardous waste and hazardous waste, both liquid and solid.

3.7.1 Liquid waste

3.7.1.1 The CSP Development

- **Wastewater Collection, Treatment, and Disposal**

The primary wastewater collection system will collect process wastewater from all of the CSP plant systems, including the boiler and steam system drains and water treatment process equipment. To the extent practicable, process wastewater will be recycled and reused to reduce the amount of effluent generated and disposed of.

The aggregate discharge from this waste stream will be sent to double-lined evaporation ponds where the water will be retained on site to evaporate, leaving solid waste constituents behind. The anticipated volume of effluent disposed of in the evaporation ponds amount to approximately 4 m3/h. The plant will include a potable water treatment system to treat raw water to potable quality water for personnel health, safety and sanitary uses around the facility. The system will be sized to accommodate between 40 and 60 operations and maintenance personnel.

- **Plant Drains and Oil/Water Separator**

General plant drains will collect containment area wash down, sample drains, and drainage from facility equipment drains. Water from these areas will be collected in a system of floor drains, hub drains, sumps, and piping and routed to the wastewater collection system. Drains that potentially could contain oil or grease will first be routed through an oil/water separator. Water from the plant wastewater collection system make up a portion of the waste disposed of in the evaporation ponds.

- **Boiler Blowdown**

The boiler blowdown stream consists of water purged continuously from the boiler during normal operations in order to control the concentration of dissolved solids, silica and pH in the boiler following accepted practices and guidelines for corrosion control. Boiler blowdown flow is purged directly from the boiler steam drum and discharged to a flash tank. Demineralised water is injected into the blowdown flow to limit the temperature of (quench) the blowdown water in order to prevent rapid flashing and over-pressurization when the blowdown water reaches the flash tank which is vented to atmospheric pressure.

The flash tank collects and retains a minimum volume of water and drains excess volumes in equilibrium discharging to the evaporation ponds in a relatively continuous flow. When the power plant is operating normally under steady-state conditions, cycle feed water makeup rate and boiler blowdown rate is equal. Flows may vary during transient conditions such as start up, load-changes and shut-down.

3.7.1.2 The PV Developments

- **Wastewater Collection, Treatment, and Disposal**

The PV developments will create a minimal amount of waste water. The source of waste water would be the water used for washing the PV panels at set intervals and surface runoff. To the extent practicable, process wastewater will be recycled and reused to reduce the amount of effluent generated and disposed of. The aggregate discharge from this waste stream will be sent to double-lined evaporation ponds where the water will be retained on site to evaporate, leaving solid waste constituents behind.

- **Sanitary Waste**

Both the CSP and PV will create sanitary waste streams will be generated at both the administrative building and at the operations building and maintenance areas within the power block. Each area will have a kitchen as well as the requisite quantity of toilets and or showers to support the crew size. At these locations, a septic tank and leach field will be used to capture and treat the flows. As and when required, the septic tank (solids holding tank) will be cleaned out by a vacuum truck and the wastes will be trucked and disposed at a licensed facility. This activity will adhere to the plant safety program as administered by plant personnel.

3.7.2 **Solid waste**

Both the PV and CSP will produce maintenance and plant wastes typical of power generation operations. Solar park wastes include oily rags, broken and rusted metal and machine parts, defective or broken electrical materials, empty containers, broken mirrors, salt that has leaked and hardened, and other solid wastes including the typical refuse generated by workers. Solid wastes will be temporarily kept on site and trucked offsite for recycling or disposal at a suitable recycling facility or licensed landfill site in the vicinity.

3.7.3 Management of Hazardous Materials and Waste

SRSA has assessed and recorded all possible hazardous materials and wastes for both the CSP and PV developments. There will be a variety of chemicals stored and used during construction and operation of the Plant. Chemicals will be stored in appropriate chemical storage facilities. Bulk chemicals will be stored in storage tanks, and most other chemicals will be stored in returnable delivery containers. Chemical storage and chemical feed areas will be designed to contain leaks and spills. Concrete containment pits and drain piping design will allow a full tank capacity spill without overflowing the containment. For multiple tanks located within the same containment area, the capacity of the largest single tank will determine the volume of the containment area and drain piping. Drain piping for reactive chemicals will be trapped and isolated from other drains to eliminate noxious or toxic vapours.

Safety showers and eyewash stations will be provided adjacent to, or in the vicinity of, chemical storage and use areas. Plant personnel will use approved personal protective equipment (PPE) during chemical spill containment and cleanup activities. Personnel will be properly trained in the handling of these chemicals and instructed in the procedures to follow in case of a chemical spill or accidental release. Adequate supplies of absorbent material will be stored onsite for spill cleanup.

Several methods will be employed to properly manage and dispose of hazardous wastes generated by the Plant. Lubricating oil will be rigorously analyzed to ensure maximum equipment reliability and operational life. When end-of-life lubricating oil is replaced, the spent oil will be flushed from the system and recycled by a properly licensed waste oil recycling contractor. Spent lubricating oil filters will be changed at the appropriate frequency and disposed of in a Class H landfill. Salt spills from the CSP system or salt samples extracted pose no significant concerns with respect to hazardous waste. As such, any salt handled outside the closed salt circulation and storage systems will be treated as a controlled substance in terms of the relevant regulations. Plant personnel and maintenance workers will be trained to handle hazardous wastes generated at the site in accordance with all applicable regulations and protocols.

3.7.4 Waste Management Licensing

The Solar Park development would require a waste licence for the CSP plant infrastructure only. The most suitable locations on the property will be identified to establish the effluent evaporation ponds. The waste will be classified to ensure that the design of the ponds will be in accordance with the Minimum Requirements of latest National Regulations for Waste Disposal. The design will be submitted to the National Department of Environmental Affairs for approval. The waste management license application form, the Environmental Impact Assessment Report, design of the effluent evaporation pond will form the waste management application that will be sent to the DEA for approval and a license to be issued. The license will contain strict conditions according to which the waste should be managed at the plant.

3.8 Network Integration

Power from the solar park will be fed into the national grid. The network integration options is currently still under investigation and the final integration options will be discussed fully in the EIA report.

3.9 Property Description

The proposed development will be located on the Farm Arriesfontein 267 Barkley Wes RD (Arriesfontein). The site is situated approximately 32km from the town of Upington, and falls within the jurisdiction of the Kgatelopele Local Municipality of the Siyanda District, in the Northern Cape.

The farm owner is LCM Cloete, who is the registered title deed holder. The property is registered as follows:

Table 2: Registered Land Owner

Ownership	Property Description	Size (ha)	Title Deed Nr.
LCM Cloete	Farm 267 Barkley Wes RD (Arriesfontein)	± 1838.25	T2097/1995

3.9.1 Access Roads and Site Access

Access to the site can take place via the existing Provincial R31 road– and a short gravel road. This aspect counts in favour of the logistical components pertaining to the development of the proposed Solar Thermal Energy Power Plant. The site is approximately 160 km from Kimberly and 32 km from Danielskuil. The site is also served by several farm roads – some of which will have to be realigned to make way for the proposed development. Within the site area, existing farm tracks will be up-graded and new gravel roads may be constructed to facilitate movement of construction and maintenance vehicles. Site access roads that are developed will be up to 6 m wide with associated infrastructure including drainage trenches adjacent to the road according to the road agency guidelines.

3.10 Project Rationale

SRSA intends to invest equity in all of its projects and maintain that equity over a long period of time, for this reason SRSA has a truly vested interest in the long term success of the proposed project and the renewable energy sector as a whole. The achievement of this goal can only be realised when it is aligned with the policies, plans and targets for the sector set by the South African government.

The primary objectives of SRSA are:

- Where the parties work together to disperse knowledge;
- To create jobs in a new industry in order to position ourselves as a world leading South African industry capable of being deployed to other markets around the globe; and
- To reduce the price of electricity produced through a concerted joint R&D program which will look to improve performance and reduced the cost of installation, operation and maintenance.

The technology proposed by SRSA enables South Africa to construct, operate and maintain an efficient, economic, reliable, safe and environmentally-sound, solar-powered generating facility. The facility will help meet the regional and national objectives mandated for renewable electric energy. The site selected is located in an area where there is excellent solar resource.

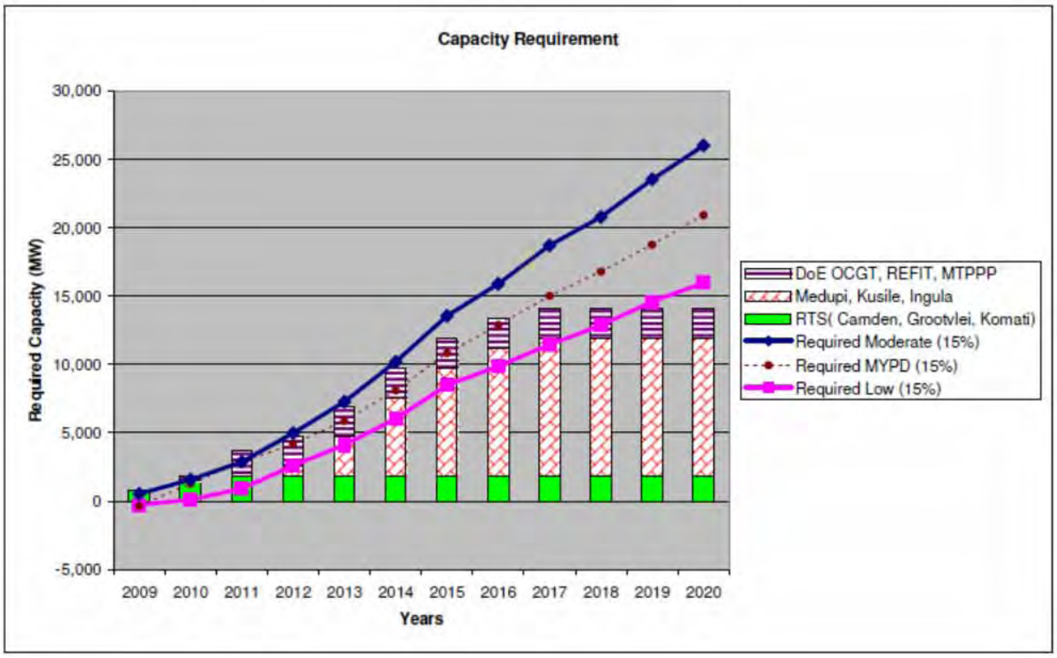
The project cost would be substantial of which could potentially be spent in South Africa on procurement of local materials, services, and labour. It is estimated that the project could create a number of jobs throughout the country during the peak of construction and about 65 sustainable employment opportunities during operations. Given the aforementioned, the project will make a notable contribution towards the achievement of the job creation targets set in the New Growth Path.

The Project is designed to meet the increasing demand for clean, renewable electrical power in South Africa. The multiple benefits associated with developing renewable energy infrastructure have been recognized by both local regional and National policy-makers. Development of solar resources reduces reliance on foreign sources of fuel, promotes national energy security, diversifies energy portfolios and contributes to the reduction of greenhouse gas emissions at the same time creating a large number of jobs within a new industry at the same time raising the core knowledge bases of the country. In addition, the Kyoto Protocol, as a result of concern about climate change, establishes the obligation of reducing green-house effect gas emissions by industrialised countries including South Africa. Energy efficiency and the use of renewable energy sources are presented as sustainable solutions leading to a reduction in C02 emissions into the atmosphere.

South Africa has committed to a target in the Integrated Resource Plan for Electricity 2010-2030, that 17.8 GW of primary energy consumption should come from renewable sources by 2030. In addition to these environmental and legislative reasons, the fact is that renewable energy sources mean a reduction in the country's energy dependence on carbon fuels, increasing the safety and quality of the energy supply and providing a valuable source of employment.

South Africa's climate is ideal with regards to solar resources, with a broad time band of sunlight and a high level of energy delivered by area of land. Utilising this solar resource in combination with SolarReserve's exclusive molten salt storage system makes it an ideal system in the generation of renewable energy. Further to its environmental attributes, the project will contribute much needed on-peak power to the electrical grid serving the region. The additional demand for power continues to grow in other regions as older technology fossil fuel plants reach the end of their shelf lives. The additional demand for power in South

Africa over the period 2009 until 2020 is shown below, as submitted to NERSA by Eskom,



(Eskom's Multi-Year Price Determination 2 (MYPD 2) Application (2010/11 to 2012/13):

Figure 11: Additional power demand in South Africa (2020)

Power demand in South Africa is growing at a rate whereby power cuts due to shortages are anticipated within the next three years. Demand for electricity rose by 5.4% 2010 in comparison to 2009 with an annual forecast growth of 1.3% per Eskom's MYPD 2 Application (2010/11 to 2012/13). In order to meet these demanding requirements, which is a clear indication of the country's future growth prospects, South Africa must facilitate the rapid build out of capacity in order not to limit the countries potential.

	Low (GWh)	% Growth	Reference (GWh)	% Growth	Moderate (GWh)	% Growth
2010/11	220,260	1.0%	229,260	5.4%	226,790	4.0%
2011/12	224,737	2.0%	235,674	2.8%	232,816	2.7%
2012/13	232,388	3.4%	241,974	2.7%	245,288	5.4%
2013/14	239,536	3.1%	250,250	3.4%	256,755	4.7%
2014/15	248,621	3.8%	260,787	4.2%	270,774	5.5%
2015/16	258,921	4.1%	274,336	5.2%	285,856	5.6%
2016/17	265,399	2.5%	283,503	3.3%	297,547	4.1%
2017/18	271,946	2.5%	292,756	3.3%	309,650	4.1%
2018/19	279,163	2.7%	302,025	3.2%	320,790	3.6%
2019/20	286,388	2.6%	310,901	2.9%		

Figure 12: Future sales growth: (Eskom's MYPD 2 Application (2010/11 to 2012/13)

The project offers the following key benefits:

- Job creation: The project will make a notable contribution towards achievement of the New Growth Path targets related to job creation, and particularly the 2020 target of creating 300 000 jobs to green the economy. The project will create many jobs during construction and more sustainable employment opportunities during operation. Importantly, it will improve the employment situation in the local economy and contribute to skills development of the involved workers.
- Economic development: The project will stimulate the development of national and local economies during operation. This will result in the expansion of the existing manufacturing industries and the creation of new businesses in the country. From a local economic perspective, it will diversify the local economic structure and reduce its dependency on the mining sector.
- Green House Gas emission savings: The project will make a direct contribution towards the expansion of the use of renewable energy sources to reduce carbon emissions involved in generating electricity, as outlined in the Integrated Resource Plan (IRP2) dated February 2010. The potential Green House Gas (GHG) emission savings from generation of electricity that could be achieved by the project are about 487 200 tons of CO2 -equivalent.

- Reduced power line losses: The project will be located in the Northern Cape, which means that it will provide support to the grid system in areas that is in need for reliable supply of electricity generating facilities that could negate power line losses.
- Water savings: The project will minimize the use of water compared to the conventional power generation technologies by utilizing an air cooled condenser.
- Power generation flexibility: The project can provide flexibility for the region's renewable power supplies by being able to generate electricity for a short period of time or electricity over a longer period of time without changing the size of the solar array but by changing the power generating capacity.

4. Project Alternatives

4.1 Site Location Alternatives

An integrated site selection study was done in order to identify a suitable site for the proposed solar power plant.

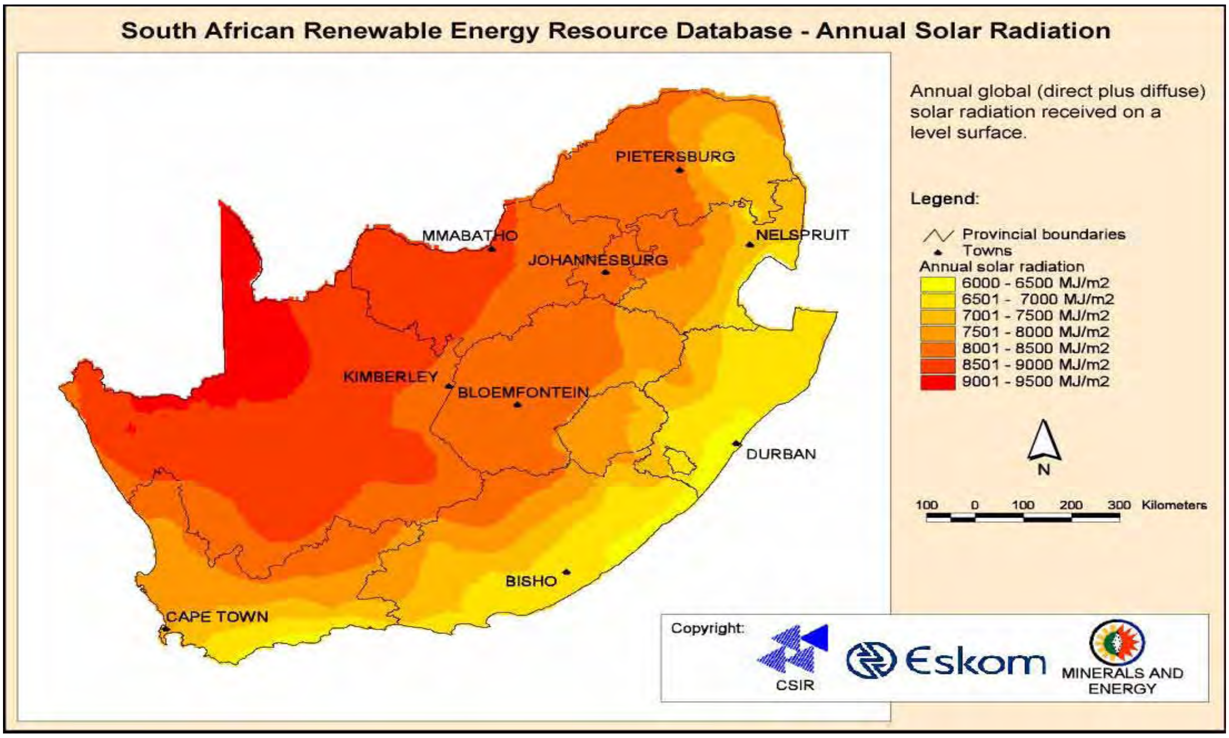


Figure 13: Annual incoming short wave radiation for South Africa

The proposed solar energy site on the farm Arriesfontein is considered highly desirable due to the following considerations:

- Solar resource: Analysis of available data from existing weather stations suggests that the site has sufficient solar resource to make a solar energy facility viable (Figure 8).
- Site extent: Sufficient land was secured under long-term lease agreements with the land owner to enable sufficient power supply and to allow for a number of heliostats to make the project feasible.
- Land suitability:

  - Sites that facilitate easy construction conditions (relatively flat land with few rock outcrops or water-bodies) were favoured during site selection.
  - The site position will strategically strengthen the national grid.
  - Surrounding ridges and hills act as a screen to reduce the visual impact.
  - Avoidance of obvious environmentally sensitive areas.
- Landowner support: The selection of sites where the land owners are supportive of the development of renewable energy is essential for ensuring the success of the project.
- Consideration of the above criteria resulted in the selection of the preferred site. No further site location alternatives are considered in the EIA process.

4.2 Site Layout Alternatives

- The PV, CSP layout and project component design may undergo a number of alterations based on technical aspects of the project such as detailed site specific solar data and construction conditions, and the environmental and social considerations which will be explored during the EIA process.
- From a technical perspective, the layout depends on a number of factors including:
- local topographical conditions and the aspect of the site in relation to the sun's daily movements;
- the intensity of the solar resource at the site as determined from on site measurements and data modelling; and
- Other local meteorological conditions such the amount of suspended particles in the air (dust).
- Currently three main layout options have been assessed. Please refer to Appendix B for maps of the layout options.
- An indicative project layout will be developed using the resource data that is currently available. After initial field surveys by the EIA team, particular areas posing environmental and social constraints will be identified. The technical team will then

generate a revised development layout taking these environmental and social constraints into consideration.

- The output of this process will encompass the consideration of layout alternatives and will be used in the assessment of impacts in the EIA report.

4.3 Technology Alternatives

4.3.1 Concentrated Solar Power (CSP) Systems

There are three CSP systems that were considered for the proposed project. The three systems are the most prominent systems in use worldwide and each system is concisely described below. Ultimately it was determined that the power tower system is the most feasible option for the proposed site and the local conditions and the designs and calculations for the proposed plant were based on the utilisation of this system.

4.3.1.1 Linear systems

Linear CSP systems typically consist of a large number of parallel rows of parabolic (u-shaped) reflectors that track the sun from east to west during the day and concentrate the sunlight on a pipe that runs down the focal line of each trough. The concentrated sunlight is amplified 30 to 100 times its normal intensity on the pipe containing heat transfer fluid (oil). The fluid flows through the pipe and is used to boil water and generate steam. The steam is used in a conventional steam turbine to generate electricity.

Linear Fresnel reflector concentrating systems are configured similarly to that of the linear CSP. It uses Fresnel lenses and mirrors to concentrate the sunlight onto a fixed receiver tube above the mirrors.

The mirrors are mounted on trackers that are configured to follow the sun and ensure that the rays are concentrated on the focal point of the receiver. The mirrors are flat or slightly curved and are not as optically efficient as the trough reflectors.

4.3.1.2 Power Tower

Power tower systems utilize many flat, sun-tracking heliostats (mirrors) to concentrate sunlight onto a receiver on top of a central receiver tower. Heat transfer fluid flowing through the receiver is heated by the concentrated sunlight and the heated fluid generates steam, which by means of a steam turbine generates power.

Molten salt is the preferred heat transfer fluid for the power tower system due to its superior heat transfer and heat storage capabilities which enables it to be effective in generating steam even when the sun is not shining or during cloudy conditions.

4.3.1.3 Dish Engine

The dish engine uses mechanical energy rather than steam to generate electricity. A large mirrored dish tracks the sun and concentrates the sunlight onto a receiver at the focal point of the dish. The receiver is integrated into a high efficiency combustion engine that has thin tubes containing helium or hydrogen gas that expands when heated. The tubes run on the outside of the engine's four piston cylinders and open into the cylinders.

As the gas is heated to high temperatures it expands in the cylinders driving the pistons and effectively drives an electric generator. This system does not lend itself to thermal storage and will only generate electricity when the sun is shining.

4.3.2 **Heat transfer mediums**

There are three main heat transfer mediums used in utility scale concentrating solar power facilities. Oil, or Therminol, is the liquid used in a typical parabolic trough solar power project (molten salt is typically not used as there are many kilometres of horizontal piping, unlike a central tower project, which has only short lengths of almost exclusively vertical tubing). The main heat transfer mediums used in central power tower projects are steam ("Direct Steam" method) or molten salt.

The comparative advantages of these heat transfer mediums are summarised in **Table 3** below:

Table 3: Comparative Advantages

Oil	Direct Stream	Molten Salt
Issues:	**Issues:**	**Advantages:**
– 1.6 km of tube per MW – Sourcing Vacuum Tubes – Toxic Therminol – Curved, Stressed Glass – Requires Natural Gas – Loses Energy at Night – Requires large volume of water – Low temperature change – No inherent storage – Low quality steam	– High pressure piping (thick wall, expensive, safety) – Two phase flow (erratic flow control, high stress, turbine erosion, more complex start up) – Typically requires natural gas – No inherent storage – Complex water / steam control	– Primary heat transport – Meters of tube, not kilometers – Inherent storage – Dispatchable / On Demand – No Natural Gas required – No energy loss at night – High quality steam – Standard steam turbine

4.3.3 Cooling Alternatives

In thermal power generation there are predominantly three types of cooling systems that are in use. These are wet cooling, dry cooling and hybrid wet/dry cooling systems. These systems were evaluated and compared and the most suitable alternative selected for the proposed project.

4.3.3.1 Wet Cooling

Evaporative wet cooling is widely considered to be the most common method for new power plants due to its economical and high performing cooling technique. This technique however consumes high volumes of water, in access of 1 million cm3 per annum. Waste heat energy dissipated from the power plant is rejected to the air through evaporation of the cooling water. The cooling water evaporates in a cooling tower. As a result of the continuous evaporation, water treatment chemicals and minerals contained in the water become concentrated over time and require that a portion of the cooling water ("blowdown") be drained to remove high concentrations of accumulated salts and particulates. This is a potential source of an environmentally hazardous substance.

4.3.3.2 Dry Cooling

Dry cooling uses considerably less water than dry cooling and is becoming more prevalent in new power plants due to the limitations on water in arid areas, where most solar thermal power plants are established. All of the waste heat from the plant is rejected to the air. Air has a much lower capacity to carry heat and is considered less efficient than water as a cooling medium. Large fans are required to remove the heat from the pipe array in the cooling system and often these fans use a portion of the power generated by the plant. This effectively causes dry cooling to have a reduced thermal efficiency compared with wet cooling. The dry cooling system does not create any environmentally hazardous blowdown. In summary dry cooling uses less water but the plant produces slightly less power as a result.

4.3.3.3 Hybrid Wet/Dry Cooling

Hybrid cooling involves a combination of wet and dry cooling. Hybrid designs are aimed at reducing water consumption in comparison with wet cooling and enhance the plant's performance in warm weather when the thermal efficiency of dry cooling is least effective. Hybrid systems either involve separate wet and dry systems that operate in parallel or use water to cool the air used in the air cooled condenser. This system uses a fraction of the water of wet cooling and the turbine performance can be maintained on or close to design conditions. Considerably less blowdown will be resultant when compared with wet cooling. It is less expensive than an air-cooled plant and more expensive than a water-cooled plant.

4.3.4 **Photovoltaic Power (PV) Systems**

There are two PV technologies that were considered for the proposed project. The two technologies are the most prominent technologies in use worldwide and described below

4.3.4.1 Crystalline Technologies

By far, the most prevalent bulk material for solar cells is crystalline silicon (C-SI). Bulk silicon is separated into multiple categories according to crystallinity and crystal size in the resulting ingot, ribbon, or wafer.

- Monocrystalline silicon (c-Si): often made using the Czochralski process. Single-crystal wafer cells tend to be expensive, and because they are cut from cylindrical ingots, do not completely cover a square solar cell module without a substantial waste of refined silicon. Hence most c-Si panels have uncovered gaps at the four corners of the cells.
- Poly- or Multicrystalline silicon (poly-Si or mc-Si): made from cast square ingotslarge blocks of molten silicon carefully cooled and solidified. Poly-Si cells are less expensive to produce than single crystal silicon cells, but are less efficient.
- Ribbon silicon is a type of multicrystalline silicon: it is formed by drawing fiat thin films from molten silicon and results in a multicrystalline structure. These cells have lower efficiencies than poly-Si, but save on production costs due to a great reduction in silicon waste, as this approach does not require sawing from ingots.

Prices of polycrystalline silicon have gradually dropped as companies build additional polysilicon capacity quicker than the industry's projected demand. Manufacturers of wafer-based cells have responded to high silicon prices in 2004 - 2008 prices with rapid reductions in silicon consumption.

4.3.4.2 Thin film Technologies

Thin-film technologies reduce the amount of material required in creating a solar cell. Though this reduces material cost, it also reduces energy conversion efficiency. Thin-film solar technologies have enjoyed large investment due to the success of First Solar and the promise of lower cost and flexibility compared to wafer silicon cells, but they have not become mainstream solar products due to their lower efficiency and corresponding larger area consumption per watt production.

Cadmium telluride (CdTe), copper indium gallium selenide (CIGS) and amorphous silicon (A-Si) are three thin-film technologies often used as outdoor photovoltaic solar power production.

4.4 No-go Alternative

The "no-go" alternative is mandatory and has to be considered as a definite alternative. It entails that the development does not take place and that the proposed site remain in its current state and that the current land use and activities be continued. Currently the proposed site is in an undeveloped state. Should the status quo be maintained it would entail that the site will continue to be utilized for the current agricultural practices with no projected growth in the creation of additional jobs.

The current proportionate contribution to the GDP will be maintained and no formal skills development is expected to take place.

The current low environmental impact associated with long term sustainable farming practices will be maintained and no change in land use or zoning would be required. The status quo needs to be measured against the proposed facility to determine whether the environmental and socio-economic benefits warrant the approval thereof or whether the status quo should be

5. Legislative Overview

5.1 The National Framework

A summary of all legislation pertaining to and the relevance thereof on the proposed Arriesfontein Solar Thermal Energy Power Plant and the permitting thereof, are contained below. This legislation includes the following:

- The Constitution of the Republic of South Africa (Act No.108 of 1996);
- National Environmental Management Act (Act No. 107 of 1998)
- National Environmental Management: Waste Act (Act No. 59 of 2008);
- National Environmental Management: Air Quality Act (Act No. 39 of 2004);
- Mineral Petroleum Development Resources Act (Act No. 28 of 2002);
- National Water Act (Act No. 36 of 1998);
- National Heritage Resources Act (Act No. 25 of 1999);
- National Environmental Management: Biodiversity Act (Act 10 of 2004)

5.2 Constitution of South Africa

Section 24 of Chapter 2, the Bill of Rights, of the Constitution of South Africa is the cornerstone of the protection and conservation of the environment through responsible and sustainable development for the benefit of the citizens of this country and future generations. It reads as follow:

24) "Everyone has the right –

a) to an environment that is not harmful to their health or well-being; and

b) to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that -

i. prevent pollution and ecological degradation;

ii. promote conservation; and

iii. *secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development."*

In terms of the proposed development the Constitution upholds the rights of all the surrounding citizens to a clean and healthy environment and that the environment is protected through sustainable development practices whilst promoting economic and social development. The impact of the proposed project on the environment and citizens of the Republic must be determined "through reasonable legislative and other measures".In order to give effect to Section 24 numerous environmental laws, of which the National Environmental Management Act is but one, were instituted to protect and manage the environment and to promote sustainable development.

5.3 National Environmental Management Act

The relevant legislation pertaining to the Environmental Authorization for development projects and this application in particular is the National Environmental Management Act (NEMA) (No. 107 of 1998) as amended, and the EIA Regulations of 2010 promulgated under NEMA. NEMA requires that activities be investigated that may have a potential impact on the environment, socio-economic conditions and cultural heritage. Various activities of the proposed project will definitely impact on the environment and requires assessment by means of an EIA.

The results of the EIA must be reported to the relevant authority. Procedures for the investigation and communication of the potential impact of activities are contained in Section 24 (7) of the Act.

Section 24(C) of the Act defines the competent decision-making authority which is normally the provincial environmental department. However, as set out in Section 4.1 of the 'Guideline on Environmental Impact Assessments for Facilities to be Included in the Electricity Response Plan', GN 162 of 2010, all EIA applications from Independent Power Producers (IPPs) or those involving co-generation, where these are included in the National Energy Resource Plan (NERP), the DEA shall be the competent authority.

5.3.1 EIA Regulations

On 18 June 2010 new EIA Regulations (Government Notice No R.544, 545 and 546) were promulgated in terms of Section 24(5) of NEMA. These Regulations came into effect on 2 August 2010and was further corrected in December 2010, superseding the regulations of 21 April 2006.

The Regulations will determine whether a Basic Assessment or EIAR is applicable to a proposed project based on the listed activities in the Regulations. In relation to the proposed project a Scoping and EIAR will be required due to certain listed activities in the EIA Regulations.

5.3.2 Activities Applied for in Terms of the NEMA

In terms of Government Notices No. R544, R545 and R546 published in the Government Gazette no. 33306 of 18 June 2010 of the National Environment Management Act, 1998 (Act No. 107 of 1998) an Environmental Impact Assessment Process is required for the above-mentioned project. The following listed activities are being applied for:

Table 4: Listed activities in terms of Government Notice No. R544.

Number and date of the relevant notice:	Activity No(s) (in terms of the relevant notice) :	Listed activity description:
R. 544, 18 June 2010	Activity 9	The construction of facilities or infrastructure exceeding 1 000 meters in length for the bulk transportation of water, sewage or storm water – with an internal diameter of 0,36 meters or more; or with a peak throughput of 120 liters per second or more, excluding where: such facilities or infrastructure are for bulk transportation of water, sewage or storm water drainage inside a road reserve; or where such construction will occur within urban areas but further than 32 meters from a water course, measured from the edge of the

Number and date of the relevant notice:	Activity No(s) (in terms of the relevant notice):	Listed activity description:
		watercourse.
R. 544, 18 June 2010	Activity 10	The construction of facilities or infrastructure for the transmission or distribution of electricity – outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts; or inside urban areas or industrial complexes with a capacity of 275 kilovolts or more.
R. 544, 18 June 2010	Activity 11	The construction of: canals; channels; bridges; dams; weirs; bulk storm water outlet structures; marinas; jetties exceeding 50 square meters in size; slipways exceeding 50 square meters in size; buildings exceeding 50 square meters in size; or infrastructure or structures covering 50 square meters or more where such construction occurs within a watercourse or within 32 meters of a watercourse, measured from the edge of a watercourse, excluding where such construction will occur behind the development setback line.
	(12)	The construction of facilities or infrastructure for the off-stream storage of water, including dams and reservoirs, with a combined capacity of 50000 cubic metres or more, unless such storage falls within the ambit of activity 19 of Notice 545 of 2010;

Number and date of the relevant notice:	Activity No(s) (in terms of the relevant notice) :	Listed activity description:
R. 544, 18 June 2010	Activity 13	The construction of facilities or infrastructure for the storage, or for the storage and handling of dangerous good, where such storage occurs in containers with a combined capacity of 80 but not exceeding 500 cubic meters;
R. 544, 18 June 2010	Activity 22	Construction of a road, outside urban areas; with a reserve wider than 13, 5 meters or, where no reserve exists where the road is wider than 8 meters, or for which environmental authorization was obtained for the route determination in terms of activity 5 in Government Notice 387 of 2006 or activity in Notice 545 of 2010.

Table 5: Listed activities in terms of Government Notice No. R545.

Number and date of the relevant notice:	Activity No(s) (in terms of the relevant notice) :	Listed activity description:
R. 545, 18 June 2010	Activity 1	The construction of facilities for the generation of electricity where the electricity output is 20 megawatts or more.
R. 545, 18 June 2010	Activity 3	Construction of facilities or infrastructure for the storage, or storage and handling of dangerous good, where such storage occurs in containers with a combined capacity of more than 500 cubic meters;
R. 545, 18 June 2010	Activity 15	Physical alteration of undeveloped, vacant or derelict land for residential, commercial, recreational, industrial or institutional use where the total area to be transformed is 20 hectares or more; Except where such physical alteration takes

Number and date of the relevant notice:	Activity No(s) (in terms of the relevant notice) :	Listed activity description:
		place for: linear development activities; or agriculture or afforestation where activity 16 in this Schedule will apply.
R. 545, 18 June 2010	Activity 26	Commencing of an activity, which requires an atmospheric emission license in terms of section 21 of the National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004), except such commencement requires basic assessment in terms of Notice of No R 544 of 2010.

Table 6: Listed activities in terms of Government Notice No. R546

Number and date of the relevant notice:	Activity No(s) (in terms of the relevant notice) :	Listed activity description:
R. 546, 18 June 2010	Activity 14	The clearance of an area of 5 hectares or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation, except where such removal of vegetation is required for: The undertaking of a process or activity included in the list of waste management activities published in terms of section 19 of the National Environmental Management: Waste Act, 2008 (Act no 59 of 2008) in which case the activity is regarded to be excluded from this list; In Eastern Cape, Free State, Kwa-Zulu Natal, Limpopo, Mpumalanga and Northern Cape Provinces All areas outside urban area

5.4 National Environmental Management: Waste Act

In terms of Schedule 1 of the National Environmental Management: Waste Act (NEMWA), certain activities will require environmental authorization. With regards to the proposed project there are activities that are applicable and will require authorization prior to the commencement of the activities.

5.4.1 Activities applied for in terms of the NEM: Waste Act

The CSP Plant would require a waste licence. A separate EIA process is being conducted for the Waste Licence process (DEA Ref 12/9/11/L743/8). It is required in terms of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) and Government Notice 718 of 2009 that prior to the commencement of any construction activities the competent authorities must review and authorize the EIA required for the following activities and issue a waste license accordingly:

Table 7: Listed activities in terms of Government Notice No. R718 of 2009

Number and date of the relevant notice:	Activity No(s) (in terms of the relevant notice) :	Listed activity description:
GNR. 718, 03 July 2009	Category B (1)	The storage including the temporary storage of hazardous waste in lagoons.
	Category B (5)	The treatment of hazardous waste using any form of treatment regardless of the size or capacity of such a facility to treat such waste.
	Category B (11)	The construction of facilities for activities listed in Category B

5.5 Mineral Petroleum Development Resources Act

The proposed activity will require the use of borrow material during construction and the borrow material will be obtained from borrow pits with suitable material in close proximity to the site. The utilization of a borrow pit is classified in terms of the Mineral Petroleum

Development Resources Act (MPRDA) as a mining activity and will require a mining permit if the pit is smaller than 1.5 ha and will be utilized within 2 years of the authorization thereof.

5.6 National Water Act

The National Water Act (NWA) compels any water use in terms of Section 21 of the Act to be licensed. Various activities of proposed project are classified as water uses and will require a Water Use Licence. These activities in terms of Section 21 include but are not limited to:

a) Taking water from a water resource;

b) Storing water;

c) Impeding or diverting the flow of water in a watercourse; and

i) Altering the bed, banks, course or characteristics of a watercourse.

5.7 National Heritage Resources Act

With regards to the heritage resource management there are certain listed activities in Section 38 of the National Heritage Resources Act (NHRA) that require assessment of the potential impact on the heritage resources. The applicable activities related to the proposed Arriesfontein development includes but are not limited to the following:

(1) Subject to the provisions of subsections (7), (8) and (9), any person who intends to undertake a development categorised as—

(a) the construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300 m in length;

(c) any development or other activity which will change the character of a site—

(i) exceeding 5 000 m^2 in extent; or

(iv) the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority;

(d) the re-zoning of a site exceeding 10 000 m^2 in extent; or

(e) any other category of development provided for in regulations by SAHRA or provincial heritage resources authority,

must at the very earliest stages of initiating such a development, notify the responsible heritage resources authority and furnish it with details regarding the location, nature and extent of the proposed development.

5.8 National Environmental Management: Biodiversity Act

The objectives of the National Environmental Management: Biodiversity Act (NEMBA) in relation to the proposed Arriesfontein Project is:

(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;

5.9 Provincial or District Policies, Guidelines and Frameworks

In order to put the proposed project in a regional context it is necessary to investigate the applicable Provincial or District environmental and development policies, guidelines or frameworks. From this point of view it was determined from the Siyanda District Municipality Environmental Management Framework that the area is reliant on groundwater and that the utilisation of the resource is nearing its limits with little potential for further development of the resource. Detailed Geohydrological assessments should determine the potential for the utilisation of this resource and the possible impact on the resource in terms of utilisation and pollution.

6. Public Participation Process

6.1 Overview of the Public Participation Process undertaken during the Scoping Phase

The Public Participation Process (PPP) for the project is conducted in accordance with Chapter 6 of the EIA Regulations. The primary aims of the PPP during the Scoping Phase were:

- To inform Interested and Affected Parties (I&APs) of the proposed project;
- To identify issues, comments and concerns as raised by I&APs;
- To promote transparency and an understanding of the project and its consequences;
- To serve as a structure for liaison and communication with I&APs; and
- To provide local knowledge and input in identifying potential environmental (biophysical and social) impacts and "hotspots" associated with the proposed development.

6.2 Identification of Key Stakeholders

The first step in the PP Process was to identify key stakeholders, including:

- National and Provincial Government Representatives:
    - Department of Environmental Affairs (DEA);
    - Department of Water Affairs (DWA);
    - Department of Agriculture, Forestry and Fisheries (DAFF);
    - South African Heritage Resources Agency (SAHRA); and
    - Relevant Northern Cape Provincial Authorities (ex. Environment & Conservation, Agriculture).
    - Relevant Local and District Municipalities:
    - Siyanda District Municipality;
- Kgatelopele Local Municipality;
- Parastatals – Eskom, Civil Aviation Authority;
- Affected and surrounding landowners;

- Environmental Non-Governmental Organizations (e.g. Wildlife Society of South Africa, BirdLifeSA);
- Community based organisations; and
- Other (i.e. Air Traffic and Navigation Systems)

All I&AP information (including contact details), together with dates and details of consultations and a record of all issues raised is recorded within a comprehensive project database. This database will be updated on an on-going basis throughout the project, and will act as a record of the communication/public consultation process.

6.3 **Advertising**

As per the statutory requirements of the 2010 EIA Regulations, the project was advertised in the following local newspapers on 12 January 2012:

- Sowetan (English); and
- Kalahari Bulletin (Afrikaans and English).

The advertisement provided an abstract on key aspects of the proposed project (project description, location, application process and contact details of the Environmental Assessment Practitioners). Furthermore the advertisement requested I&APs to register, and to become involved in the project by submitting comments and highlighting issues of concern to the WorleyParsons RSA. The primary aim of the newspaper advert was to ensure that the widest possible group of I&APs were informed of the project. Copies of the Newspaper Advertisements will be attached to the finale scoping report as **Annexure C**

The notification of the availability of the Draft Scoping Report for public review will be published in the same newspapers in conjunction with the notification of any public meetings to be hosted.

6.4 **Site Notices**

Site notices were prepared according to the requirement set out in the EIA Regulations. The site notices included basic information regarding the proposed project, application process, I&AP registration and contact details of the Environmental Assessment Practitioners. A site notice was at the entrance of the development site and at the Main road (R34) turnoff to the site as well as on 2 of the throughways of the farm– refer to **Figure 14**.

Figure 14: Site notices

6.5 Pamphlets and Notices

Due to the proximity of project to Kgatelopele Local Municipality the PPP focused on this Municipal area. .The site notice was printed on A5 sized paper (pamphlets) and distributed via the South African Post Office Services post boxes in Danielskuil, Postmasburg and Lime Acres.

Furthermore sets of A3 site notices were placed on notice boards at the following amenities frequented by I&APs in Danielskuil, Postmasburg, Lime Acres and Groenwater:

- Danielskuil:
  - Danielskuil Public Library
  - OK Store
- Postmasburg:
  - Outside Post Office
  - Public Library;
  - Pick & Pay
- Lime Acres
  - Outside SPAR notice board
- Groenwater
  - Groenwater Super Store

Photographs of the notices and flyers placed in and around the affected area will be attached to the finale scoping report for submission as **Appendix D**.

6.6 Review of Draft Environmental Scoping Report

6.6.1 Public Review of Draft Environmental Scoping Report

The draft Environmental Scoping Report was available for public review at the following locations in close proximity to the study area, which were identified as readily accessible to I&APs:

- Kgatelopele Local Municipal Offices;
- Tsantsabane Local Municipal Offices
- Danielskuil Public Library
- Postmasburg Public Library
- Groenwater Mobile Library

The availability of this draft report was advertised in the Kalahari Bulletin and Sowetan. On-site notices were also placed on the perimeter of the site, pamphlets were distributed in the post boxes of Danielskuil, Postmasburg and Lime Acres and posters were placed on community notice boards at the following venues:

- Danielskuil:
  - Danielskuil Public Library
  - OK Store
- Postmasburg:
  - Outside Post Office
  - Public Library;
  - Pick & Pay
- Lime Acres
  - Outside SPAR notice board
- Groenwater
  - Groenwater Super Store

A 30-calendar day period will be allowed for this review process from 25 Januery 2012 to 25 February 2012. Stakeholders and I&APs on the project database were notified of the availability of this report via post or e-mail. The report was also distributed to all the commenting authorities for review and comment in electronic or hard copy format.

6.7 Consultation and Public Involvement

Through consultations with I&AP's and Stakeholders, issues for inclusion within the Final Scoping Report will be identified and recorded. Consultations will take place in the form of formal meetings with I&AP's and other stakeholders. The primary aims of the meetings will be to:

- Disseminate background information regarding the proposed project to I&APs;
    - o Supply more information regarding the EIA Process and the findings of the specialist studies undertaken during the Scoping Phase;
    - o Answer questions regarding the project and the EIA Process;
    - o Obtain feedback from I&APs with respect to the proposed project; and
    - o Receive input regarding the Public Participation Process.

One public meeting with I&APs was held during the public review period of the Draft Scoping Report. The meetings was held at:

- The Danielskuil Community Hall on 8 February 2010 at 17:30; and

The purpose of the public meetings was to discuss the key findings of the Scoping Phase and provide the representatives with an additional platform to provide input to the EIA Process.

Stakeholders and I&APs was notified of the public meetings through the following methods:

- Invitation letter sent via either e-mail, registered mail and/or fax;
- Telephonic dialogue with key Stakeholders;
- Distribution of pamphlets; and
- Liaison with the relevant Ward Councillors and Ward Committee Representatives.

The minutes of the public meeting was compiled, distributed to attendees of the meetings and included in this Final Scoping Report for record purposes. Attendance Registers and Minutes of all public meetings was attached as **Appendix E** of this report.

Networking with I&APs, will further continue throughout the duration of the project.

6.8 Social Issues Trail

Issues and concerns raised during the Scoping Phase Public Participation Process were compiled into an Issues Trail. This information is incorporated within the Final Scoping Report before submission to the relevant environmental authorities. All comments and Responses from I&AP's will be attached to this report as **Appendix F**.

7. General Description of the Study Area

7.1 Biophysical Environment

7.1.1 Agricultural Potential

The ARC-Institute for Soil, Climate and Water (ARC-ISCW) was contracted to undertake a soil investigation for the proposed development site. The objectives of this study, which is a desk-top investigation that forms part of the Scoping Phase assessment, are:

- To obtain all existing soil information and to produce a soil map of the specified area; as well as
- To assess broad agricultural potential.

7.1.1.1 Terrain

The site is almost flat and lies at a height of approximately 1 415 metres above sea level, sloping to the south-east. No permanent drainage ways are present in the area and only a few small dry pans occur.

7.1.1.2 Climate

The climate of the study area (Koch & Kotze, 1986) can be regarded as warm to hot with rain in summer and dry winters. The long-term average annual rainfall in this region of the Northern Cape is only 329 mm, of which 142 mm, or 80%, falls from November to April. Rainfall is erratic, both locally and seasonally and therefore cannot be relied on for agricultural practices. The average evaporation is 2 105 mm per year, peaking at 8.6 mm per day in December. Temperatures vary from an average monthly maximum and minimum of 31.7ºC and 16.2ºC for January to 18.9ºC and 0.2oC for July respectively. The extreme high temperature that has been recorded is 41.8oC and the extreme low –10.0ºC. Frost occurs most years on 33 days on average between late May and early September.

7.1.1.3 Geological Parent Material

The geology of the area comprises Tertiary and Quaternary deposits (Geological Survey, 1977). In the west, sandy deposits occur, while surface limestone occurs in the east.

7.1.1.4 Soils

A summary of the dominant soil characteristics of each land type is given in **Table 7** below

The distribution of soils with high, medium and low agricultural potential within each land type is also given, with the dominant class shown in bold type.

Table 8: Soil types in study area

Land Type	Dominant soils	Depth (mm)	Percent of land type	Characteristics	Agric. Potential (%)
Ae9	Hutton 33	450 – 1000 200 - 450	37% 32%	Red, sandy soils, occasionally on hardpan calcrete Red-brown, sandy topsoils on hard rock and calcrete	High:0.0 Mod: 41.4 **Low: 58.6**
Fc4	Mispah 22 Mispah 20	100-250 100-250	71% 12%	Grey-brown, sandy, calcareous topsoils on calcrete Grey-brown, sandy, calcareous topsoils on rock	High:0.0 **Mod: 0.0** Low: 100

7.1.1.5 Agricultural Potential

The area comprises a mixture of red, sandy soils, sometimes deep, in the west, with shallow calcareous soils in the east, as can be seen from the information contained in Table 8. The very low rainfall in the area (Section 2.3) means that the only means of cultivation would be by irrigation and the Google Earth image of the area shows absolutely no signs of any agricultural infrastructure and certainly none of irrigation.

The climatic restrictions mean that this part of the Northern Cape is suited at best for grazing and here the grazing capacity is low, around 20 ha/large stock unit (ARC-ISCW, 2004).

Please refer to attached Soil and Agricultural Study **Appendix G**

7.1.2 Air Quality

Airshed Planning Professionals was requested by WorleyParsons RSA (Pty) Ltd to carry out an Air Quality Impact Assessment for the development of a proposed Solar Power Park near Danielskuil. The Air Quality Assessment aims to investigate the impacts associated with the construction, operation and eventual decommissioning of the proposed plant, and associated infrastructure, as well as provide guidance on possible mitigation measures to reduce environmental impacts.

7.1.2.1 Surrounding Receptors

The closest major sensitive receptor is Danielskuil. Other smaller sensitive receptors in the immediate vicinity of the proposed development will be determined by means of a site visit.

7.1.2.2 Current Air Quality

A comprehensive emissions inventory has not been completed for the region to date, and no ambient air quality monitoring around the proposed site has been carried out. However, due to the remoteness of the proposed project location it is expected that the concentrations of criteria pollutants would be low. Existing sources of air pollution in the study area will be identified via a site visit.

Please refer to attached Air Quality Scoping Study **Appendix H**

7.1.3 Avi-faunal Assessment

7.1.3.1 Terms of Reference

The following terms of reference for the EWT avifaunal study were adopted:

- Identification of sensitive sites: The bird sensitive sections of the study area will be identified.
- Describe affected environment and determine status quo: The existing environment will be described and the bird communities most likely to be impacted will be identified. Different bird micro-habitats will be described as well as the species associated with those habitats.

- Describe focal species: Threatened bird species (as per red data book status), will be identified, and species most likely to be impacted upon will be identified.
- Identification of impacts: The potential impact on the birds will be identified.
- Propose and explain mitigation measures: Practical mitigation measures will be recommended and discussed.
- Identify and address any other aspects related to avifauna in the study area that should be incorporated into the reports.

7.1.3.2 Affected Environment

The Northern Cape region is one of the most arid in southern Africa. In examining the region as a whole in terms of avifauna, it is important to relate the avifauna to the biomes and vegetation types present in the area. Harrison et al (1997) in "The Atlas of Southern African Birds" provide an excellent description of the various biomes represented in the region and the associated bird species. It is widely accepted within the ornithological community that vegetation structure, rather than the actual plant species, influences bird species distribution and abundance (in Harrison et al 1997). Therefore, this vegetation description focuses on factors which are relevant to bird distribution and is not a complete account of plant species. While this report is an avifaunal specialist report, vegetation and micro habitats are very important in determining avifaunal abundances and likelihood of occurrences.

Nama karoo biome: This biome comprises mainly low shrubs and grasses, trees such as Acacia karoo and exotic species such as Prosopis glandulosa are restricted to watercourses. Compared to "succulent karoo", "nama karoo" has a much higher proportion of grass and tree cover. The "karoo" used loosely to mean both "nama" and "succulent karoo", supports a particularly high diversity of species endemic to southern Africa. Avifauna characteristically comprises ground dwelling species of open habitats. The tree lined watercourses allow penetration of several species typical of arid woodland such as the Kori Bustard and Karoo Korhaan. Several species are almost entirely confined to the "Nama karoo" such as the Red Lark and Sclaters Lark. Because rainfall in the "nama karoo" is in summer and the neighbouring "succulent karoo" has winter rainfall, there is opportunity for species to migrate seasonally between the two. Two species suspected to do so (on the basis of atlas data) are the Ludwig's Bustard and Larklike Bunting.

Woodland biome: Woodland covers much of the northern and eastern parts of the country and is defined as having a distinct grassy under story and a woody upper story of trees and shrubs. Tree cover can range from sparse such as in the southern Kalahari, to almost closed. The more arid woodland types such as the Kalahari vegetation types are typically fine leaved and dominated by acacias and typically occur on nutrient rich, often alluvial soils in the western regions.

The dominant vegetation type in the study area is “Ghaap Plateau Vaalbosveld”. This vegetation type falls within the Eastern Kalahari Bushveld Bioregion, and occurs in the Northern Cape and North-West Provinces, around Campbell in the south, east of Danielskuil , through Reivilo, to around Vryburg in the north. The entire proposed project site falls within this vegetation type. “Kuruman Mountain Bushveld”, “Kuruman Thornveld”, and “Olifantshoek Plains Thornveld” vegetation types are also present in the broader area, to the west of the site, while numerous salt pans are scattered throughout, and are classified as “Southern Kalahari Salt Pans”.

In addition to the description of vegetation, it is important to understand the habitats available to birds at a smaller spatial scale, i.e. micro habitats. Micro habitats are shaped by factors other than vegetation, such as topography, land use, food sources and man-made factors. Investigation of this study area revealed the following bird micro habitats.

Artificially constructed dams have become important attractants to various bird species in the South African landscape. Various waterfowl frequent these areas and crane species often use dams to roost in communally. Birds such as flamingos and African Spoonbills may make use of these areas. Therefore dams are a key element of this study.

Although not within the true Grassland Biome, open “Grassy” are extensive throughout the site, and even more so in the broader study area, especially around pans that are dry. Grasslands represent a significant feeding area for many bird species such as White Stork, Secretarybird, Kori Bustard, Red-crested Korhaan and Northern Black Korhaan. The grassland patches are also a favourite foraging area for game birds such as francolins and Helmeted Guineafowl, as well as small mammals. This in turn may attract raptors because of both the presence and accessibility of prey. Listed species such as Lanner Falcon, Lesser Kestrel, African Marsh Harrier and Martial Eagle, may often hunt in open grassland areas.

Patches of thickets, trees and bushes were observed, usually close to disturbed areas such as homesteads and kraals. This was also evident around Windmill water pumps. These areas attract smaller passerine species such as Robins and Shrikes. Weavers and Sparrow weavers use the tree as structures for nesting and Raptors such the Southern Pale Chanting Goshawk may use these areas for perching.

7.1.3.3 Relevant bird populations

- **Southern African Bird Atlas Project 1**

Table 1: Red Data species recorded in the relevant quarter degree squares covering the study site (2823BD) and surrounding areas (2823BA, 2823BB, and 2823BC).

Total species		59	164	88	161
# cards submitted		4	76	14	51
Species	**Cons. status**	**2823BD**	**2823BC**	**2823BB**	**2823BA**
Tawny Eagle	VU	-	-	7	-
Martial Eagle	VU	-	3	7	2
Lesser Kestrel	VU	-	3	-	2
Kori Bustard	VU	-	-	29	-
African Marsh Harrier	VU	-	1	-	2
Lanner Falcon	NT	-	1	-	-
Black Stork	NT	-	5	-	2
Yellow-billed Stork	NT	-	1	-	-
Secretarybird	NT	-	3	7	-
Greater Flamingo	NT	50	38	-	14
Lesser Flamingo	NT	50	7	-	-
Chestnut-banded Plover	NT	-	1	-	-
White Stork	Bonn	-	3	14	2

CE = Critically endangered, E = Endangered, VU = Vulnerable, NT = Near threatened, Bonn = Protected Internationally under the Bonn Convention on Migratory Species.

The primary data source used to determine the distribution and abundance of bird species in the study area was the Southern African Bird Atlas Project data (Harrison et al, 1997). This data was collected over an 11 year period between 1986 and 1997. Although it is now quite old, it remains the best long term data set on bird distribution and abundance available to us at present. This data was collected on the basis of quarter degree squares, which is also a relatively large spatial scale. The proposed site falls within the Quarter Degree Grid Square (QDGS), 2823BD, while data from three additional squares, 2823BA, 2823BB, and 2823BC was also considered due to their close proximity to the site. The South African Bird Atlas Project (SABAP) recorded 12 Red Listed Species (Harrison et al, 1997), across all four squares, of which 5 are classified as Vulnerable, and 7 as Near Threatened. One additional species, the White Stork, is also included as it is protected internationally under the Bonn Convention on Migratory Species. The species recorded in the relevant quarter degree squares could have been recorded anywhere within these squares and not necessarily in the exact study area for the proposed developments. It does however provide a good indication of what could be found in the study area.

- **Southern African Bird Atlas Project 2**

The table above indicates report rates, based on the number of cards submitted, for the red data species identified, as well as additional relevant species (i.e. larger species vulnerable to collision and/or electrocution, as well as aerial forages, doves, crows, and waterfowl species that may be attracted to the developments evaporation ponds). The study site fall within Pentad 2815_2345, which had only been counted once in the SABAP2 survey, and therefore all species recorded in this pentad will reflect a 100 % report rate (1 out of 1). In general, the surrounding areas close to the site have been relatively poorly counted, and therefore other selected pentads in the broader study area were also examined and their data is included below. Although some distance from the study site, these areas are likely to contain similar micro-habitats, and can give a good indication of the general bird life in the area, and which species may be present or pass through the study site. Pentads 2820_2330 and 2820_2325, were more extensively counted (22 and 65 cards respectively), as they include the settlement of Lime Acres, and the CWAC site of Rooipan.

Interestingly, of the 13 listed species recorded in the SABAP 1 data, 8 have not been recorded in the SABAP 2 data for the pentads examined, and only the White Stork has been recorded in the Pentad covering the development site. This however, does not necessarily mean that the other species do not occur in the study area, or that they have moved from the area, post SABAP1, but may merely be due to the low counting effort of the pentads, or selective micro habitat counting by the SABAP2 field counters. Furthermore, one must be cautious when comparing these data sets, as the pentads represent far smaller sampling areas than the QDGS's.

- **Coordinated Avifaunal Road-count (CAR) data**

An evaluation of CAR data revealed that there are no Co-ordinated Avifaunal Road-count routes through or near to the site

- **Coordinated Waterbird count (CWAC) data**

Four Coordinated Waterbird Count (CWAC) areas, which are regarded as sites important for water birds either by virtue of the species present or the numbers in which they are represented, are within close proximity to the study area, namely Danielskuil Pan, Great Pan, Rooipan and Soutpan, and their locations are shown in Figure 2 above. Data was not available for Great Pan, and neither for Rooipan, as both sites are classed as private, and individual cards are not available for public viewing. The species occurring at these sites are expected to be similar to those present at Danielskuil Pan and Sout Pan, discussed below.

- **Danielskuil Pan**

Danielskuil Pan actually consists of two dams and a dam/pan with open shoreline, some shorebird habitat, and almost no fringing vegetation. Counts are available for 1996 and 1997, when mainly small numbers of 17 species were recorded, 16 species in summer (only South African Shelduck being missing) and only 3 in winter (SA Shelduck, Threebanded Plover and Cape Wagtail). The most numerous birds in summer were Whitefaced Duck, Blacksmith Plover (a good count of 47 birds in 1997), Curlew Sandpiper and Little Stint. This site was observed to be dry, with no presence of water-birds, during the site visit to the study area.

- **Sout Pan**

Cape Teal, Red-billed Teal, Yellow-billed Duck, South African Shelduck, Egyptian Goose, Greater Flamingo, as well as various other waders have all been recorded here.

- **Important Bird Areas (IBA's)**

The site does not fall within an Important Bird Area (IBA) and there were no IBA's within close proximity to the site.

7.1.3.4 Focal Species List

After determining the red data species and other relevant species that are likely or may possibly be found on site, as well as identifying the microhabitats, the focal species for the study were identified.

Determining the focal species for this study, i.e. the most important species to be considered, is a four step process. Firstly, the micro-habitats available on site were identified. An analysis of the above existing avifaunal data represents the second step, i.e.

which species occur in the area at significant abundances. The third step is to identify those species (which may be present based on the above two steps), and are more likely to be impacted upon by the proposed development and associated infrastructure. In terms of associated infrastructure, especially powerlines, this step called on the vast experience of the EWT in evaluating and investigating electrical infrastructure impacts on birds (these impacts are discussed in more detail below). In general, large, heavy flying birds are more vulnerable to collision with over-head powerlines, while perching Raptors are more vulnerable to electrocution. Knowledge of the species sensitive to the CSP and PV infrastructure is more scarce, however the following species groups are considered to have particular relevance to this study and include: raptors, doves, pigeons and aerial foragers such as swallows and swifts, as well as waterfowl species that may be attracted to the developments evaporation ponds. The fourth and final step was to consider the species conservation status or other reasons for protecting the species.

The resultant list of 'target/focal species' for this study is as follows: **Lesser Kestrel, Lanner Falcon, Kori Bustard, Secretarybird, Greater Flamingo, Lesser Flamingo, White Stork, Martial Eagle, Northern Black Korhaan, Namaqua Dove, Rock Martin, Little Swift, Barn Swallow, European Bee-eater, Namaqua Sandgrouse, Greater Kestrel, Sothern Pale-chanting Goshawk, and South African Shelduck** . In many cases, these species serve as surrogates for other similar species (as mitigation will be effective for both), examples being White Stork for Black, Martial Eagle for Tawny and Verreaux's Eagles, Kori Bustard for Ludwig's Bustard, Namaqua Dove for all other recorded dove species and so on. Assorted more common species will also be relevant to this study (shown in table 3 above), but it is believed that the above target species will to a large extent serve as surrogates for these in terms of impact assessment and management.

Please refer to attached Avifauna Scoping Study **Appendix I**

7.1.4 **Biodiversity**

The study area is situated within Griqualand West Centre of Endemism. This is an indication that the habitat that characterises the study area could potentially be significant in terms of species richness and diversity. The region was thus named because of the Griqua, a KhoeKhoe people, who lived there.

The mountainous western parts of the WC are covered by Kalahari Mountain Bushveld, and the eastern plateau area is covered by Kalahari Plateau Bushveld, both endemic to the centre (Low & Rebelo, 1996). *Tarchonanthus camphoratus* is a particularly common woody species in these two bushveld types. Typical mountain species include *Searsia tridactyla*, *Croton gratissimus* and *Buddleja saligna*. Pockets of Karoo-type vegetation increase towards the south and west, especially in overgrazed areas. Succulents of the *Asclepiadaceae, Euphorbiaceae and Mesembryanthemaceae* are well represented in the centre.

The proximity of the GWC is signified by the pockets and tongues of wind-blown, orange-red Kalahari sand that have accumulated in some of the intermontane valleys. The vegetation of the GWC is still fairly intact, although extremely poorly conserved. Apparently, the Kalahari Plateau Bushveld is the only Savanna Biome vegetation type that is not represented in any sizeable nature reserve (Van Rooyen & Bredenkamp, 1996b). Bush encroachment, which is due to inappropriate management practices (mainly overgrazing by domestic livestock), is a major problem in many parts of the region.

7.1.4.1 Fauna

Red Data animals known to occur in the Northern Cape were included in the Red Data faunal assessment. The following databases were used for the various faunal groups (data concerning species' habitat requirements and known regional distribution were used in concert with personal experience of the red data species of the Northern Cape):

- Invertebrates: Butterflies (South African Butterfly Conservation Assessment – http://sabca.adu.org.za);
- Amphibians: Frogs (Atlas and Red Data Book of the Frogs of South Africa, Lesotho and Swaziland);
- Reptiles: Snakes and other Reptiles (South African Reptile Conservation Assessment – http://sarca.aduorg.za);
- Birds: All bird groups (Roberts VII Multimedia: Birds of Southern Africa, PC Edition); and
- Mammals: Terrestrial Mammals (Red Data Book of the Mammals of South Africa: A Conservation Assessment)

Animals known to be present in the Q-grid 2823BD were considered potential inhabitants of the study area (all species known from the Northern Cape Province were included in the assessment to limit the known effects of sampling bias; except for birds where sampling has been comprehensive in the last decade).

- **Faunal Diversity of the Site**

The presence of 80 animal species was confirmed during the site investigation (Table 4), by means of visual sightings, tracks, scats, burrows and species-specific calls. The following groups were observed:

- 1 scorpion;
- 1 dragonfly;
- 1 termite;
- 1 beetle;
- 4 butterflies;
- 1 bee;
- 1 frog;
- 8 reptiles;
- 45 birds; and
- 18 mammals.

The 80 species found to occur in the study area did not include any Red Data species. Additionally, invertebrates of 22 families were also confirmed to occur in the study area (for various reasons, these animals could only be identified to family level).

The animals (species and families) observed in the study area are, for the most part, typical arid savanna species and representative of savanna animal communities that are widespread in the regional areas of the Ghaap Plateau Vaalbosveld and in the larger extent of the Eastern Kalahari Bushveld Bioregion.

Animal species occurring in the study area				
Class	**Order**	**Family**	**Biological Name**	**English Name**
Arachnida	Scorpiones	Scorpionidae	*Opistophthalmus carinatus*	Burrowing Scorpion
Insecta	Odonata	Aeshnidae	*Anax imperator*	Blue Emperor
	Isoptera	Termitidae	*Trinervitermes sp*	Snouted Harvester Termite
	Coleoptera	Scarabaeidae	*Pachnoda sinuata*	Garden Fruit Chafer
		Nymphalidae	*Danaus chryssipus*	African Monarch
		Pieridae	*Belenois aurota*	Brown-veined White
		Papilionidae	*Papilio demodocus*	Citrus Swallowtail
	Hymenoptera	Apidae	*Apis mellifera*	Honey Bee
Amphibia	Anura	Bufonidae	*Amietophrynus poweri*	Western Olive Toad
Reptilia	Testudines	Testudinidae	*Stigmochelys pardalis*	Leopard Tortoise
	Squamata	Atractaspididae	*Atractaspis bibronii*	Bibron's Burrowing Asp
		Colubridae	*Dasypeltis scabra*	Common Egg Eater
		Elapidae	*Naja nivea*	Cape Cobra
		Viperidae	*Bitis arietans*	Puff Adder
		Lacertidae	*Pedioplanis lineoocellata*	Spotted Sand Lizard
		Agamidae	*Agama aculeata*	Ground Agama
		Gekkonidae	*Pachydactylus capensis*	Cape Thick-toed Gecko
Aves	Galliformes	Numididae	*Numida meleagris*	Helmeted Guineafowl
		Phasianidae	*Scleroptila levaillantoides*	Orange River Francolin
	Anseriformes	Anatidae	*Anas erythrorhyncha*	Red-billed Teal
			Anas undulata	Yellow-billed Duck
	Ciconiiformes	Threskiornithidae	*Bostrychia hagedash*	Hadeda Ibis
		Ardeidae	*Ardea melanocephala*	Black-headed Heron

	Falconiformes	Accipitridae	*Melierax canorus*	Pale Chanting Goshawk
	Gruiformes	Rallidae	*Fulica cristata*	Red-knobbed Coot
	Charadriiformes	Burhinidae	*Burhinus capensis*	Spotted Thick-knee
		Charadriidae	*Vanellus armatus*	Blacksmith Lapwing
			Vanellus coronatus	Crowned Lapwing
	Columbiformes	Columbidae	*Streptopelia capicola*	Ring-necked Dove
			Spilopelia senegalensis	Laughing Dove
	Cuculiformes	Cuculidae	*Chrysococcyx caprius*	Diderick Cuckoo
	Strigiformes	Tytonidae	*Tyto alba*	Western Barn Owl
		Caprimulgidae	*Caprimulgus rufigena*	Rufous-cheeked Nightjar
	Apodiformes	Apodidae	*Apus caffer*	White-rumped Swift
	Passeriformes	Laniidae	*Nilaus afer*	Brubru
			Lanius collurio	Red-backed Shrike
			Lanius collaris	Common Fiscal
		Corvidae	*Corvus albus*	Pied Crow
		Alaudidae	*Mirafra fasciolata*	Eastern Clapper Lark
			Calendulauda africanoides	Fawn-coloured Lark
		Pycnonotidae	*Pycnonotus nigricans*	African Red-eyed Bulbul
		Hirundinidae	*Hirundo rustica*	Barn Swallow
			Ptyonoprogne fuligula	Rock Martin
			Cecropis cucullata	Greater Striped Swallow
			Cecropis semirufa	Red-breasted Swallow
		Cisticolidae	*Cisticola juncidis*	Zitting Cisticola
			Prinia flavicans	Black-chested Prinia
		Sylviidae	*Sylvia subcaerulea*	Chestnut-vented Tit-Babbler

		Zosteropidae	*Zosterops pallidus*	Orange River White-eye
		Sturnidae	*Creatophora cinerea*	Wattled Starling
		Muscicapidae	*Cossypha caffra*	Cape Robin-Chat
			Erythropygia paena	Kalahari Scrub Robin
			Sigelus silens	Fiscal Flycatcher
		Passeridae	*Passer motitensis*	Great Sparrow
		Ploceidae	*Sporopipes squamifrons*	Scaly-feathered Weaver
			Ploceus velatus	Southern Masked Weaver
		Estrildidae	*Uraginthus granatinus*	Violet-eared Waxbill
		Viduidae	*Vidua regia*	Shaft-tailed Whydah
		Motacillidae	*Motacilla capensis*	Cape Wagtail
		Fringillidae	*Crithagra atrogularis*	Black-throated Canary
			Crithagra flaviventris	Yellow Canary
			Emberiza flaviventris	Golden-breasted Bunting
Mammalia	Lagomorpha	Leporidae	*Lepus capensis*	Cape Hare
	Rodentia	Sciuridae	*Xerus inauris*	Cape Ground Squirrel
		Bathyergidae	*Cryptomys hottentotus*	Common Mole-rat
		Hystricidae	*Hystrix africaeaustralis*	Porcupine
	Carnivora	Felidae	*Caracal caracal*	Caracal
		Hyaenidae	*Proteles cristata*	Aardwolf
		Herpestidae	*Cynictis penicillata*	Yellow Mongoose
			Galerella sanguinea	Common Slender Mongoose
			Suricata suricatta	Meerkat
		Canidae	*Canis mesomelas*	Black-backed Jackal
			Otocyon megalotis	Bat-eared Fox

			Vulpes chama	Cape Fox
	Tubulidentata	Orycteropodidae	*Orycteropus afer*	Aardvark
	Hyracoidea	Procaviidae	*Procavia capensis*	Rock Hyrax
	Artiodactyla	Suidae	*Phacochoerus africanus*	Common Warthog
		Bovidae	*Strepsiceros strepsiceros*	Cape Kudu
			Raphicerus campestris	Steenbok
			Sylvicapra grimmia	Bush Duiker

Invertebrate families occurring in the study area			
Class	**Order**	**Family**	**English Name**
Insecta	Thysanura	Lepismatidae	Silverfish
	Mantodea	Mantidae	Praying Mantids
	Orthoptera	Gryllidae	Crickets
		Pyrgomorphidae	Foam Grasshoppers
		Acrididae	Short-horned Grasshoppers
	Hemiptera	Notonectidae	Backswimmers
		Cicadellidae	Leafhoppers
		Cicadidae	Cicadas
		Pentatomidae	Stink Bugs
		Gerridae	Water Striders
	Thysanoptera	Thripidae	Common Thrips
	Coleoptera	Carabidae	Ground Beetles
		Meloidae	Blister Beetles
		Scarabaeidae	Scarab Beetles
		Tenebrionidae	Darkling Beetles

	Diptera	Culicidae	Mosquitoes
		Tabanidae	Horse Flies
		Muscidae	House Flies
	Hymenoptera	Formicidae	Ants

- **Preliminary Red Data Assessment**

Ninety-six Red Data animals are known to occur in the Northern Cape Province (butterflies, frogs, reptiles and mammals) and in the Q-grid 2823BD (birds) – Table 6. This includes 18 listed as Data Deficient (DD), 31 as Near Threatened (NT), 36 as Vulnerable (VU), 5 as Endangered (EN) and 6 as Critically Endangered (CR). It is estimated that 73 of the 96 animals listed have a low probability of occurring in the study area, 12 have a moderate-low probability, 6 a moderate probability, 3 a moderate-high and 2 species a high probability of occurring in the study area.

The estimated probabilities of the red data fauna assessment are based on:

- size of the study area;
- location of the study area;
- diversity and status of each faunal habitat within the study area; and
- connectivity of the study area to other untransformed faunal habitats.

Surveys conducted during the EIA phase will be utilised to assess the status and diversity of habitat types in more detail. The preliminary probabilities ascribed to Red Data species could therefore be amended to allow for additional/ new information gathered during that period.

Red Data Fauna assessment for the study area			
Species Details			**Probability Assessment**
Biological Name	**English Name**	**RD**	
Butterflies			
Aloeides kaplani	Kaplan's Copper	VU	low

Aloeides nollothi	Nolloth's Copper	VU	low
Aloeides pallida jonathani	Giant Copper	DD	low
Chrysoritis azurius	Azure Opal	VU	low
Chrysoritis beaufortius stepheni	Stephen's Opal	VU	low
Chrysoritis dicksoni	Dickson's Strandveld Copper	CR	low
Chrysoritis pan lysander	Lysander Opal	DD	low
Chrysoritis trimeni	Trimen's Opal	VU	low
Chrysoritis turneri wykehami	Wykeham's Opal	VU	low
Lepidochrysops badhami	Badham's Blue	VU	low
Lepidochrysops penningtoni	Pennington's Blue	VU	low
Lepidochrysops titei	Tite's Blue	VU	low
Lepidochrysops wykehami	Wykeham's Blue	VU	low
Phasis pringlei	Pringle's Arrowhead	VU	low
Thestor dryburghi	Dryburgh's Skolly	VU	low
Thestor pringlei	Pringle's Skolly	VU	low
Tuxentius hesperis	Western Pie	DD	low
Tuxentius melaena griqua	Black Pie	DD	low
Frogs			
Cacosternum karooicum	Karoo Caco	DD	low
Pyxicephalus adspersus	Giant Bullfrog	NT	low
Strongylopus springbokensis	Namaqua Stream Frog	VU	low
Reptiles			
Bitis inornata	Plain Mountain Adder	VU	low
Bitis schneideri	Namaqua Dwarf Adder	VU	low
Cordylus macropholis	Large-scaled Girdled Lizard	NT	low

Cordylus mclachlani	McLachlan's Girdled Lizard	VU	low
Dermochelys coriacea	Leatherback Turtle	CR	low
Gerrhosaurus typicus	Karoo Plated Lizard	NT	low
Goggia gemmula	Richtersveld Pygmy Gecko	DD	low
Goggia microlepidota	Small-scaled Gecko	NT	low
Homopus signatus	Speckled Padloper	NT	low
Lamprophis fiskii	Fisk's House Snake	VU	low
Typhlosaurus lomiae	Lomi's Blind Legless Skink	VU	low
Birds			
Phoenicopterus roseus	Greater Flamingo	NT	low
Phoenicopterus minor	Lesser Flamingo	NT	low
Mycteria ibis	Yellow-billed Stork	NT	low
Ciconia nigra	Black Stork	NT	low
Leptoptilos crumeniferus	Marabou Stork	NT	low
Sagittarius serpentarius	**Secretarybird**	**NT**	**high**
Gyps africanus	White-backed Vulture	VU	moderate-low
Gyps coprotheres	Cape Vulture	VU	moderate-low
Torgos tracheliotus	Lappet-faced Vulture	VU	moderate-low
Circus ranivorus	African Marsh Harrier	VU	moderate-low
Circus maurus	Black Harrier	VU	moderate-low
Aquila rapax	Tawny Eagle	VU	moderate
Polemaetus bellicosus	Martial Eagle	VU	moderate
Falco naumanni	Lesser Kestrel	VU	moderate-low
Falco biarmicus	**Lanner Falcon**	**NT**	**moderate-high**
Falco peregrinus	Peregrine Falcon	NT	moderate-low

Ardeotis kori	**Kori Bustard**	**VU**	**high**
Neotis ludwigii	Ludwig's Bustard	VU	moderate
Anthropoides paradisea	Blue Crane	VU	moderate-low
Charadrius pallidus	Chestnut-banded Plover	NT	low
Rostratula benghalensis	Greater Painted-snipe	NT	low
Glareola nordmanni	Black-winged Pratincole	NT	moderate-low
Mammals			
Acinonyx jubatus	Cheetah	VU	low
Atelerix frontalis	South African Hedgehog	NT	low
Bathyergus janetta	Namaqua Dune Mole-rat	NT	low
Bunolagus monticularis	Riverine Rabbit	CR	low
Chrysochloris asiatica	Cape Golden Mole	DD	low
Chrysochloris visagiei	Visagie's Golden Mole	CR	low
Cistugo lesueuri	Leseur's Wing-gland Bat	NT	low
Cistugo seabrai	Angolan Wing-gland Bat	VU	low
Crocidura cyanea	Reddish-grey Musk Shrew	DD	moderate
Crocidura fuscomurina	Tiny Musk Shrew	DD	low
Crocidura hirta	Lesser Red Musk Shrew	DD	low
Crocidura silacea	Lesser Grey-brown Musk Shrew	DD	low
Crocuta crocuta	Spotted Hyaena	NT	low
Cryptochloris wintoni	De Winton's Golden Mole	CR	low
Damaliscus lunatus lunatus	Tsessebe	EN	low
Diceros bicornis bicornis	Black Rhinoceros - arid ecotype	CR	low
Elephantulus intufi	Bushveld Elephant-shrew	DD	low
Equus zebra hartmannae	Hartmann's Mountain Zebra	EN	low

Erimitalpa granti	Grant's Golden Mole	VU	low
Graphiurus platyops	Rock Dormouse	DD	low
Hippotragus equinus	Roan Antelope	VU	low
Hyaena brunnea	Brown Hyaena	NT	moderate
Lycaon pictus	African Wild Dog	EN	low
Manis temminckii	Pangolin	VU	low
Mellivora capensis	**Honey Badger**	**NT**	**moderate-high**
Miniopterus schreibersii	Schreiber's Long-fingered Bat	NT	moderate
Mirounga leonina	Southern Elephant Seal	EN	low
Myosorex varius	Forest Shrew	DD	low
Mystromys albicaudatus	White-tailed Rat	EN	low
Otomys slogetti	Sloggett's Rat	DD	low
Panthera leo	Lion	VU	low
Paratomys littledalei	Littledale's Whistling Rat	NT	low
Petromys typicus	Dassie Rat	NT	low
Poecilogale albinucha	African Weasel	DD	moderate-low
Rhinolophus capensis	Cape Horseshoe Bat	NT	low
Rhinolophus clivosus	Geoffroy's Horseshoe Bat	NT	moderate-low
Rhinolophus darlingi	Darling's Horseshoe Bat	NT	moderate-low
Rhinolophus denti	Dent's Horseshoe Bat	NT	low
Rhinolophus fumigatus	Ruppel's Horseshoe Bat	NT	low
Suncus varilla	Lesser Dwarf Shrew	DD	low
Tatera leucogaster	**Bushveld Gerbil**	**DD**	**moderate-high**
Xerus princeps	Mountain Ground Squirrel	NT	low

7.1.4.2 Flora

The regional vegetation is described as Ghaap Plateau Vaalbosveld (Mucina & Rutherford, 2006), comprising the flat plateau from around Campbell in the south, east of Danielskuil through Reivilo to around Vryburg in the north and is characterised by a well-developed shrub layer with *Tarchonanthus camphoratus* and *Acacia karroo*. The open tree layer has *Olea europaea* subsp. *africana, A. tortilis, Ziziphus mucronata* and *Searsia lancea. Olea europaea* is more important in the southern parts of the unit, while *Acacia tortilis, A. hebeclada* and *A. mellifera* are more important in the north and parts of the west of the unit. Much of the south-central part of this unit has remarkably low cover of *Acacia* species for an arid savannah, dominated by the non-thorny *Tarchonanthus camphoratus*, *Searsia lancea* and *Olea europaea* subsp. *africana.*

The conservation status of this vegetation type is regarded Least Threatened, although none is conserved in statutory conservation areas. Only about 1% is transformed.

Biogeographically important species that occur in this unit include *Calobota cuspidosa, Nuxia gracilis, Blepharis marginata, Putterlickia saxatilis, Tarchonanthus obovatus, Euphorbia wilmaniae, Prepodesma orpenii, Digitaria polyphylla, Panicum kalaharense, Corchorus pinnnatipartitus, Helichrysum arenicola* and *Orbea knobelii*. The endemic taxon *Rennera stellata* is also present within this unit.

- **Trees**

Acacia erioloba, *A. mellifera* subsp*. detinens, Searsia lancea, A. karroo, A. tortilis, subsp. heteracantha* and ***Boscia albitrunca****.*

- **Shrubs**

Olea europaea* subsp. *africana, *Rhigozum trichotomum, Tarchonanthus camphoratus, Ziziphus mucronata, Diospyros austro-africana, D. pallens, Ehretia rigida, Euclea crispa* subsp*. ovata, Grewia flava, Gymnosporia buxifolia, Lessertia frutescens, Searsia tridactyla, Acacia hebeclada* subsp*. hebeclada, Aptosimum procumbens, Chrysocoma ciliata, Helichrysum zeyheri, Hermannia comosa, Lantana rugosa, Leucas capensis, Melolobium microphyllum, Peliostomum leucorrhizum, Pentzia globosa, P. Viridis, Thesium hystrix* and *Zygophyllum pubescens.*

- **Succulent shrubs**

Hertia pallens and *Lycium cinereum.*

- **Woody climber**

Asparagus africanus

- **Graminoids**

Anthephora pubescens, Cenchrus ciliata, Digitaria eriantha subsp*. eriantha, Enneapogon scoparius, Eragrostis lehmanniana, Schmidtia pappophoroides, Themeda triandra, Aristida adscensionis, A. congesta, A. diffusa, Cymbopogon pospischilii, Enneapogon cenchroides, E. desvauxii, Eragrostis echinochloidea, E. obtusa, E. rigidior, E. superba, Fingerhuthia africana, Heteropogon contortus, Sporobolus fimbriatus, Stipagrostis uniplumis* and *Tragus racemosus.*

- **Herbs**

Barleria macrostegia, Geigeria filifolia, G. ornativa, Gisekia africana, Helichrysum cerastioides, Heliotropium ciliatum, Hermbstaedtia odorata, Hibiscus marlothianus, H. pusillus, Jamesbrittenia aurantiaca, Limeum fenestratum, Lippia scaberrima, Selago densiflora, Vahlia capensis subsp*. vulgaris* and *Aloe grandidentata.*

7.1.4.3 Regional Diversity

Information obtained from the SANBI database indicate the known presence of only 8 plant species within the ¼ degree grids in which the proposed sites are located (2823BD). Generally, it is estimated that any grid where less than 300 species are known to occur is regarded a result of under sampling and does not reflect the true floristic diversity of the particular area. The existing database is therefore not regarded an accurate reflection of the true floristic diversity of the region.

7.1.4.4 Flora species of Conservation Importance

South Africa's Red List system is based on the IUCN Red List Categories and Criteria Version 3.1 (finalized in 2001), amended to include additional categories to indicate species that are of local conservation concern. The IUCN Red List system is designed to detect risk of extinction. Species that are at risk of extinction, also known as threatened or endangered species are those that are classified in the categories Critically Endangered (CR), Endangered (EN) and Vulnerable (VU).

No Red Data species are known to occur in the ¼ degree grids in which the study areas are located. However, since much of the study area comprises relative pristine habitat, the possibility that Red Data species might be present within the study area cannot be excluded.

In terms of the National Forests Act of 1998 certain tree species can be identified and declared as protected. All trees occurring in natural forests are also protected in terms of the Act. Protective actions take place within the framework of the Act as well as national policy and guidelines. Trees are protected for a variety of reasons, and some species require strict protection while others require control over harvesting and utilization. In terms of the National Forests Act of 1998, protected tree species may not be cut, disturbed, damaged, destroyed and their products may not be possessed, collected, removed, transported, exported, donated, purchased or sold – except under license granted by the Department of Water Affairs and Forestry (or a delegated authority). The following species are present in the study area and are protected under this act:

- *Acacia erioloba;* and
- *Boscia albitrunca.*

The lack of floristic knowledge of the region is reflected in the absence of information on conservation important species. The likelihood of encountering Red Data flora species on the property is regarded medium low. Surveys conducted during the raining period are likely to reveal more accurate information on the presence/ absence of Red Data flora species within the study area.

7.1.4.5 Preliminary Macro Habitat types

Results of the photo analysis and basic site investigations revealed the presence of the following preliminary macro habitat types within the study area (Figure 6):

- Calcareous Pans – usually devoid of vegetation or characterised by short grasses and low forbs, trees and shrubs generally absent. Ephemeral in nature, assumed to be dominated by more dense vegetation during periods of inundation;

- Drainage Lines – similar to pans in appearance, devoid of vegetation, characterised by clayey substrate, low grasses and forbs, trees and shrubs generally absent;
- Infrastructure, Homestead, etc. – no natural habitat remaining;
- Natural Spring – lasting source of water, characterised by sedges and trees, relative dense vegetation; and
- Natural Woodland – comprises the largest extent of the study area, vegetation typical to the regional vegetation with open savannah/ shrubland, dominated by *Tarchonanthus camphoratus* and other shrubs/ trees.

The vegetation of the study area exhibits the characteristics of the natural regional vegetation types and little degradation is noted across the site, which is mostly the result of grazing by cattle. The physiognomy is typically open shrubveld with occasional/ frequent trees and a small drainage line and natural spring in the central western part of the study area. A relative diverse herbaceous component was noted during the site investigation, this would be investigated in more detail during the EIA phase of the project.

The regional database indicates a relative low likelihood of encountering Red Data species within this area, but this is regarded a reflection of the under sampling of the region, rather than a true reflection of the floristic status thereof. Protected trees (Olea europaea and Acacia erioloba) occur in the study area, but at low abundance values.

While the conservation status of the regional vegetation is regarded as Least Threatened, mostly because of the untransformed nature of these vegetation types on a regional scale, the vegetation of the study area is found to be relative pristine. At this stage, a moderate floristic sensitivity is ascribed to the terrestrial vegetation types, but a medium-high floristic sensitivity is ascribed to macro habitat types that are associated with wetland habitat, comprising the pans, drainage line and natural spring (high).

EIA investigations will aim to assess the diversity of the macro habitat types, confirm the variability in habitat, assess the abundance/ presence of conservation important species and, ultimately, confirm the sensitivity of habitat types that characterise the study area. Habitat importance will not only be considered on a local scale, but will also be considered in a cumulative sense, taking cognisance of numerous similar developments in the region.

Please refer to attached Biodiversity Scoping Study **Appendix J**.

7.1.5 Geohydrological

7.1.5.1 Physiography and Climate

The site is located ~32 km south-east of Danielskuil and ~9 km south of the R31 route from Kimberley to Postmasburg. Drainage is in a southerly direction towards the Klein Riet River, which drains in a south-easterly direction to the Vaal River. The terrain in the study area is very flat with a general slope of ~1:2 000 or 0.05% to the south-east.

The elevation of the study area varies between ~1 410mamsl in the south-eastern corner of the farm and 1 425mamslat the Arriesfontein homestead near the north-western boundary of the farm. Numerous pans occur in the area of which several are most likely formed by subsidence of sinkholes.

The climate of the area is typical of a semi-desert with very hot summers and cold winters. Temperature data for Kimberley, ~140 km east of the site (as supplied by the South African Weather Service), for the period 1961-2000 is summarized in **Table 8** below. The data indicate that January is the hottest month with an average maximum daily temperature of 32oC and June the coldest with an average maximum daily temperature of 18.4oC. During July the average minimum daily temperature drops to only 2.5oC.The maximum temperature reached during this period was 40.9oC and the lowest -8.1oC.

Table 9: Temperature data for Kimberley (South African Weather Service)

Month	Temperature (° C)				Precipitation		
	Highest Recorded	Average Daily Maximum	Average Daily Minimum	Lowest Recorded	Average Monthly (mm)	Average Number of days with >= 1mm	Highest 24 Hour Rainfall (mm)
January	42	36	20	10	24	4	33
February	42	34	20	9	35	6	59
March	41	32	18	5	37	6	46
April	38	28	13	2	26	5	52
May	34	24	8	-2	10	2	26
June	29	21	5	-5	4	2	13
July	29	21	4	-6	2	1	7
August	33	23	6	-7	4	1	40
September	39	27	9	-2	4	2	19
October	40	30	13	2	9	3	22
November	41	33	16	5	17	3	51
December	43	35	19	6	17	4	42
Year	**43**	**29**	**13**	**-7**	**189**	**37**	**59**

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(MAP) of 458 m

Table 10: Precipitation statistics for the Arriesfontein area (Source: South African Rain Atlas)

	Average monthly precipitation for Arriesfontein (Station Coordinates: S28°17' E023°46'												
	Jan	***Feb***	***Mar***	***Apr***	***May***	***Jun***	***Jul***	***Aug***	***Sep***	***Oct***	***Nov***	***Dec***	***Year***
Mean (mm):	*73.9*	*87.1*	*88.8*	*48.5*	*17.1*	*5.9*	*4.1*	*6.4*	*12.8*	*25.3*	*35.7*	*52.4*	***458.2***
SD (mm):	*40.3*	*44.6*	*43.5*	*30.8*	*16.3*	*8.8*	*7.2*	*9.8*	*14.9*	*21.1*	*24.9*	*32.0*	***94.2***

The data indicate that 84% of the precipitation occurs during the months November to April. This phenomenon is characteristic of a summer rainfall area. March is the wettest month with an average precipitation of ~89 mm, whilst July is the driest with 4 mm.

The rainfall distribution for this area is indicated in **Figure 15** over page. Rainfall generally decreases from site to the east, west and south and increases to the north. The highest precipitation in the Arriesfontein area and its direct surrounds occurs immediately north of the northern corner of the property, where the MAPexceeds480 mm. The lowest precipitation occurs in the southern part of the farm with a MAP of ~445 mm.

Please refer to attached Geohydrological Scoping Study **Appendix K**.

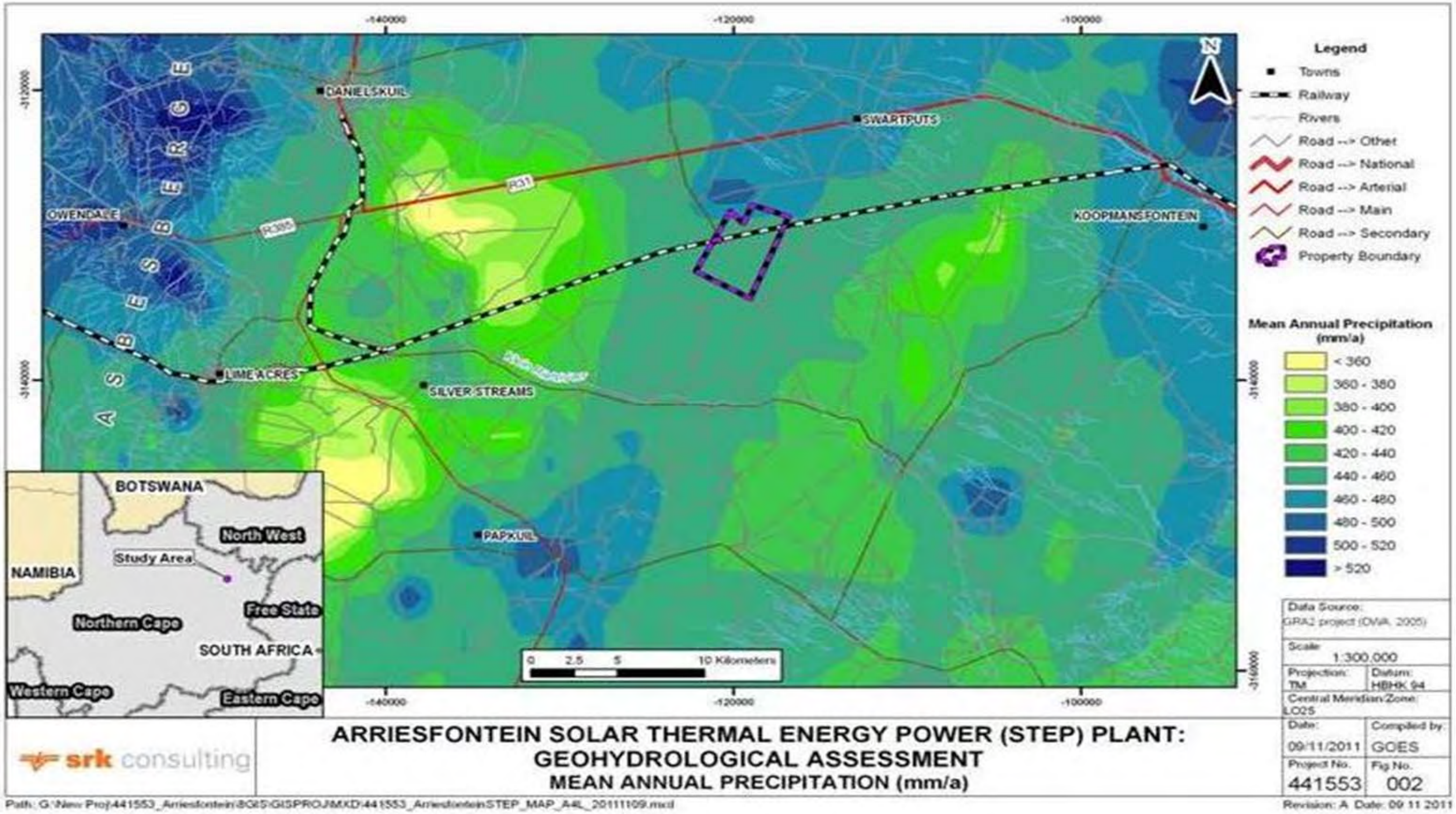


Figure 15: Rainfall distribution in the Arriesfontein

7.1.5.2 Geology

The geology of the study area is depicted in **Figure 16** over page. The geological map indicates that significant parts of the study area are covered by recent deposits of mainly red to pale coloured windblown sand of the Gordonia Formation, surface limestone and some rock rubble. These deposits occur along the flat laying areas and are generally thin, seldom exceeding 10 m in vertical thickness in this area. However, thick recent deposits can occur along drainage channels and in some pans where leaching of the dolomite took place. Closer to the Asbestos Hills the rubble can reach a vertical thickness of >70 m as indicated by exploration drilling supervised by the author during the 1990s. During this exploration drilling a NW-SE striking palaeo-river channel was intersected on the farm Beadle ~22 km west of Arriesfontein. The exploration borehole intersected some surface limestone on top followed by banded ironstone gravel. Dolomitic bedrock was only intersected at 60 mbgl. Diamonds are presently mined from these alluvial deposits.

A salt pan located on the farm Soutpan ~17 km south of Arriesfontein has formed as a result of Dwyka sediments that have collapsed in a sinkhole. The Dwyka sediments are ~80 m thick at this location (Based on a hydrocensus survey conducted by the author during the early 1990s).

Arriesfontein homestead is located between the parallel NE-SW striking dolerite dykes which can likely be linked to faults in the dolomitic rocks of the Lime Acres Member of the Ghaap Plateau Formation, Campbell Group. Rocks of this Member consist mainly of dolomite with interbedded limestone, chert and chert breccia. Though not indicated on geological maps, drilling programmes have indicated that thin interlayers of black shale occur in the dolomite and limestone. These layers are seldom >1 m in vertical thickness and weathers negative due to its relative softness. The interbedded chert formations occur as layers and lenses, whilst the limestone occurs mostly as lenses.

Dolerite dykes seldom outcrop, but can in most cases be identified on surface by prominent tree lines and calcrete ridges. These linear ridges can protrude >1 m above the surrounding flat areas. A prominent chert layer occurs east of the farm. This layer forms the base of the Lime Acres Member, with the Fairfield Member, consisting mainly of re-crystallized dolomite, underneath.

The general dip of the sediments in this area is ~2o to the west, but the dip steepens westwards towards the Asbestos Hills. On the eastern flank of the Asbestos Hills rock dips of >6o west can be encountered

SOLARRESERVE

ARRIESFONTEIN SOLAR POWER PLANT: PHOTOVOLTAIC PHASE 1 - 3

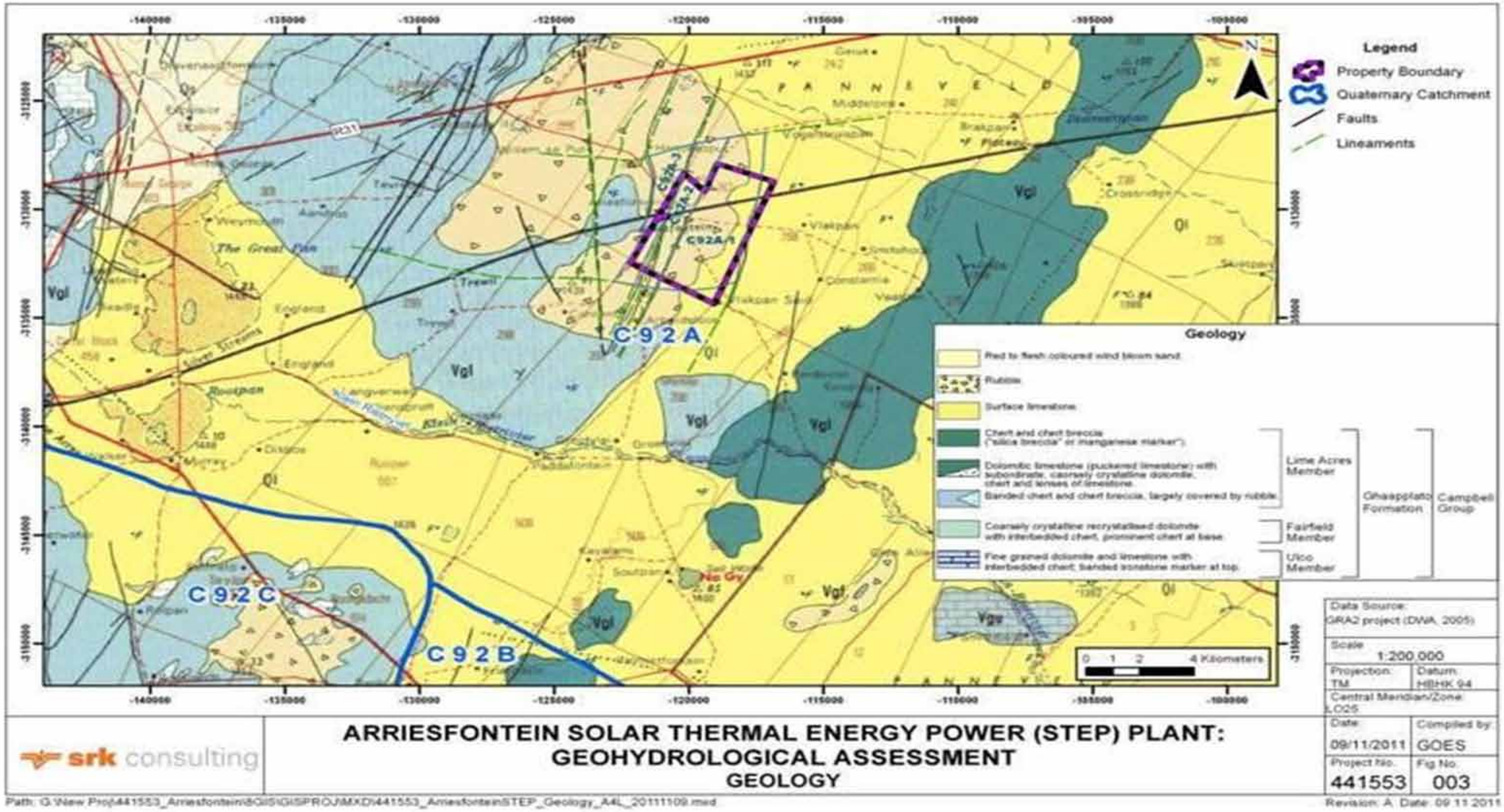


Figure 16: Geology of the Arriesfontein area (Council for Geosciences)

7.1.5.3 Hydrogeology

- **Aquifer Type**

Groundwater in this area occurs mainly in semi-confined fractured-rock aquifers, also known as secondary aquifers (**Figure 17** over page). These aquifers are formed by jointing and fracturing of the otherwise solid bedrock by compressional and tensional forces that operates in the Earth's crust from time to time. The fractures are formed by faulting, folding, intrusion of dolerite dykes and other geological forces. Slightly acidic rainwater infiltrates along these joints and fractures and slowly dissolves the alkaline rocks to eventually form solution cavities. Solution cavities commonly also form on contact zone of dolomite with other rock types like chert and black shale.

Unconfined interganular aquifers (also known as primary aquifers) occur in and near drainage channels and in some pans where the groundwater levels are shallow and within the unconfined unconsolidated sediments and weathered zone. These areas have been leached by water and are characterized by loose, unconsolidated material extending to well below 10 mbgl. The unconsolidated deposits and weathered zoneon the site are, however, limited in both horizontal and vertical extend and consist mainly of clay and silt. These result in a poorly developed, low yielding primary aquifer that is vulnerable to droughts. Therefore the primary aquifer in this area can be regarded as insignificant.

- **NGA Data**

The Geohydrological information retrieved from the NGA is summarized in **Table 11** page **100**. The table indicates that borehole yields are highly variable and four of the 115 boreholes have yields >12L/s. The average borehole yield of the successful boreholes is 2.02 L/s compared to the median yield of 0.43 L/s, which emphasize the fact that the average borehole yield is skewed by a few extraordinary high yielding boreholes. Therefore the median yield is a much better indication of the yield that can be expected from a successful borehole in this area. The median yield correlates well with DWA's yield map which suggests an average yield of 0.1 - 0.5 L/s for successful boreholes. Average borehole depths for this area are >50mbglwhilst the median depth is ~40 mbgl. This again indicates that the average borehole depth is skewed by a few deep boreholes (>200 mbgl) drilled on the farms Rooipan and Geluk. The localities of the NGA boreholes are indicated in

Figure 18. Field measured electrical conductivities (ECs) are generally well below 200 mS/m except for a few anomalous ECs recorded on the farms Jonasbank, Weiveld and Farm 266. The very high EC (for this area) of 404 mS/m recorded at Jonasbank is suspected to be a result of nitrate pollution from soak-away pits kraals and or stock water points.

ID	Type	Latitude	Longitude	Accuracy (m)	Elevation (mamsl)	Farm	Farm No	Depth (mbgl)	Yield (L/s)	EC (mS/m)	pH
2823BC00013	Borehole	-28.35620	23.64028		1440	LANGVERWAGHT	299	45			
2823BC00011	Borehole	-28.35620	23.64028		1440	LANGVERWAGHT	299	60	5.00		
2823BC00012	Borehole	-28.35620	23.64028		1440	LANGVERWAGHT	299	100	2.13		
2823BA00131	Borehole	-28.23341	23.64945	100		JONASBANK	263	4.2			
2823BA00132	Borehole	-28.22869	23.65306	100		JONASBANK	263	4.6			
2823BA00133	Borehole	-28.21229	23.66084	100		JONASBANK	263	60			
2823BA00134	Borehole	-28.21257	23.66251	100		JONASBANK	263	6		113	7.20
2823BC00035	Borehole	-28.38370	23.66612		1440	ROOIPAN	507	30.78			
2823BC00033	Borehole	-28.38370	23.66612		1440	ROOIPAN	507	61.26			
2823BC00036	Borehole	-28.38370	23.66612		1440	ROOIPAN	507	46.02	0.08		
2823BC00029	Borehole	-28.38370	23.66612		1440	ROOIPAN	507	53.95	5.69		
2823BC00034	Borehole	-28.38370	23.66612		1440	ROOIPAN	507	54.86	0.03		
2823BC00031	Borehole	-28.38370	23.66612		1440	ROOIPAN	507	73.15	0.01		
2823BC00028	Borehole	-28.38370	23.66612		1440	ROOIPAN	507	85.04	3.79		
2823BC00032	Borehole	-28.38370	23.66612		1440	ROOIPAN	507	137.16	1.22		
2823BC00030	Borehole	-28.38370	23.66613		1440	ROOIPAN	507	94.49			
2823BA00125	Borehole	-28.23562	23.67529	100		JONASBANK	263	11.2		131	7.60
2823BC00044	Borehole	-28.27260	23.67779		1440	TEVREDE	300	39	3.20		
2823BC00043	Borehole	-28.27260	23.67779		1440	TEVREDE	300	60	0.10		
2823BC00050	Borehole	-28.37450	23.68278		1420	ROOIPAN	507	29	0.60		

2823BC00048	Borehole	-28.37450	23.68278		1420	WITPUT	507	50		
2823BC00049	Borehole	-28.37450	23.68279		1420	WITPUT	507	62		
2823BA00123	Borehole	-28.24396	23.68722	100		JONASBANK	263			
2823BC00042	Borehole	-28.32230	23.68806		1440	TREWIL	299	30.78	1.60	
2823BC00040	Borehole	-28.32230	23.68806		1440	TREWIL	299	45.11	0.17	
2823BC00041	Borehole	-28.32230	23.68806		1440	TREWIL	299	57.3		
2823BC00039	Borehole	-28.32230	23.68806		1440	TREWIL	299	75.59		
2823BA00121	Borehole	-28.24146	23.68806	100		JONASBANK	263	6.3	12.60	118
2823BA00120	Borehole	-28.24174	23.68945	100		JONASBANK	263		12.60	143
2823BA00129	Borehole	-28.19979	23.68972	100		JONASBANK	263	5.3		172
2823BC00045	Borehole	-28.37060	23.69334		1420	VLEIPLAAS	298	75.9	0.06	
2823BA00124	Borehole	-28.23230	23.69334	100		JONASBANK	263	13.6	12.60	
2823BC00046	Borehole	-28.37060	23.69335		1420	VLEIPLAAS	298	57.3		
2823BA00128	Borehole	-28.22619	23.69472	100		JONASBANK	263	6.4		
2823BA00127	Borehole	-28.22591	23.69472	100		JONASBANK	263	6.9		192
2823BA00130	Borehole	-28.19424	23.70028	100		JONASBANK	263	60		
2823BA00122	Borehole	-28.24729	23.70084	100		JONASBANK	263	20.5		103
2823BA00126	Borehole	-28.21063	23.70167	100		JONASBANK	263			116
2823BA00135	Borehole	-28.18685	23.71233	100		WEIVELD	246	11		192.5
2823BC00027	Borehole	-28.38290	23.71612		1420	PADDAFONTEIN	297	26.15	1.82	
2823BA00136	Borehole	-28.17141	23.71817	100		WEIVELD	246	11		220
2823BA00119	Borehole	-28.22869	23.71918	100		JONASBANK	263	27	0.37	69
2823BC00107	Borehole	-28.26400	23.71945	100	1440	PLAAS 265	265	13.7		197
2823BA00118	Borehole	-28.21758	23.72140	100		JONASBANK	263	36	0.37	404
2823BC00108	Borehole	-28.25810	23.72168	100	1440	PLAAS 265	265	9.4		144
2823BA00155	Borehole	-28.19136	23.72528	100		KAIS	245	19.8		215

2823BC00002	Borehole	-28.31920	23.72863		1420	CONTENT	298	45.72	3.79	
2823BA00137	Borehole	-28.16307	23.73078	100		WEIVELD	246	2.73		153.5
2823BA00138	Borehole	-28.16302	23.73104	100		WEIVELD	246	16.68		
2823BA00141	Borehole	-28.23146	23.73917	100		PLAAS 265	265	11.9		81
2823BC00109	Borehole	-28.25480	23.73945	100	1430	PLAAS 265	265	7.9		
2823BA00154	Spring	-28.16886	23.74175	100		KAIS	245		12.60	140.5
2823BC00110	Borehole	-28.27420	23.74500	100	1430	PLAAS 266	266	11.7		147
2823BD00084	Borehole	-28.28920	23.75167	100	1430	PLAAS 266	266	26.6		89
2823BD00081	Borehole	-28.25590	23.75945		1440	PLAAS 266	266			
2823BD00083	Borehole	-28.28060	23.76028	100	1430	PLAAS 266	266	6.1		102
2823BD00086	Borehole	-28.28290	23.76056	100	1430	PLAAS 266	266	17.6		203
2823BD00079	Borehole	-28.25400	23.76112		1440	PLAAS 266	266	4.8		99
2823BD00074	Borehole	-28.28200	23.76612		1420	PLAAS 267	267	5.6		81
2823BB00037	Borehole	-28.20040	23.76612			VERGENOEG	244	83.21		
2823BB00036	Borehole	-28.20040	23.76612			VERGENOEG	244	60.04	0.05	
2823BB00039	Borehole	-28.20040	23.76612			VERGENOEG	244	76.5	1.81	
2823BB00035	Borehole	-28.20040	23.76612			VERGENOEG	244	81.99	0.07	
2823BB00038	Borehole	-28.20040	23.76614			VERGENOEG	244	131.06		
2823BD00077	Borehole	-28.30060	23.76668		1420	PLAAS 267	267	7.2		119
2823BD00085	Borehole	-28.27060	23.76890	100	1430	PLAAS 266	266	6.1		81
2823BD00076	Borehole	-28.28480	23.77529		1420	PLAAS 267	267			82
2823BB00048	Borehole	-28.20370	23.77960	100		SURPRISE	243	3.69		159.6
2823BD00075	Borehole	-28.28200	23.78029		1420	PLAAS 267	267	9.4		84
2823BD00078	Borehole	-28.27060	23.78223		1420	PLAAS 267	267	11.3		93
2823BD00013	Borehole	-28.27260	23.78278		1420	HOPEFIELD	267	48.15		
2823BD00011	Borehole	-28.27260	23.78278		1420	HOPEFIELD	267	126.8		

2823BD00009	Borehole	-28.27260	23.78278		1420	HOPEFIELD	267	30.48		
2823BD00007	Borehole	-28.27260	23.78278		1420	HOPEFIELD	267	213.96		
2823BD00003	Borehole	-28.27260	23.78278		1420	HOPEFIELD	267	93		
2823BD00002	Borehole	-28.27260	23.78278		1420	HOPEFIELD	267	34	1.29	
2823BD00008	Borehole	-28.27260	23.78278		1420	HOPEFIELD	267	123.44	0.03	
2823BD00005	Borehole	-28.27260	23.78278		1420	HOPEFIELD	267	126	0.98	
2823BD00014	Borehole	-28.27260	23.78278		1420	HOPEFIELD	267	150.57	0.43	
2823BD00006	Borehole	-28.27260	23.78278		1420	HOPEFIELD	267	195.98	0.04	
2823BD00012	Borehole	-28.27260	23.78278		1420	HOPEFIELD	267	223.11	1.16	
2823BD00004	Borehole	-28.27260	23.78279		1420	HOPEFIELD	267	129		
2823BD00010	Borehole	-28.27260	23.78282		1420	HOPEFIELD	267	90.52		
2823BB00049	Borehole	-28.21900	23.79836	100		SURPRISE	243	7.14		
2823BB00055	Borehole	-28.24920	23.79889			PLAAS 267	267	12.3		112
2823BB00044	Borehole	-28.18370	23.79945			WATERKOP	244	96.92	0.63	
2823BD00071	Borehole	-28.40900	23.80195		1390	PLAAS 510	510	51.4		
2823BB00050	Borehole	-28.17520	23.8127	100		SURPRISE	243	12.09		171.9
2823BD00060	Borehole	-28.40400	23.82418		1390	PLAAS 13	13	6.65		89
2823BB00046	Borehole	-28.18620	23.82999	100		SURPRISE	243	6.12		161.4
2823BB00047	Borehole	-28.18650	23.83050	100		SURPRISE	243	7.45		162.2
2823BD00034	Borehole	-28.30040	23.84167		1400	SMITHSHOOP	269	54.86	0.05	
2823BD00033	Borehole	-28.30040	23.84167		1400	SMITHSHOOP	269	69.49	0.13	
2823BD00030	Borehole	-28.30040	23.84167		1400	SMITHSHOOP	269	70.4	0.18	
2823BD00032	Borehole	-28.30040	23.84167		1400	SMITHSHOOP	269	76.5	0.42	
2823BD00031	Borehole	-28.30040	23.84167		1400	SMITHSHOOP	269	88.08	0.1	
2823BD00087	Borehole	-28.30920	23.84695		1400	CONSTANTIA	269	59.44		
2823BB00041	Borehole	-28.21700	23.84945			GELUK	242	152.4	0.26	

2823BB00040	Borehole	-28.21700	23.84945			GELUK	242	213.36	0.04	
2823BD00061	Borehole	-28.41060	23.85418		1380	PLAAS 13	13	12		129
2823BB00014	Borehole	-28.23370	23.85835			MIDDELPOS	241	19.5	2.52	
2823BB00015	Borehole	-28.23370	23.85835			MIDDELPOS	241	39.92	0.90	
2823BB00016	Borehole	-28.23370	23.85835			MIDDELPOS	241	46.32	2.83	
2823BB00017	Borehole	-28.23370	23.85835			MOOIPLAATS	370	75.59	0.11	
2823BB00018	Borehole	-28.23370	23.85835			MOOIPLAATS	370	83.51	0.30	
2823BD00035	Borehole	-28.31700	23.86613		1400	VAALPAN	269	49.68	2.14	
2823BB00002	Borehole	-28.20040	23.86613			BAKKIESDRAAI	207	31.08	1.76	
2823BB00003	Borehole	-28.20040	23.86613			BAKKIESDRAAI	207	36.57	0.01	
2823BB00001	Borehole	-28.20040	23.86613			BAKKIESDRAAI	207	53.34	0.07	
2823BB00056	Borehole	-28.19140	23.86646	100		BAKKIESDRAAI	207	5.68		124.8
2823BB00057	Borehole	-28.19150	23.86672	100		BAKKIESDRAAI	207	5.39		
2823BB00063	Borehole	-28.19680	23.88077	100		PLAAS 207	207	8.25		152.9
2823BB00061	Borehole	-28.16890	23.89452	100		BAKKIESDRAAI	207	6.19		170.1
2823BB00062	Borehole	-28.19100	23.89641	100		PLAAS 207	207	15.14		
2823BB00032	Borehole	-28.24760	23.89946			BRAKPAN	240	52.12	0.42	
Average								**50.65**	**2.02**	**141.5**
Median								**39.92**	**0.43**	**131.0**

Table 11: Summary of NGA Data for the Arriesfontein Area

SOLARRESERVE

ARRIESFONTEIN SOLAR POWER PLANT: PHOTOVOLTAIC PHASE 1 - 3

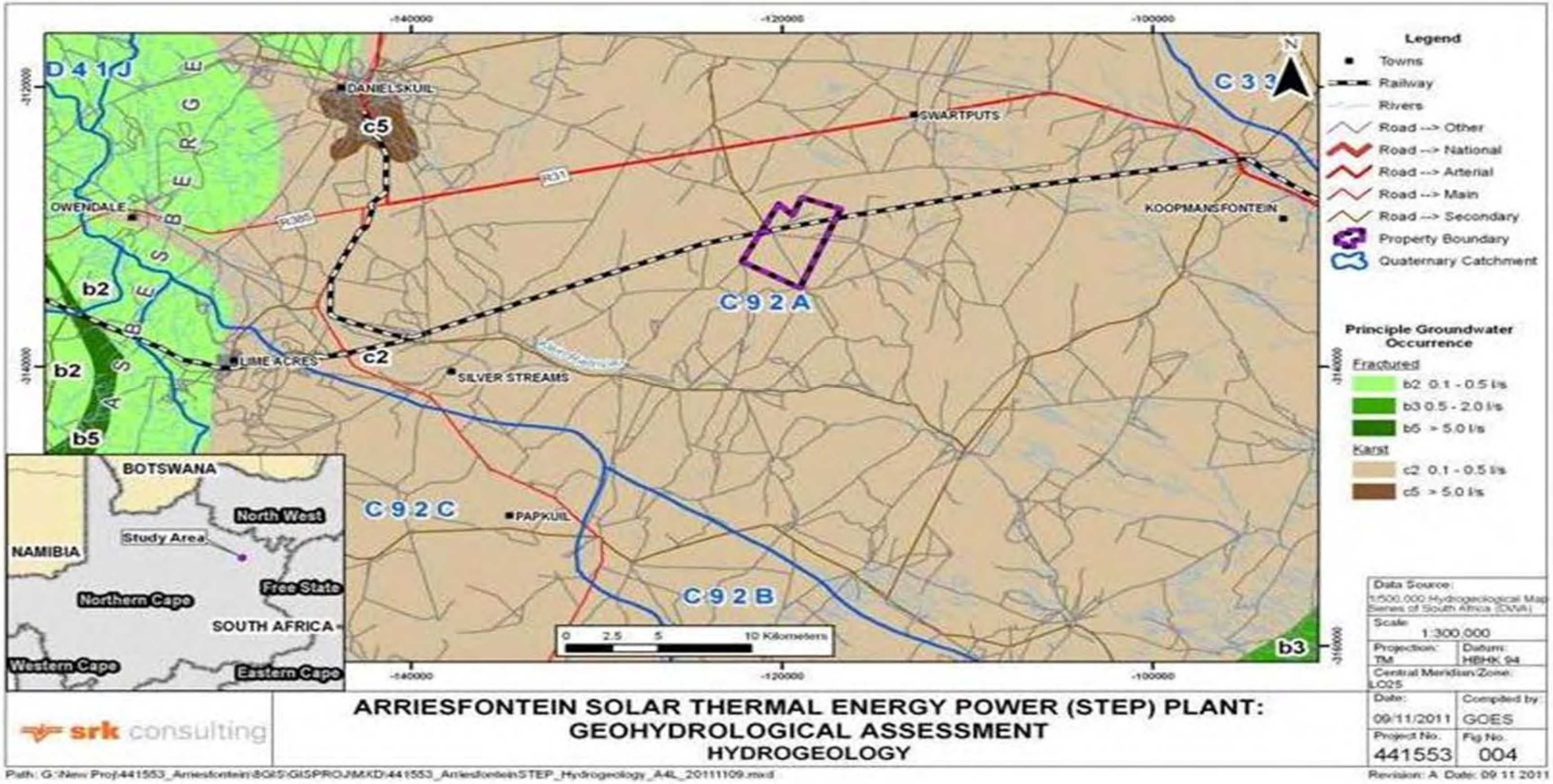


Figure 17: Aquifer type and yield potential in the Arriesfontein area (after the DWA 1:500 000 scale hydrogeological map series data)

SOLARRESERVE

ARRIESFONTEIN SOLAR POWER PLANT: PHOTOVOLTAIC PHASE 1 - 3

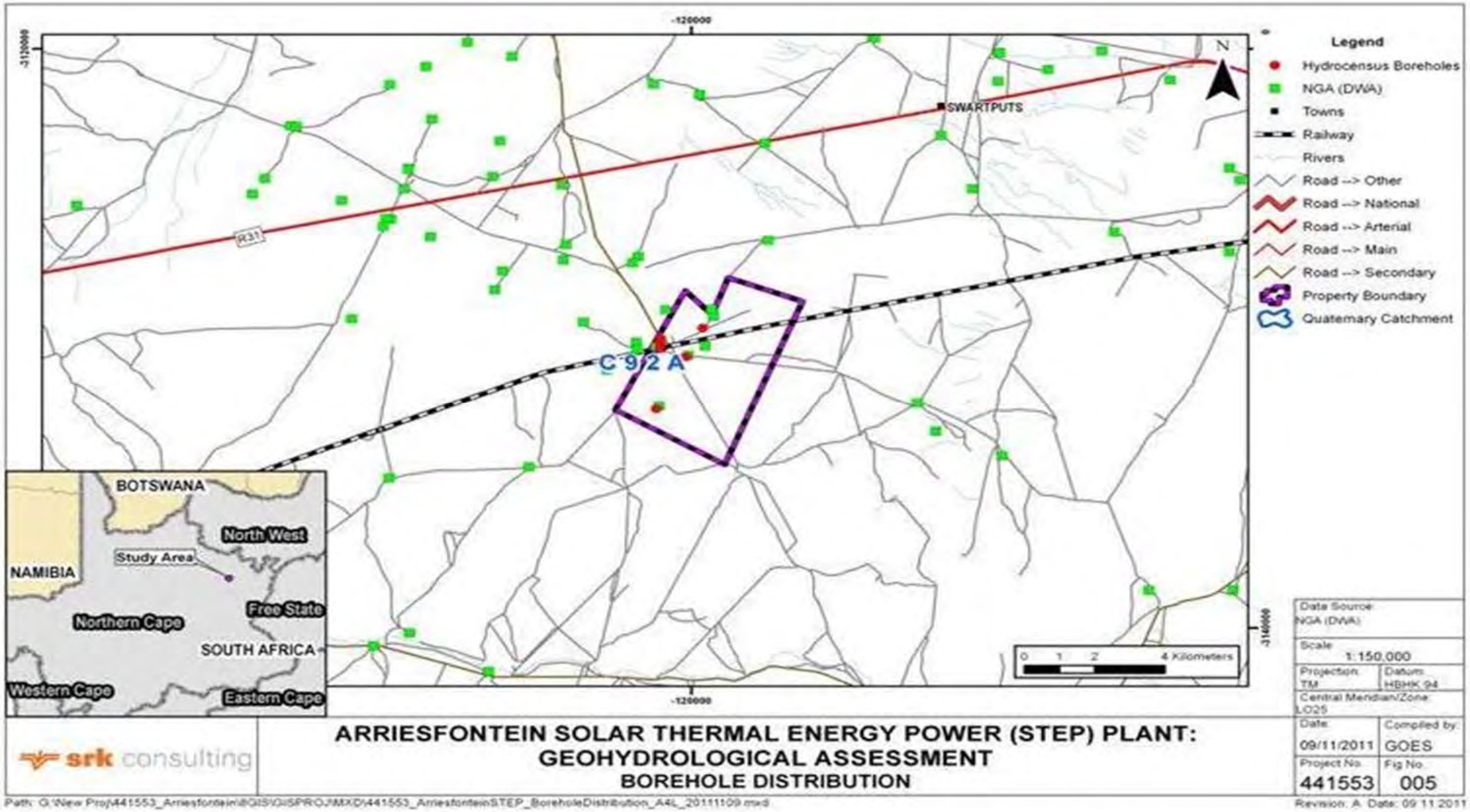


Figure 18: Localities of surveyed boreholes in the Arriesfontein area

7.1.5.4 Hydrocensus Result

The hydrocensus results are summarized in **Table 12**below with the localities of these boreholes indicated in

Figure 18 on the previous page. Seven boreholes and one non-perennial spring were surveyed on the site. Of these three were equipped with windpumps, one with a submersible pump and one with a plunger pump for stock watering purposes. The two high yielding boreholes AFN3 and AFN4 were vandalized and can no longer be used as production boreholes. All three high yielding boreholes (AFN3, AFN4 and AFN5) are close to dolerite dykes. The relatively deep water level measured in borehole AFN6 could be due to a recovering water level after pumping having been measured. According to the owner, borehole AFN5 becomes artesian after good rains.

Table 12: Summary of Hydrocensus Results of the Arriesfontein Area.

Bh No	Latitude	Longitude	Depth (mbgl)	Yield (ℓ/s)	WL* (mbgl)	EC** (mS/m)	pH	Equipment	Use	Pump Intake (mbgl)	Est.Abstrac-tion (m^3/a)	Comments
AFN1	-28.28006	23.76747	9	2.0	3.55			WP 100mm Cylinder	Domestic, Stock	7.5	3 400	
AFN2	-28.28016	23.76793	40	1.5	3.21	76	7.80	32mm Submersible	Domestic, Stock	15.0	3 942	
AFN3	-28.27929	23.76800	60	>10				None	None		0	Blocked
AFN4	-28.28235	23.76771		>10				None	None		0	Was pumped at 12 mbgl
AFN5	-28.28499	23.77537	30	10.0	1.87	173	7.65	Plunger Pump 60mm Cylinder	Stock	12	629	Artesian during wet spells
AFN6	-28.30119	23.76640	80	0.2	29.68	101	7.45	WP 60mm Cylinder	Stock	70	1 359	
AFN7	-28.27605	23.78019	36	0.6		111	7.30	WP 60mm	Stock	18	1 359	

								Cylinder				
AFN8	-28.27961	23.76912	0	0.5	0.00	80	7.70	None	None		15 768	Spring, flows intermittently
		Average	**36.43**	**4.35**	**7.66**	**108.2**	**7.58**			**TOTAL**	**26 457**	
		Median	**36.00**	**1.75**	**3.21**	**101.0**	**7.65**					
***WL =**	**Water Level**		****EC=**	**Electrical Conductivity**								

Groundwater is mainly abstracted for stock watering purposes, except for the groundwater flowing out at the Arriesfontein non-perennial spring during wet spells. A small lucerne field of ~0.25 ha was observed on the adjacent farm Hartebeesput, but the owner could not be located and the borehole(s) supplying the irrigation water could therefore not be visited.

7.1.5.5 Current Abstraction

The estimated current abstraction from the site is summarised in **Table 12**.For the three windpumps a 24 h/d operation at 12% of the maximum yield (which is determined by the cylinder size) was assumed. This assumption is based on the author's personal experience in the Karoo area. The Arriesfontein (spring) flow currently at an estimated 0.5 L/s. Unfortunately the flow could not be measured as the spring is partially submerged by the out flow, which accumulates in a pan where it largely evaporates. According to the owner this spring only flows during exceptional wet periods and has only flowed during 1974-1976, 1988 and since the beginning of 2011. No large scale irrigation takes place in the area and most of the farms are uninhabited. Based on the assumptions a total current abstraction of approximately 26,500 m3/a is calculated for the site. During normal to dry years the spring does not flow and therefore the total groundwater abstraction for this area will only be ~10,700 m3/a.

7.1.5.6 Groundwater Resource Potential

The site falls within the western part of the Quaternary Drainage RegionD92A for which the amount of water available under General Authorisation is listed under Zone A of the Groundwater Taking Zones, where no water may be taken from this drainage regions except as set out under Schedule 11 and small industrial users2 (DWAF, 2004).Therefore, if the water demand is to be satisfied from the groundwater resources, a Water Use Licence Application will have to be submitted.

Three Groundwater Management Units (GRU's) were defined for this area. These are based on surface drainage, measured groundwater elevations and lineaments such as faults and dykes. The GRA2 grid datasets (DWAF, 2005) were used to derive the MAP, effective recharge and groundwater resource potential for this GRU.

As boreholes cannot intersect all the available recharge in an area, an exploitability factor (DWAF, 2005) was used to calculate the volume of groundwater that can actually be abstracted through boreholes. Current abstraction based on the hydrocensus data was subtracted from this value to determine the current Groundwater Exploitation Potential. These calculated values are summarised in **Table 12** below.

Table 13: Groundwater exploitation potential of the Arriesfontein area

Quaternary Catchment	Area (m^2)	Volume of Water stored in Aquifer (m^3/a)	5m Drawdown Storage Volume (m^3/a)	Mean Annual Potential Recharge (m^3/a)		Average Groundwater Resource Potential (m^3/a)		Groundwater Exploitation Potential (m^3/a)	
				Wet Period	Dry Period	Wet Period	Dry Period	Wet Period	Dry Period
C92A	3 913 568 868	2 508 530 000	164 529 000	40 286 400	26 763 500	199 557 000	186 037 000	80 706 200	75 380 300
Arriesfontein	18 401 759	11 795 209	773 622	189 428	125 843	938 325	874 753	379 484	354 441

[1]Not taking more than 10 cubic metres from groundwater on any given day.

[2] •"Small industrial users" mean water users who qualify as work creating enterprises that do not use more than twenty cubic metres per day (i.e. 20 000 litres/day) and identified in the Standard Industrial Classification of All Economic Activities (5th edition), published by the Central Statistics Service, 1993, as amended and supplemented, under the following categories:-

a) 1: food processing;

b) 2: prospecting, mining and quarrying;

c) 3: manufacturing;

d) 5: construction

GRUs									
C92A-1	6 178 275	3 960 167	259 739	63 599	42 251	315 037	293 693	127 409	119 001
C92A-2	5 468 394	3 505 146	229 895	56 292	37 396	278 839	259 948	112 770	105 328
C92A-3	15 776 359	10 112 373	663 248	162 402	107 889	804 453	749 951	325 342	303 873
TOTAL	**27 423 027**	**17 577 686**	**1 152 882**	**282 293**	**187 536**	**1 398 329**	**1 303 592**	**565 522**	**528 202**

The GRA2 data indicate that the three Arriesfontein GRU's (C92A-1, C92A-2 and C92A-3) has a combined estimated average mean recharge of ~188 000 m3/a for dry periods and ~282 000 m3/a for wet periods. The average groundwater exploitation potential for these GRUs is ~528 000 m3/a for dry periods and ~566 000 m3/a for wet periods. The volume of water that is potentially stored in the aquifers of the three GRUs is ~17.6 million m3, whilst the potential storage of the upper 5 m is ~1.2 million m3.

The mean annual recharge in the Arriesfontein area is shown in **Figure 19** over page which indicates that the recharge decreases from the north-west of the property towards the south-east. Average annual recharge values vary between 11 mm/a in the extreme north-western corner of the property and 9 mm/a in the south-eastern corner thereof.

7.1.5.7 Depth to Water Table and Inferred Groundwater Flow Directions

The hydrocensus data indicate that the depth to water level at the site varies between ground surface (Arriesfontein spring) and ~30 mbgl. These data and data from the NGDB were used to plot the groundwater elevations on the topographical map, from which the groundwater flow directions were inferred (**Figure 20** over page). The groundwater elevations generally mimics the surface elevation contours and generally flows from higher lying to lower lying areas. The inferred flows are from the higher lying areas north and north-west of the property towards the lower lying Riet River south thereof. The general direction of groundwater flow can be diverted by NE-SW striking dolerite dykes to form springs in low laying areas.

7.1.5.8 Groundwater Quality

The groundwater salinity, expressed as Electrical Conductivity (EC) in mS/m, of the site and surrounds is shown in **Figure 21**. The map suggests that the groundwater quality throughout the area falls in the range 70-300 mS/m. Field measured ECs at equipped boreholes and the spring at Arriesfontein vary between 76 and 173 mS/m, which correlates well with this suggested value. Based on field measured ECs only the groundwater from borehole AFN5 is unsuitable for long term human consumption3. The variable groundwater quality is likely caused by pollution from over flowing dams and kraals.

[3] ≤150 mS/m is acceptable for long term human consumption (SABS, 2006)

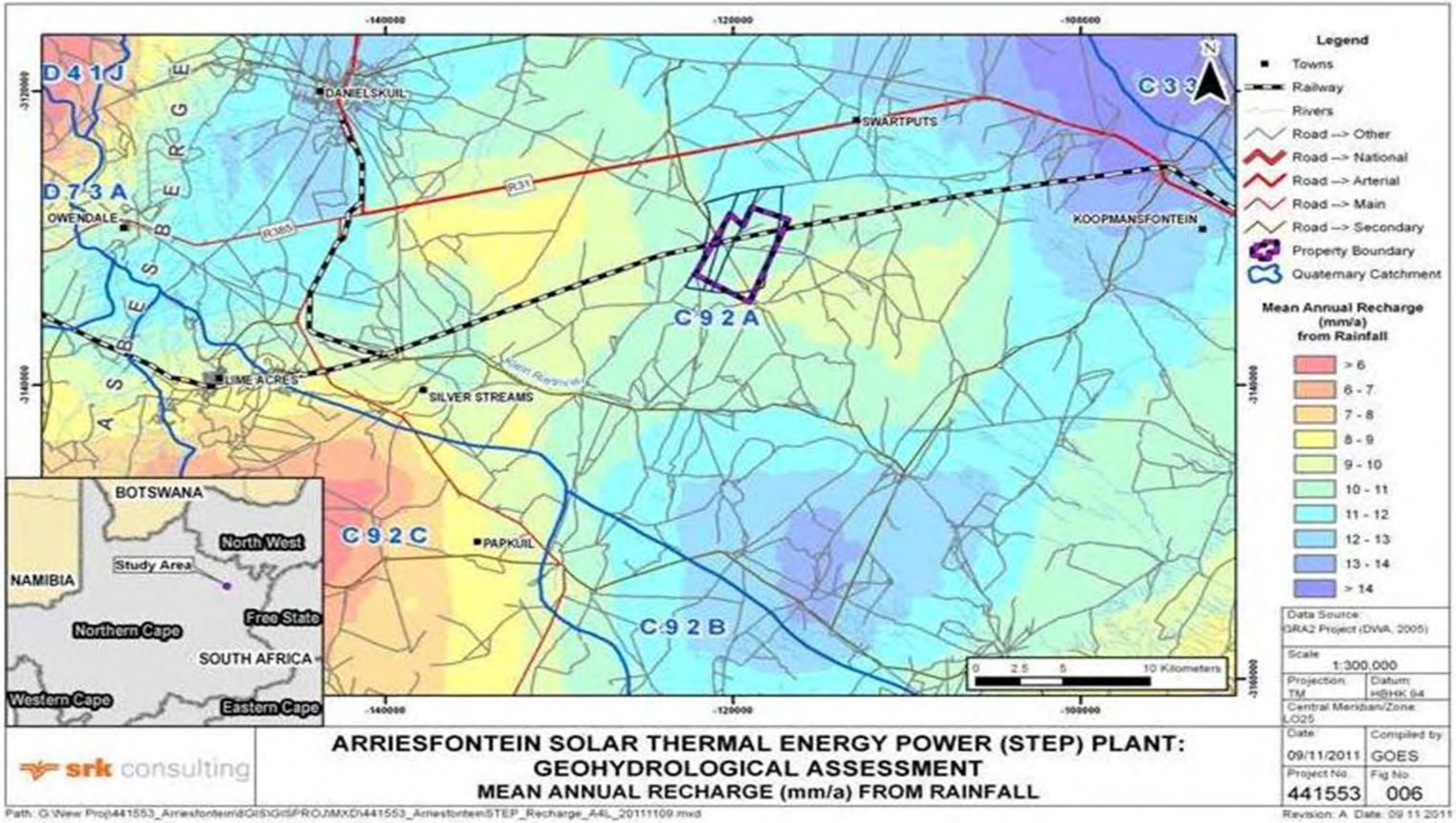


Figure 19: Mean annual recharge in the Arriesfontein area

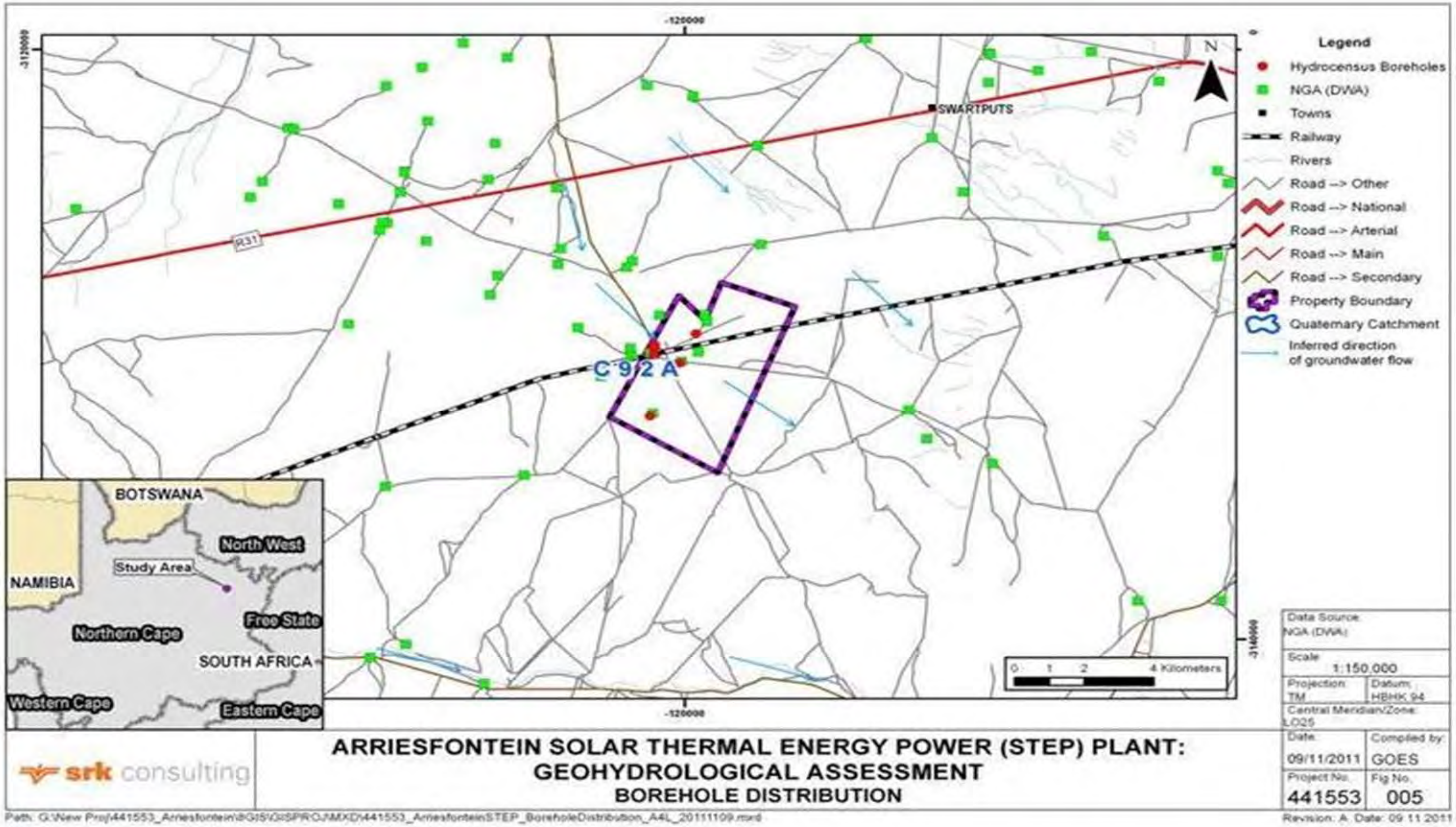


Figure 20: Groundwater elevations and inferred flow directions in the Arriesfontein area

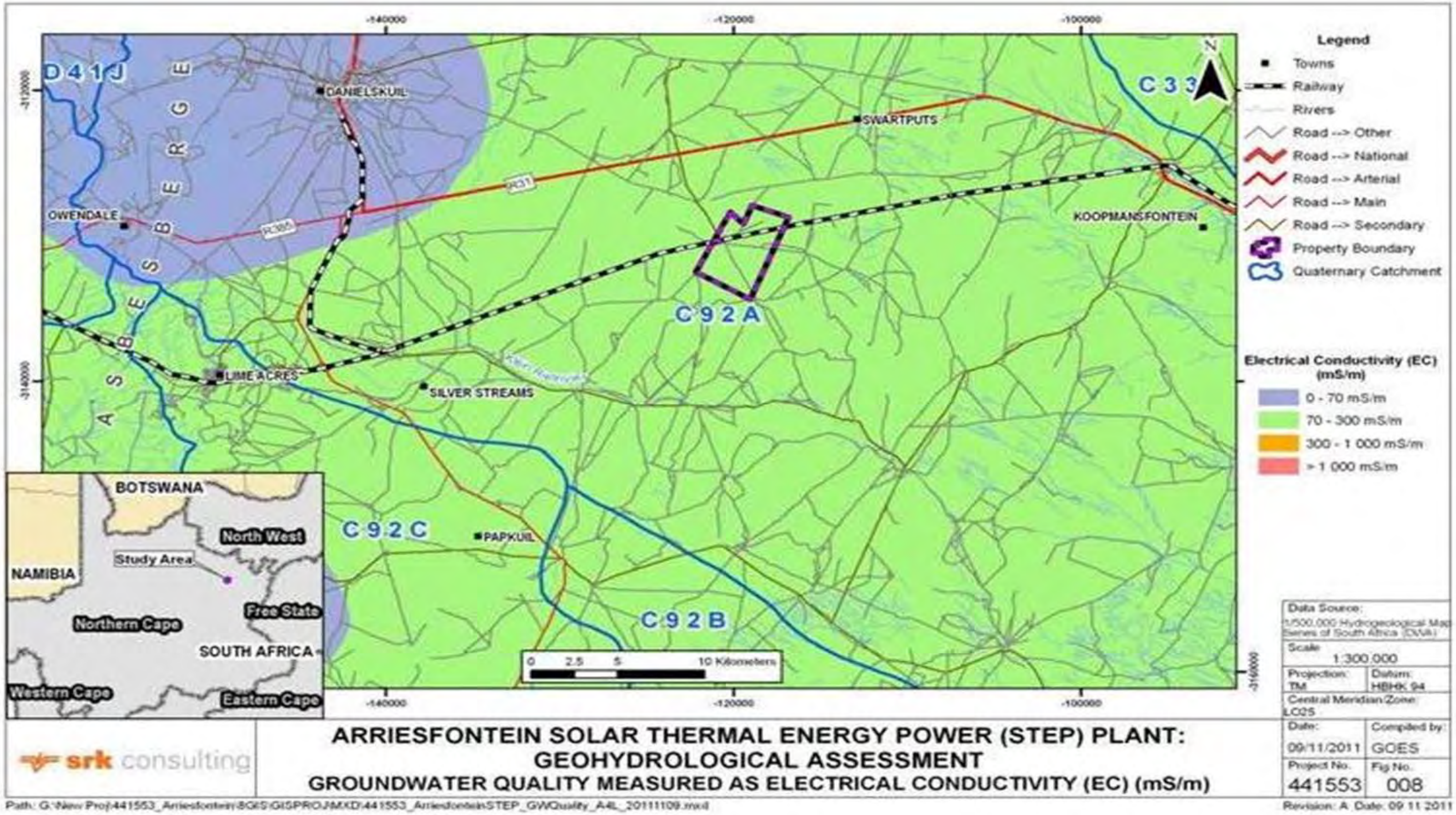


Figure 21: Groundwater salinity in the Arriesfontein area

7.1.5.9 Aquifer Vulnerability

Figure 22 over page shows aquifer vulnerability as determined by evaluating seven parameters (DWAF, 2005), namely:

- Depth to groundwater;
- Recharge;
- Aquifer media;
- Soil media;
- Topography;
- Impact on vadose zone; and
- Hydraulic conductivity.

Aquifer vulnerability is defined as the likelihood for contamination to reach a specified position in the groundwater system after being introduced at some point above the uppermost aquifer. The aquifers at Arriesfontein are classified as having very high vulnerability to contamination. Though not indicated on the map, the lowest vulnerability occur in the southern part of the farm where the groundwater levels are deeper, whilst the highest vulnerability occurs at the homestead where the groundwater level is very shallow and leached zones associated with the well-defined dyke allow rapid vertical infiltration of contaminated surface water. In view of this aquifer vulnerability, care should be taken to establish the facilities with the highest contamination risk, e.g. the evaporation ponds, as far as possible away from the high risk areas, i.e. dykes and areas with shallow groundwater levels. Best position for these facilities will be in the southern and south-eastern parts of the site where the aquifer vulnerability will be lowest due to relative deep water levels.

Please refer to attached Geohydrological Scoping Study **Appendix K**

SOLARRESERVE

ARRIESFONTEIN SOLAR POWER PLANT: PHOTOVOLTAIC PHASE 1 - 3

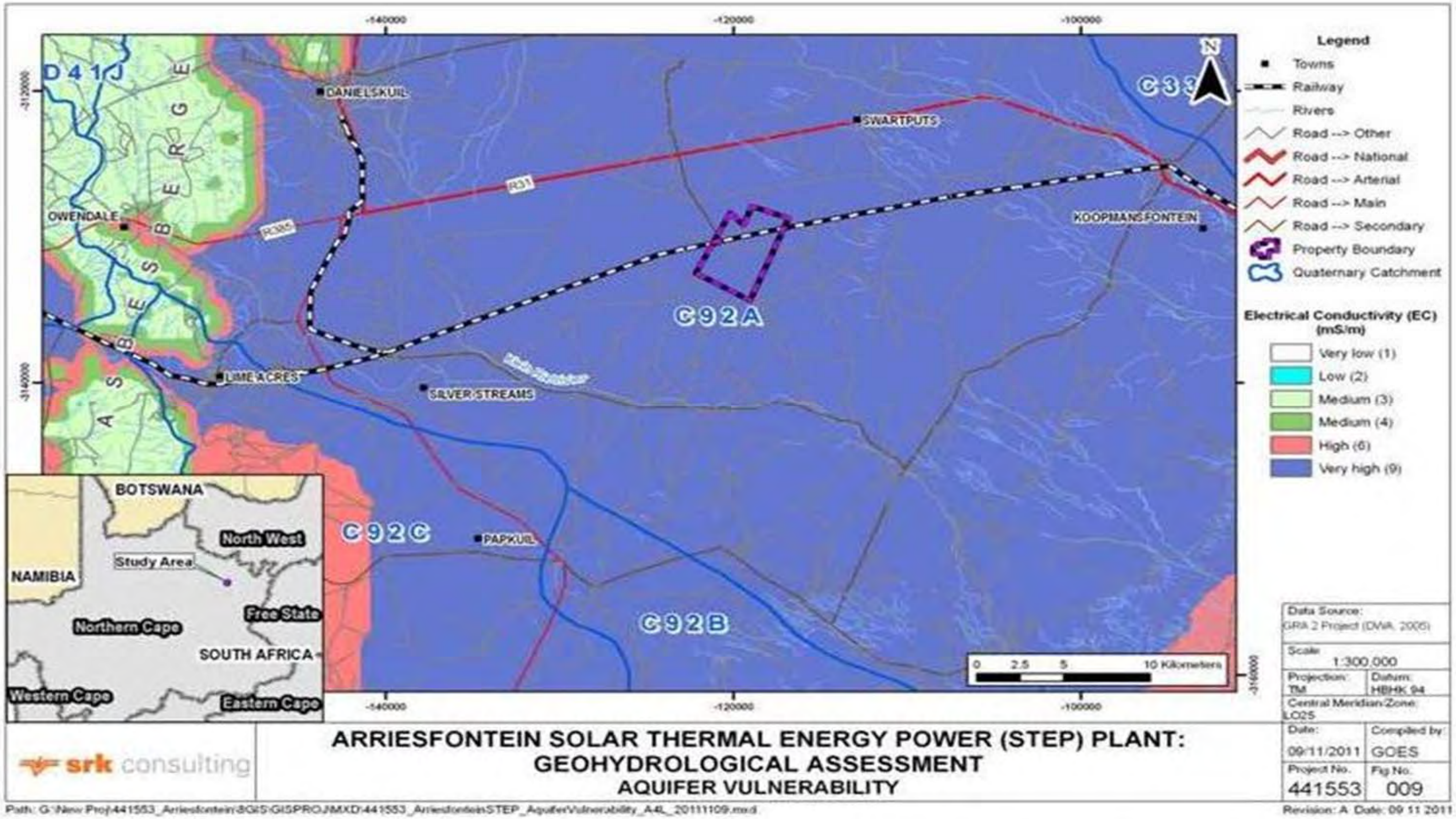


Figure 22: Aquifer vulnerability map of the Arriesfontein

7.1.6 **Geotechnics**

The purpose of the Geotechnical report is to provide preliminary foundation and earthworks recommendations based on the visual and tactile assessment of site conditions, together with the laboratory test results. MSJ have been appointed to conduct the Geotechnical study. The study will be included in the finale EIA report.

7.1.7 **Hydrology**

The Arriesfontein Project is located about 108 km north-west of Kimberley and 70 km west of Postmasburg in the Northern Cape of South Africa. The project area is situated within a small confined catchment, draining in a south easterly direction to the Vaal River. The contributing catchment area for the project covers an area of approximately 93.44 km2 and has an estimated mean annual runoff volume in the order of 663 ML/year. The project footprint covers an area of approximately 19 km2. There is no major water storage, diversion or supply infrastructure within the project area, other than small water containers and temporary ponds.

No surface water licenses are present within the catchment area, and what little surface water that is used, is used for livestock. The majority of the catchment area is used purely for grazing along with small pockets of land supporting mixed uses.

The area, in which the project is located, comprises slightly undulating, bare ground, consistent with a semi-desert region (See Plate 3.1). There is small, isolated rock outcroppings scattered throughout the catchment. Generally the catchment area is cover with tuft grasses and small shrubs. All streams within the catchment are considered ephemeral and tend to flow only for short periods following heavy rainfall.

Topography of the Arriesfontein Site

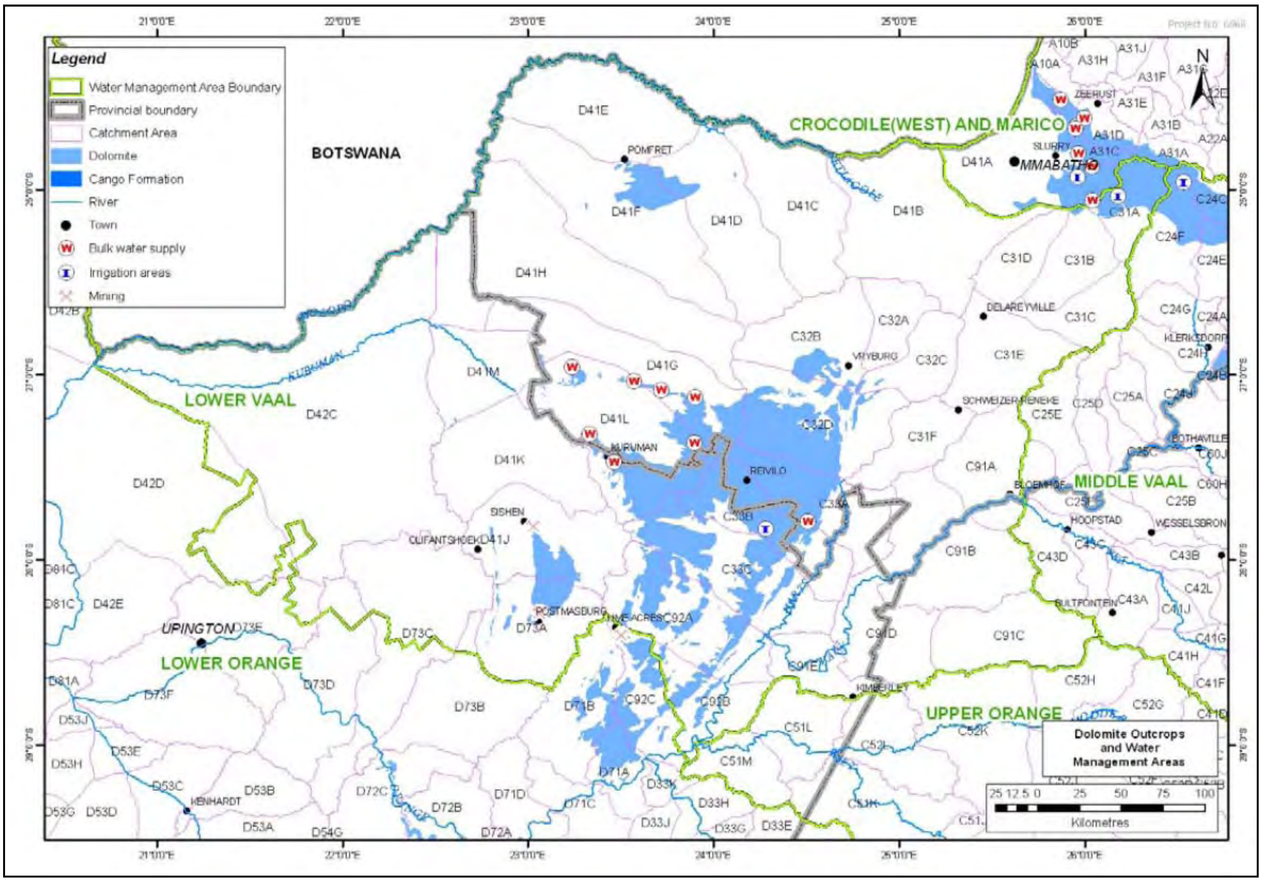
The catchment area has an arid climate with a mean annual rainfall of generally less than 350 mm. The site experiences low annual runoff, significantly high runoff rates can be experienced due to the short duration, high intensity rainfall events that can occur in the region. During such events significant runoff will report to the minor streams on the site and appropriate surface water management will be required to minimise erosion.

7.1.7.1 Surface Water Features

General comments relating to surface water features (and their potential use) can only be made at this preliminary stage. The area is characterized with very low rainfall (MAP less than 350 mm). This scarcity of rain dictates that no meaningful surface water features are relevant. There are no visible watercourses within the project area, other than dried up pans.

Relatively high 'coefficient of variation' (CV) numbers indicates that watercourses, if present within the catchment, are generally non-perennial. All surface run-off drains in a south easterly direction to the Vaal River before draining into the Orange River near Douglas in the Northern Cape. There are no specific or sensitive environments downstream of the project site that can suffer any contamination from runoff from the site.

The project area is located within a hydrologically "unimportant" area in terms of surface water hydrology but in terms of groundwater it is important as there are dolomitic aquifers in the area. These aquifers are already extensively exploited by mining, agriculture and domestic users.



Figure**Error! No text of specified style in document.** 23 : **Occurrence of dolomite in the Lower Vaal WMA** (DWAF, 2006)

It is apparent that the water requirements of the Arriesfontein Solar Project may have to be sourced, mostly, from local groundwater resources. The Sedibeng Water Board operates in this area, providing water via the Vaal-Gamagara pipeline and from groundwater resources.

The slightly undulating terrain present in the project area results in local low points or pans. These low points tend to collect stormwater runoff for short periods, before it evaporates or is consumed by the livestock.

The drainage lines are seldom active, but they are geomorphologically important because they carry large loads of sediment during spate events. This process of mobilising and redistributing sediments shapes the landscape that characterises the gravel plains and the vegetation that occur in the area have adapted to this process. The proposed solar power project is likely to impede this process by rerouting the flow of stormwater and the sediments that they carry. This can have long-lasting impacts on the downstream landscape, with consequent implications for the abundance and species composition of plants and in extreme cases, may lead to problems of erosion and damage to infrastructure.

Please refer to attached Hydrological Scoping Study **Appendix L**.

7.1.8 Wetland and Riparian Studies

7.1.8.1 Catchments

The study area is located within the Vaal River Catchment (Primary Catchment C), and more specifically within quaternary catchment C92A.

Information regarding catchment size, mean annual rainfall and runoff for the quaternary catchment is provided in the table below (Middleton, B.J., Midgley, D.C and Pitman, W.V., 1990). Figure 2 indicates the position of the proposed development area in relation to the affected quaternary catchment. A very low percentage of rainfall ends up as run-off out of the catchment, a result of the dry climate of the area and the generally flat topography.

Table 1. Table showing the mean annual precipitation, run-off and potential evaporation per quaternary catchment (Middleton, B.J., Midgley, D.C and Pitman, W.V., 1990).

Quaternary Catchment	Catchment Surface Area (ha)	Mean Annual Rainfall (MAP) in mm	Mean Annual Run-off (MAR) in mm	MAR as a % of MAP
C92A	360 074	367.32	7.8	2.12 %

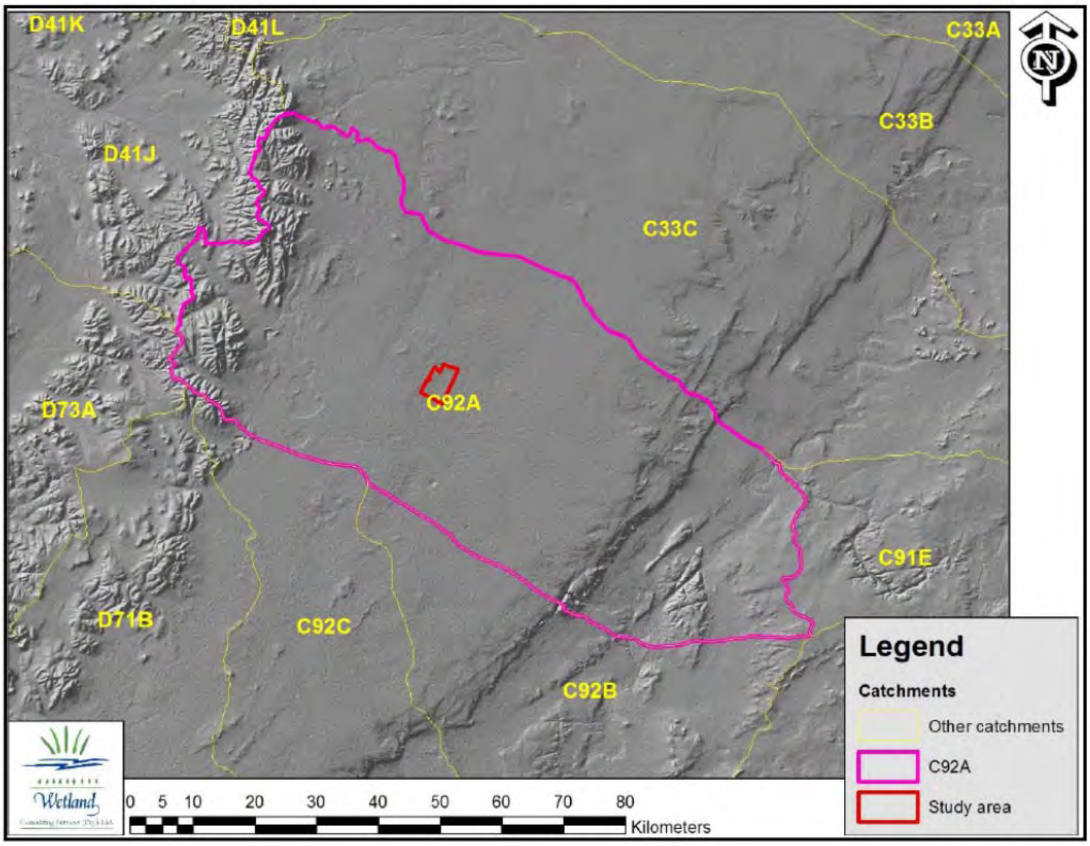


Figure 2. Map showing the study area in relation to the quaternary catchment.

7.1.8.2 Wetland Delineation

The only existing wetland information obtained for the Arriesfontein study area was from the National Wetland Inventory (SANBI, 2009), which is illustrated in Figure 4 below. A number of small pans are indicated as occurring on site. It is notable that no rivers or drainage lines are indicated as occurring on site. This is supported by the 20m contours of the area that indicate a mostly flat landscape sloping only slightly to the south east.

Assessed at a regional scale, the study area is located within an extensive pan field of the southern Kalahari, as indicated in Figure 5 and Table 2, which show that almost than 1 100 pans occur within a 20 km radius of the study area, covering almost 5.3 % of the land surface area within the region.

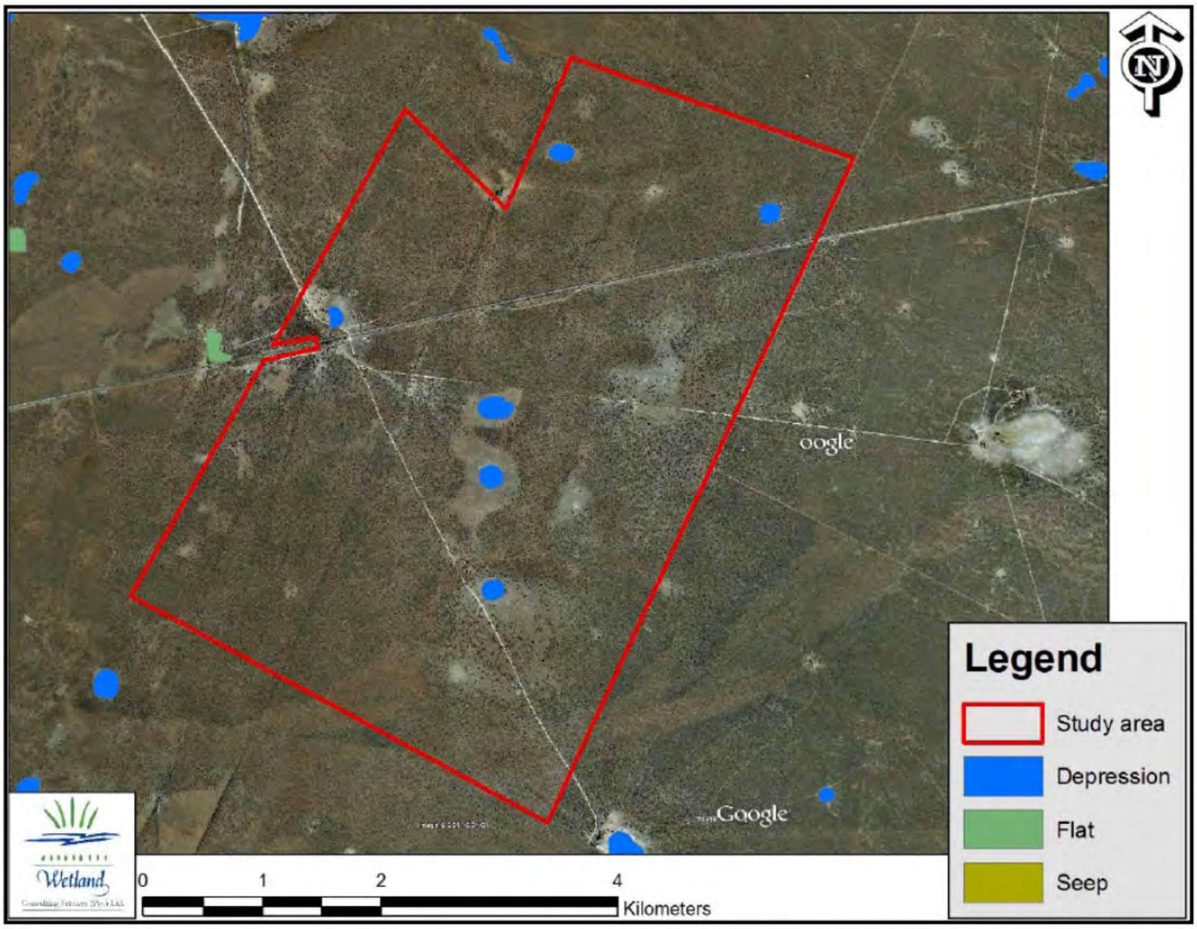


Figure 4. Extract of the National Wetland Inventory map for the Arriesfontein study area.

Table 2. Table showing the number of pans occurring within the surroundings of the Arriesfontein study area.

Distance from site	Number of pans	Area (ha) of pans	% cover
5 km radius	68	432.4	2.5 %
10 km radius	386	1 818.1	3.9 %
20 km radius	1 099	8005.0	5.3 %

A desktop delineation of wetlands was undertaken on geo-referenced Google Earth imagery of the study area, which is illustrated in Figure 6. The aim of the desktop delineation was to identify all areas expected to be wetlands within the study area based on wetness and greenness signatures visible on the Google Earth imagery, as well as on landform setting, i.e. areas where water would be expected to accumulate. All suspected wetland areas were then classified according to the Level 4 HGM classification system proposed by SANBI (2009). The results of the delineation and classification are illustrated and detailed in Figure 6 and Table 3 respectfully.

Table 3. Extent of different wetland types wetlands expected to occur on type.

Wetland Type	Area (ha)	% of wetland area	% of overall site
Flat/seep	32.80	31.67%	1.94%
Pan	10.61	10.24%	0.63%
Seep	60.17	58.09%	3.56%
TOTAL	103.58	100.00%	6.12%

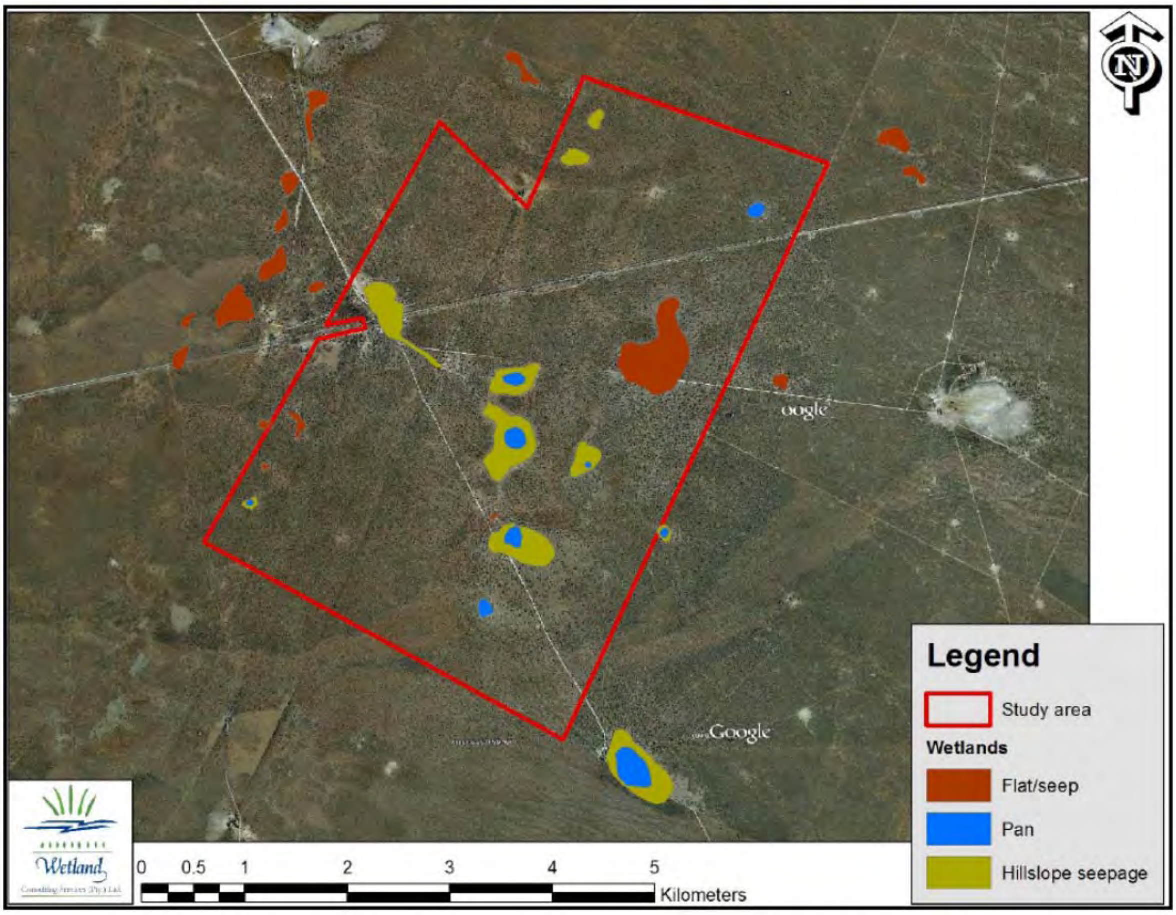


Figure 6. Map showing the suspected wetland areas on site as identified during the desktop wetland delineation.

Three different wetland types are expected to occur on site, covering a total of roughly 100 ha, which makes up 6 % of the Arriesfontein study area. The wetlands consist mostly of isolated pans with associated hillslope seepage wetlands that drain into the pans. The wetlands were identified as grassed, treeless areas within the typical Vaalbosveld of the area and appear characterised by lime and salt rich soils that appear whitish on the aerial imagery. This complies with the description of the typical Southern Kalahari Salt Pans.

7.1.8.3 Conclusion

A number of wetlands, consisting mostly of pans and associated hillslope seepage wetlands, are expected to occur within the Arriesfontein study area. No valley bottom wetlands or drainage lines were however identified in the desktop assessment.

The wetland study is included as **Appendix R.**

7.2 **Social Environment**

7.2.1 **Heritage Impact Assessment**

PGS Heritage & Grave Relocation Consultants was appointed to undertake a Heritage Impact Assessment that forms part of the EIA for the Solar Thermal Energy Power Plant Project.

7.2.1.1 Archival Findings

- **Palaeontology**

The proposed Arriesfontein solar power plant development near Danielskuil is located in an area that is in part underlain by at most sparsely fossiliferous sedimentary rocks of Precambrian and Late Caenozoic age, the latter comprising mainly quaternary to recent calcretes and downwasted rock rubble.

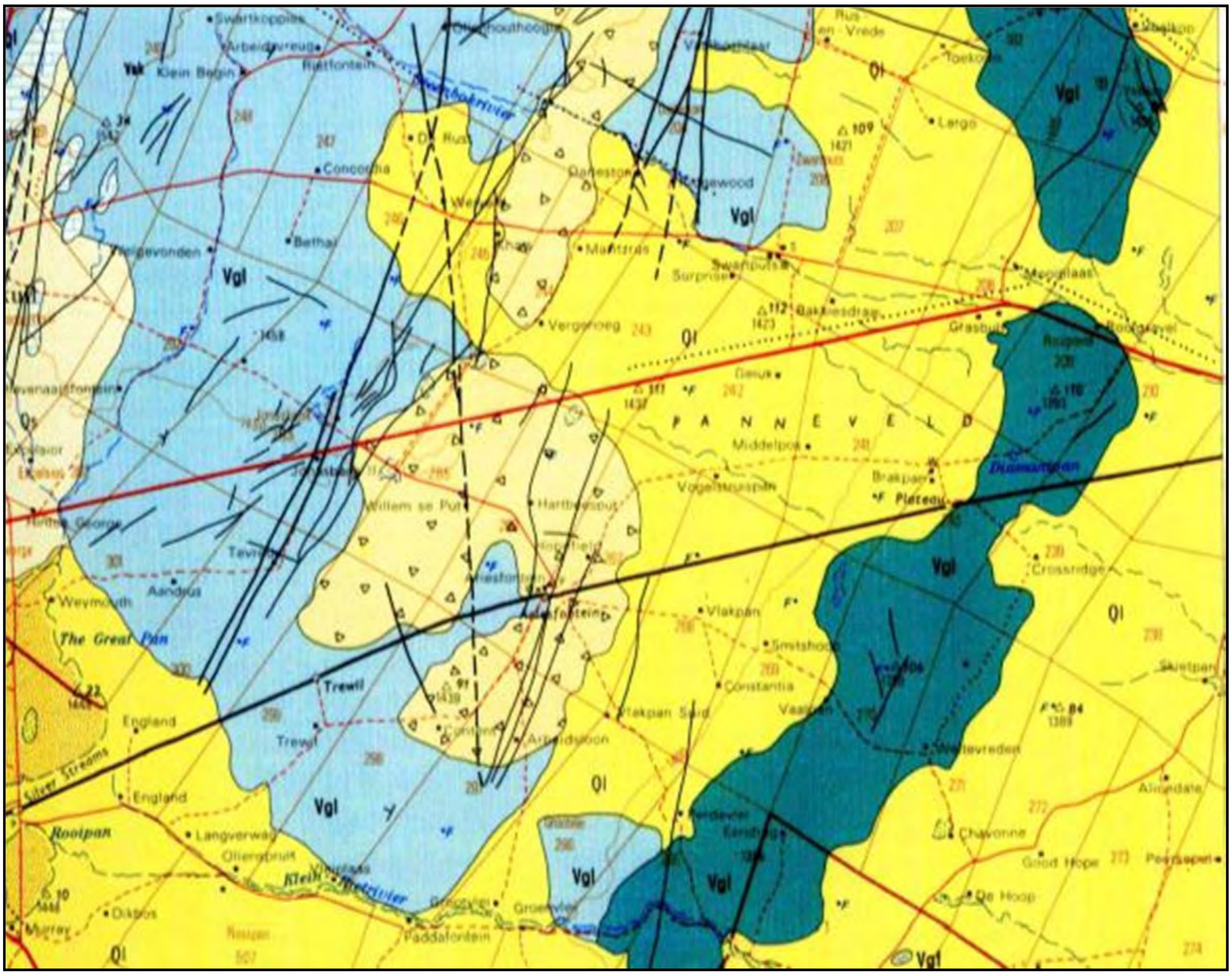
Potentially fossiliferous sedimentary rock units mapped within the broader study region include:

Vgl (pale blue) = Precambrian limestones, dolomites and cherts of the Ghaap Group (Campbell Rand Subgroup)

Vgl (dark green) = Precambrian banded cherts and chert breccia of the Ghaap Group

Ql (yellow) = Late Caenozoic calcretes (Kalahari Group in part)

Buff with triangular symbols = superficial down wasted "rubble" (verweringspuin)



Extract from 1: 250 000 geological map 2822 Postmasburg (Council for Geoscience, Pretoria) showing approximate location of proposed Arriesdrift Solar Power Plant study area c. 24 km southeast of Danielskuil, Northern Cape Province (blue polygon).

- **Archaeological background**

Most archaeological material in the Northern Cape is found near water sources such as rivers, pans and springs, as well as on hills and in rock shelters. Sites usually comprise of open sites where the majority of evidence of human occupation is scatters of stone tools (Parsons 2003). The region in which Danielskuil is located is known as the Ghaap Plateau.

The town itself is located in the foothills of the Kuruman Hills that are found to the west. It is in these hills, between Danielskuil and Kuruman, that the most significant archaeological site in the region is found, Wonderwerk Cave, which has material from the Earlier Stone Age to historical times. Much information about the archaeology of the region derives from this site, especially regarding chronology (Beaumont & Vogel 2006).

- **Farm History**

The Warren report (1877) paved the way for the proclamation of farms in the Danielskuil area. Sir Bartle Frere envisaged the establishment of a considerable township around Danielskuil and commissioned Warren to allocated 163 hectares to white farmers, 122 000 hectares to Griqua farmers and a further 32 600 hectares as location area

The farm Arriesfontein was allocated to I. Johnson as part of a large land grant to the white farmers, most of who was of English decent with substantial trade influence (Snyman 1988).

The current owners Mr and Mrs Cloete have been staying on the farm since the early 1970's when Mrs Cloete inherited the farm from her farther Mr Venter. Mr Venter inherited the farm from his step-father a Mr Roux.

The Roux family have been associated with the farm since the late 1800's, this fact is confirmed by the family cemetery on the farm with two of the three headstone bearing Roux names dating to 1932 and earlier (**Figure 24**).

Figure 24 – Headstone in cemetery dating to 1932

7.2.1.2 Findings of the Heritage Scoping Document

The findings can be compiled as follow and is combined to produce a heritage sensitivity map for the project:

- **Palaeontology**

The study area for the proposed Arriesfontein solar power plant near Danielskuil is underlain at depth by Early Precambrian marine carbonate sediments of the Ghaap Group that are only sparsely fossiliferous (e.g. microbial mounds or stromatolites). Most of the study area is mantled by Late Caenozoic superficial deposits including Quaternary to Recent calcretes (pedogenic limestones) and down wasted rock rubble of comparable age, all of which are of low to very low palaeontological sensitivity. Extensive, deep excavations are unlikely to be involved in this sort of solar power plant project.

The overall impact significance of the proposed development is therefore likely to be LOW and no no-go areas or buffer zones for palaeontological heritage resources have been identified by this desktop study. No further specialist palaeontological studies, monitoring or mitigation are recommended for this development.

- **Archaeology**

The possibility of archaeological finds in the study area has been indicated by previous research and field work in the greater Danielskuil area. This is confirmed by an initial site visit by an archaeologist from PGS to the study area. Concentrations of Stone Age artefact around the pans and dry runs.

Mr Cloete indicated that a local teacher, and tenant on his farm, had a great interest in archaeology and spent numerous hours on Arriesfontein investigating the pan areas and identifying Stone Age Scatters.

This fact along with the evidence of stone artefacts found during the site visit indicates the possibility of sensitive archaeological areas being present in the study area.

- **Historical**

Discussion with the current owner Mr Gerrie Cloete, also revealed a rich history around the farm with the Arriesfontein fountain (**Figure 25**) playing a major role on the transport routes in the area. The fountain was utilised as an outspan when the transport route followed the current rail line that passes just to the south of the fountain and farmstead.

Mr Cloete further indicated that the original farmstead was situated just to the west of the fountain in the area where the current farm workers houses and cemetery of the Roc family are situated (**Figure 26**).

Figure 25 – View of the fountain on Arriesfontein

An evaluation of the available information and the site visit data enabled the development of a heritage sensitivity map (**Figure 27**) to guide further investigations during the EIA phase of the project that entails detailed field work in the study area.

Figure 26 – Cemetery situated just east of the original farmstead area

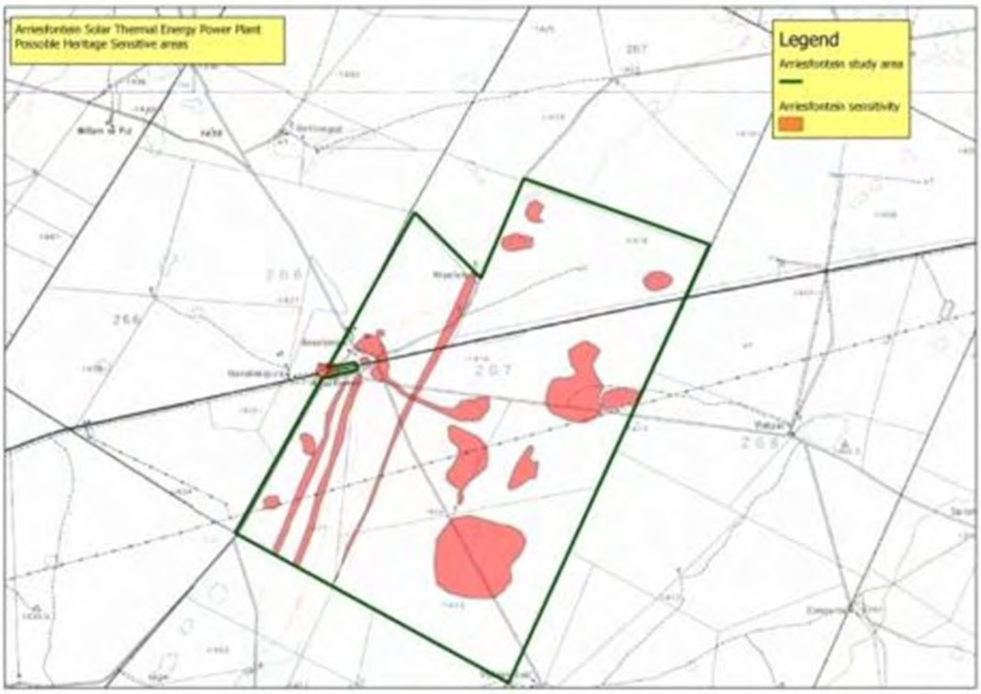


Figure 27–Heritage Sensitivity Map

7.2.1.3 Conclusions and Recommendations

Heritage resources are unique and non-renewable and as such any impact on such resources must be seen as significant.

The Heritage Scoping Report has shown that the study area and surrounding area has a rich historical and archaeological history.

Initial field work has also identified heritage sensitive areas within the study area that will need further investigation during the HIA/EIA phase.

- **Palaeontology**

The overall impact significance of the proposed development is therefore likely to be LOW and no no-go areas or buffer zones for palaeontological heritage resources have been identified by this desktop study. No further specialist palaeontological studies, monitoring or mitigation are recommended for this development.

- **Archaeology**

These findings provide the basis for the recommendation of further field thruthing through an archaeological walk down covering the whole of the study area. The aim of this will be to compile a comprehensive database of heritage sites in the study area, with the aim of developing a heritage management plan for inclusion in the EMP as derived from the EIA.

7.2.2 **Noise**

As part of the EIA, a noise impact assessment has been undertaken by Jongens Keet Associates (JKA). The study was undertaken by Mr Derek Cosijn and Dr Erica Cosijn.

7.2.2.1 Topography

The terrain may be classified as flat to mildly undulating across the farm and the surrounding areas. The main topographical feature in the area is the Klein Riet River, which flows in a west to east direction through the study area. There is a range of low hills to the west of Danielskuil and to the north of Lime Acres. The land falls gently south-eastwards towards the Klein Riet River.

7.2.2.2 Land Use

The land use in the study area is predominantly agricultural with mines to the west of the development site. The main farming endeavour is cattle. Other significant land uses in the area are:

- Residential.
  - The town of Danielskuil is located approximately 25 kilometres north-east of the development site.
  - The urban settlement (township) of Lime Acres serving the Lime Aces Mine lies approximately 17 kilometres west of the development site.
  - Numerous farmhouses and farm labourer houses throughout the area.
- Educational. There are a number of schools in Danielskuil and Lime acres, and a farm school to the north of the development site.
- Industrial.
  - The industrial area of Danielskuil is located in the southern sector of the town.
  - The Idwala Limestone Mine and Factory lies just south of Danielskuil.
  - The Lime Acres Mine lies to the west of the development site.

7.2.2.3 Roads

There are a number of major roads and secondary roads servicing the area:

- Provincial Road TR07001 (Route R385) from Postmasburg to Route R31.
- Provincial Road TR00503 (Route R31) from intersection with road TR07001 (Route R385).
- Provincial Road TR00504 (Route R31) from Kuruman to Danielskuil to intersection with Road TR07001.
- Provincial Road MR00803 (Route R385).

7.2.2.4 Railway Lines

Two railway lines pass through the study area:

- The Postmasburg – Barkly West railway line is aligned in an east-west direction through the central portion of the farm Arriesfontein. The line carries 14 trains per day (data obtained from Transnet Freight Rail). The Arriesfontein Siding is located on the western boundary of the farm Arriesfontein.

- There is an industrial spur line from the Idwala Lime Mine just south of Danielskuil, joining the main Postmasburg – Barkly West railway line at the Silver Streams Siding.

7.2.2.5 Factors of Acoustical Significance

The relatively flat topographical features in the study area provide little acoustic shielding between the possible development sites and the adjacent noise sensitive areas. Noise will tend to be channelled along the shallow drainage valleys in the area.

The main meteorological aspect that will affect the transmission (propagation) of the noise is the wind. The wind can result in periodic enhancement downwind or reduction upwind of noise levels. Analysis of the wind records for the area indicates that the main prevailing winds blow from the northeast (48% of the time) and the northwest (21%). Approximately 6,7% still periods are experienced annually.

Temperature inversions have a significant effect on the noise propagation character of the area. Temperature inversions tend to increase noise levels at some distance from a source. A temperature inversion is formed when air near the ground is cooler than the air above. This occurs mainly at night or to a lesser extent during cloudy days away from large bodies of water. Stable conditions with high humidity and very low velocity wind conditions are necessary. As cool air is denser than warm air, sound rays are refracted towards the cooler air, that is, towards the ground.

7.2.2.6 Noise Sensitive Receptors

The residential, educational and recreational land uses are considered to be noise sensitive receptors (NSR). Refer to Figure 2.

For this study, the position of houses/dwellings on the farms was taken off 1:50 000 topographical cadastral maps and verified as far as possible using Google Earth. Even though the latest editions were used, the relevant maps are 30 years out of date and there may be new dwellings and/or some of the existing shown buildings may be derelict. During the field survey for the noise measurement survey, such aspects were noted where possible. The following 1:50 000 topographical cadastral maps were used:

- SOUTH AFRICA 1:50 000 Sheet 2823AB, GROENWATER Second Edition 1989.

- SOUTH AFRICA 1:50 000 Sheet 2823BA, DANIELSKUIL Second Edition 1982.
- SOUTH AFRICA 1:50 000 Sheet 2823BB, SWARTPUTS Second Edition 1982.
- SOUTH AFRICA 1:50 000 Sheet 2823AD, LIME ACRES Second Edition 1982.
- SOUTH AFRICA 1:50 000 Sheet 2823BC, SILVERSTREAMS Second Edition 1982.
- SOUTH AFRICA 1:50 000 Sheet 2823BD, ARRIESFONTEIN Second Edition 1982

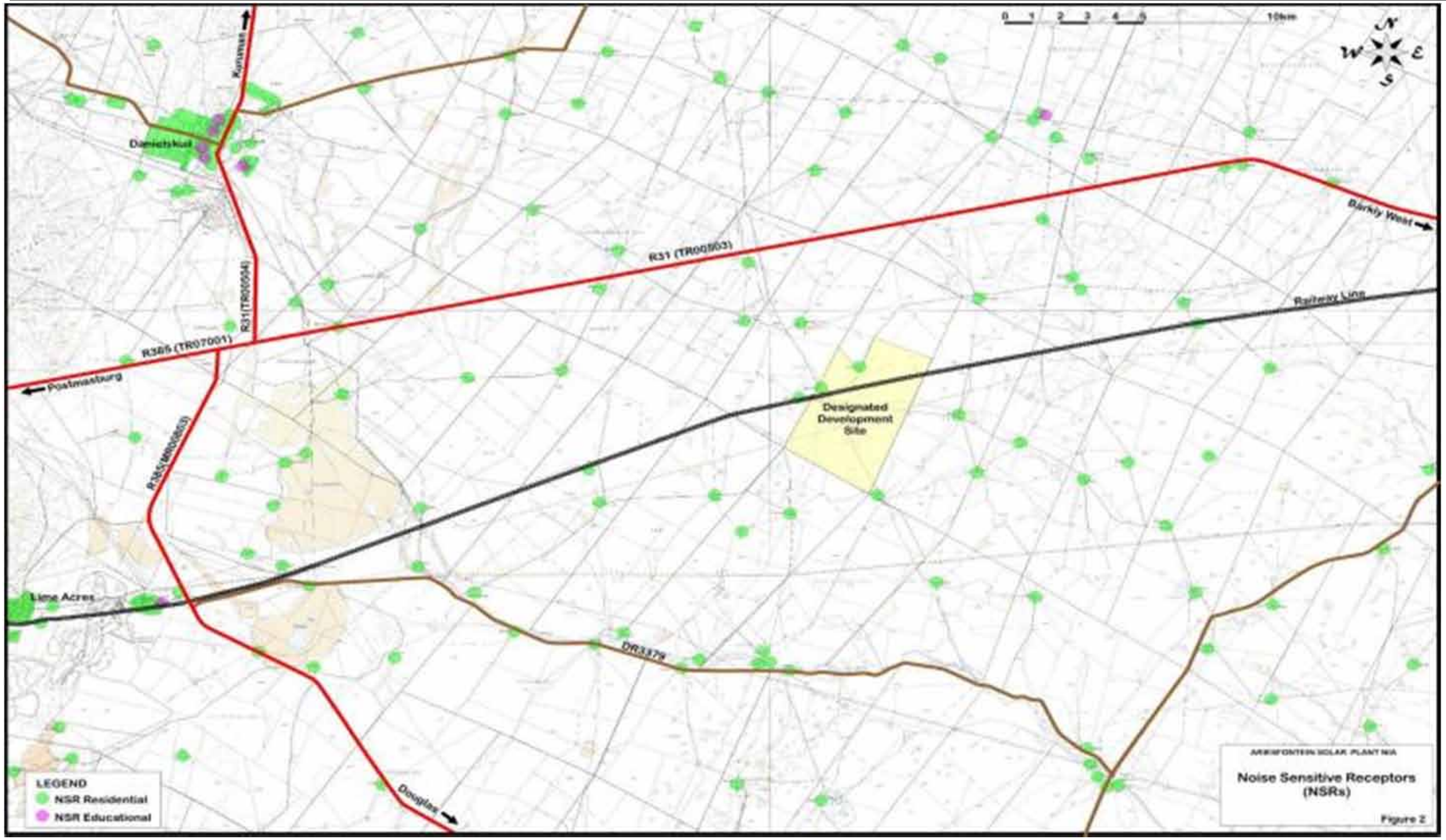


Figure 28: Noise sensitive receptors

7.2.2.7 Noise Sources and Noise Sensitive Areas

- **Noise Sources**

The main noise sources presently affecting the study area and the additional sources that will affect the area once the Solar Plant is commissioned are:

- Road traffic noise from the traffic on Road TR00503 (Route R31) to Barkly West.
- Railway traffic on the line on the Postmasburg – Barkly West line and the industrial spur line from the Idwala Lime Mine.
- The Lime Acres Mine 17 kilometres to the west of the development site.
- Idwala Lime Mine and factory just to the south of Danielskuil.
- Noise from general farming operations.

- **Noise Sensitive Areas**

The main noise sensitive receptors in the area are (refer also to Figure 2):

- Various farmhouses and farm labourer residences.
- The residences in the south-eastern part of Danielskuil.
- Various schools in Danielskuil and Lime Acres, as well as farm schools in the area.

7.2.2.8 The Residual (Existing) Noise Climate

The determination of the residual (existing) noise climate in the study area is based on the measurements and observations made in the area, and where relevant also from the calculation of the noise from the traffic on the main roads. The following were determined:

- The existing typical residual noise climate throughout most of the study area is typical of a rural/agricultural environment as defined in SANS 10103:2008, that is, areas where ambient noise levels generally do not exceed 45dBA during the day and generally do not exceed 35dBA during the night-time.
- In the residential townships of Danielskuil and Lime Acres Mine the existing residual noise climate is typical of a suburban environment as defined in SANS 10103:2008, that is, areas

where ambient noise levels generally do not exceed 50dBA during the day and generally do not exceed 40dBA during the night-time.

- Sites close to the main roads in the study area are adversely affected by traffic noise.
- The main roads affected are listed in Section B3.4. The ambient noise levels alongside these roads exceed the acceptable levels as recommended in SANS 10103 with respect to rural and suburban residential living and other noise sensitive land uses. The noise climates in these areas can be defined as being severely degraded for these land uses. The areas next to the main roads are in some areas degraded for up to the following distances (based on rural residential SANS 10103 standards – Ldn > 45dBA):
  - TR07001 (Route R385) - 600 metres
  - TR00503 (Route R31) - 550 metres
  - TR00504 (Route R31) - 650 metres
  - MR00803 (Route R385) - 50 metres
  - DR3379 - 10 metres

The train traffic is a minor factor due to the low rail traffic volumes. The noise impact from a train relates normally to the nuisance (annoyance) impact as the train passes.

7.2.2.9 Predicted Noise Climate

- **Solar Plant Generated Noise Footprint: Pre-construction Phase**

Activities during the planning and design phase that normally have possible noise impact implications are those related to field surveys (such as seismic testing and geological test borehole drilling for large building foundations). As these activities are usually of short duration and take place during the day, they are unlikely to cause any noise disturbance or nuisance in adjacent areas.

- **Solar Plant Generated Noise Footprint: Construction Phase**

There is the potential for noise impact (noise disturbance and noise nuisance) at a few sites in the immediate vicinity of the construction site.

- Source noise levels from many of the construction activities will be high. Noise levels from all work areas will vary constantly and in many instances significantly over short periods during any day working period.
- Exact daytime period and night-time period continuous equivalent sound pressure levels are not possible to calculate with certainty at this stage as the final construction site layout, work programme for the various components, work modus operandi and type of equipment have not been finalised. Working on a worst case scenario basis, it is estimated that the ambient noise level from general construction activities could negatively affect noise sensitive sites within a distance of 1380 metres of the construction site. Night-time construction could have a significant impact on noise sensitive sites within a radius of 3000 metres of the construction site.
- Slightly higher ambient noise levels than those normally considered as reasonable are acceptable during the construction period provided that the very noisy construction activities are limited to the daytime and that the contractor takes reasonable measures to limit noise from the work site.

7.2.2.10 Solar Plant Generated Noise Footprint: Operational Phase

With the construction of the Solar Plant the noise climates close to these facilities will alter.

- The main noise sources at the CSP will be from the cooling fans (for the air-cooled condensers at the power block), the salt pumps and the steam generating unit. The noise from the cooling fans will be the loudest.
- The main noise from the PV Parks will be from the power inverters.

It is predicted that the noise from the Solar Plant could be the following at the given offsets from the various installations:

Table 16: predicted noise levels from various elements of the solar plant

Offset from the Noise Source (m)	Noise Levels from CSP Plant (dBA)	Noise Levels from PV Park (dBA)
500	60	51
1000	53	44
1500	49	40
2000	46	37
2500	43	35
3000	41	
4000	38	
5000	35	

Cumulative effects between various elements of the Solar Plant may occur. These cannot be calculated in any detail before the layout of the plant is finalised. It is however, not expected to be significant (i.e. <3dBA).

Assuming daytime operations, noise sensitive sites (in a rural setting) further than 2150 metres away from the Plant will not be impacted by the noise from the Plant. Standby night-time operations will impact on any residences within 2500 metres from the CSP Plant. The construction of the power generation unit of the Solar Plant is recommended at an offset of at least 3000 metres from the nearest noise sensitive receptor, depending on the intended periods of operation. It is unlikely that the noise generated by the PV Park inverters will extend the noise footprint created by the CSP Plant significantly. This, however, will be checked during the EIA Phase once the finals layout plans are available. The examination of the area indicates that there are several potential noise sensitive receptors within 3000 metres from the boundary of the development site.

7.2.2.11 Solar Plant Generated Traffic

The total volume of traffic generated by the Solar Plant will be relatively low. The development generated traffic will have minimal effect on the noise profile of the main roads.

Please refer to attached Noise Scoping Study **Appendix N**.

7.2.3 Socio-Economic

Urban-Econ Development Economists was appointed to undertake a socio-economic impact assessment study.

7.2.3.1 Project Location

The proposed site for the Arriesfontein Solar Park is located on a portion of the farm Arriesfontein situated approximately 35km to the south western side of Danielskuil in the Northern Cape. The site falls within the Kgatelopele Local Municipality, which in turn forms part of the Siyanda District Municipality - one of the five districts of the Northern Cape Province of South Africa.

In order to delineate the study area, it is important to understand the concept of socio-economic impacts. Socio-economic impacts can be of a different nature and spatial extent. The latter differs significantly depending on the type of activity that is being analysed and the structure and composition of the locality where it is to be established. The more diversified the immediate locality of the project is in terms of its socio-economic variables, the more concentrated the impact will be in that area. It is very rare, though, to find a case when the demands of the proposed activity to be constructed and operated can be fully satisfied within the immediate locality of the project. Therefore, more often than not, economic impacts derived from any activity are spread throughout various administrative units. Understanding the potential distribution and concentration of impacts throughout the area is important to determine the magnitude and significance of these impacts in the context of spatial units.

The study area's delineation is usually done in terms of three levels – primary, secondary and tertiary. From a socio-economic impact perspective, the primary study area refers to the locality where the immediate economic effects of the proposed activity will be observed. This is usually defined considering the actual location of the proposed project, proximity to skilled and unskilled labour, and juxtaposition relative to suppliers. The primary study area is usually relatively small and includes administrative units from where the majority of labour for the proposed project will be supplied and where some parts of the capital and operational budgets will be spent, such as a city, town or Local Municipality depending on data availability. The secondary study area is generally far greater than the primary study area. It usually has a relatively diversified economy, which is why it is also characterised as an area where the majority of the domestic expenditure on the project will be distributed. The third tier of a delineated study area is the tertiary study area. From an economic impact perspective, it includes all impacts that would be derived from the project's domestic expenditure.

The proposed project is located within the Siyanda District Municipal area. The site is located not far from Danielskuil; however the closest major town to the site by road is Kimberley (approximately 120km). Other towns located within 100 kilometres from the proposed site are Delportshoop (approximately 60km) to the east and Postmasburg (approximately 100km) to the west along the R31 route. It is assumed that some of the semi-skilled people who could be employed by the proposed project during construction will come from the above-mentioned towns. It is highly likely though that unskilled and semi-skilled labour will also be sourced from other areas, including other municipalities of Siyanda, as the unemployment rate is very low in the Kgatelopele Local Municipality. As far as procurement of services and equipment during construction and operation of the project is concerned, some of these will be sourced from the Northern Cape. Given the fact though that its economy is not very diversified, it could be argued that a significant portion of the inputs required for construction of the Solar Park will be sourced from the rest of South Africa. Given the above, the following delineation of the study areas is assumed:

- primary study area include the Kgatelopele Local Municipality
- secondary study area include the Siyanda DM in the Northern Cape, and
- tertiary study area is South Africa.

7.2.3.2 Population size and growth

The population of any geographical area is the cornerstone of the development process, as it affects the economic growth through the provision of labour and entrepreneurial skills, and determines the demand for the production output. Examining population dynamics is essential to gain an accurate perspective of those who are likely to be affected by any prospective development or project. This sub-section describes the status quo of the study area's population as estimated for 2011.

In 2011, South Africa's population is expected to be above 50 million (**Table 14**), with 1.1 million people residing in the Northern Cape area. This indicates that the Province has the smallest population amongst the Provinces in the country, but at the same time it encompasses about 30% of the entire area of South Africa that makes it the biggest Province in terms of landmass. The Siyanda District Municipality is housing 247 611 people, or 22.5% of the provincial population while the Kgatelopele Local Municipality has a population of 21 941 people, i.e. just below 6.9% of the DM's population, which is indicative a relatively small economy.

Due to the fact that the Local Municipality of Kgatelopele has a relatively small community, it is possible that labour for this particular project may come from the nearby towns, i.e. Kimberley, Delportshoop (to the east), Douglas (to the south), Kuruman (to the north), and Postmasburg (to the west).

Table 14: Population size (2011) and historical growth rates (1995-2011)

Study area	2011	Historical growth rates			
		1995-2000	2000-2005	2005-2010	1995-2011
South Africa	50,430,328	1.73%	1.29%	1.12%	1.38%
Northern Cape	1,101,318	1.23%	0.45%	0.26%	0.65%
Siyanda DM	247,611	1.36%	0.51%	0.40%	0.75%
Kgatelopele LM	21,941	1.18%	2.17%	3.18%	2.17%

Source: Urban-Econ calculations based on Quantec, 2011

As indicated in the table above, the Kgatelopele LM's population has been growing at a higher rate than that of the Siyanda DM, as well as the Northern Cape and the country. Moreover, the population growth rate of the Siyanda DM, Northern Cape and South Africa has been declining; whilst in the Kgatelopele LM the population growth rate was increasing over the past decade. This could be attributed by the growing mining and services sectors in the area.

7.2.3.3 Household numbers and size

Household data enables a richer interpretation of the results of the socio-economic impact analyses. A large increase in household numbers coupled with the increase in disposable income levels and result in a greater consumption, which in turn stimulate local production and as a result the economy. In addition, knowledge of the size of the study areas in terms of households is useful for interpretation of the magnitude of the economic impact that could be created by the proposed activity.

South Africa has 13 385 517 households, which means that the average household size in the country is 3.8. The Northern Cape is estimated to have about 281 015 households and a bigger average household size than in the country. The Siyanda DM has 61 453 households; while the primary study area has approximately 5 361 households.

Table 15: Household numbers (2011), household size (2011) and its historical growth rate (1995-2011)

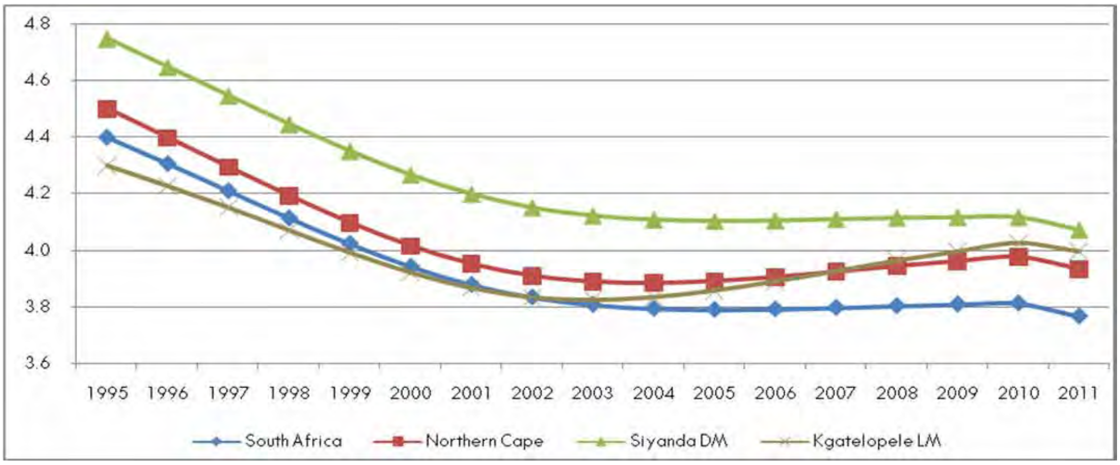
Study area	HH number	Average HH size	Household number historical growth rates			
			1995/00	2000/05	2005/10	1995/11
South Africa	13 385 517	3.8	4.0%	2.1%	1.0%	2.4%
Northern Cape	281 015	3.9	3.6%	1.1%	-0.2%	1.5%
Siyanda DM	61 453	4.1	3.5%	1.3%	0.3%	1.7%
Kgatelopele LM	5 361	4.1	3.1%	2.5%	2.3%	2.6%

Over the years, as indicated in **Table 15**, the rates at which the numbers of households in the secondary and tertiary study areas were increasing have been slowing down, which mirrors the trend observed with respect to population dynamics in these study areas. In the Kgatelopele LM, the household's growth rate has been declining over the past decade. In the municipalities surrounding Kgatelopele the same trend was observed.

The main factors that affect the household growth include, besides the population increase, the change in age structure and incidence rate, or the likelihood of people of a certain age to start a new household. The significant difference between a household growth rate and a population growth rate, though, is usually attributed to the change in age structure.

Household size is also influenced by many other factors such as culture, traditions, education levels, income levels, etc. Over the years, it has been observed that the size of an average household in the country has been declining. As illustrated in **Figure 29**, the average household size in South Africa in 1995 was 4.4, whilst in 2011 it was 3.8. In the secondary and primary study areas, the average household size also dropped significantly between 1995 and 2011, although it should be noted that in the Northern Cape, the Siyanda DM and the Kgatelopele LM, the average household size was slightly higher than in South Africa, the highest being in Siyanda DM.

Figure 29: Household size dynamics (1995 – 2011)



Source: Urban-Econ's calculations based on Quantec, 2011

7.2.3.4 Income and expenditure patterns

Income distribution is one of the most important indicators of social welfare, as income is a primary means by which people are able to satisfy their basic needs such as food, clothing, shelter, health, services, etc. Changes in income inflict changes in the standard of living, more specifically: a positive change in income can assist individuals, households, communities and countries to improve living standards.

There is a direct linkage between the household expenditure and economic growth. Increase in household expenditure means a greater demand for goods and services, which means an increase in production and positive change in the size of an economy. As has been seen in 2005-2006 in South Africa, robust increase in disposable income coupled with low interest rates in the country stimulated an increase in consumption by households, in particular durable and semi-durable goods, which in turn had a positive impact on the country's economy. Knowledge of the volume of the disposable income and the expenditure patterns of households, therefore, can provide vital intelligence with respect to the sectors that are most dependent on the household income and therefore would be most affected in the case of change in household income.

Table 16 shows income distribution in study areas as captured in the Community Survey 2007. More recent data, unfortunately, are not available, whilst historical information is not robust and reliable enough to escalate the latest figures and estimate the situation in 2011 with great confidence.

Based on the 2007 figures it is evident that the Kgatelopele LM has a lower percentage of households that do not receive an income when compared to South Africa and the Northern Cape, but has a higher percentage when compared to the Siyanda DM. Furthermore, the Kgatelopele LM also has the lowest percentage of households who earn below R38 400 per annum (R3 200 per month) when compared to other study areas under analysis; at the same time it has a significantly greater share (15.8%) of households with income over R153 601 per annum (R12 800 per month) when compared to the other study areas.

Overall, the majority of households in all areas earned an income of between R9 601 – R38 400 per annum. The Kgatelopele LM had the highest share of households earning an income between R38 401 – R76 800 per annum. This together with the fact that it also had the greatest share of households falling under the high-income category resulted in the Kgatelopele LM's average household income being the highest among all study areas. This suggests that the average household in the primary study area is better off than the average household in any other study area under analysis.

Table 16: Income distribution (2007)

Income category (per annum)	South Africa	Northern Cape	Siyanda DM	Kgatelopele LM
No income	8.20%	6.80%	4.90%	6.14%
R1 - R4 800	5.00%	3.50%	2.00%	2.57%
R4 801 - R9 600	9.00%	7.90%	9.30%	4.53%
R9 601 - R19 200	18.90%	20.20%	22.10%	15.90%
R19 201 - R38 400	19.10%	19.80%	19.60%	20.86%
R38 401 - R76 800	11.40%	13.20%	12.30%	19.41%
R76 801 - R153 600	7.60%	8.00%	6.80%	10.03%
R153 601 - R307 200	5.30%	4.70%	3.70%	10.00%
R307 201 - R614 400	2.80%	2.20%	1.70%	3.61%
R614 401 - R1 228 800	0.90%	0.60%	0.60%	1.85%
R1 228 801 - R2 457 600	0.30%	0.20%	0.10%	0.32%
More than R2 457 600	0.20%	0.20%	0.10%	0.17%
No response	11.10%	12.60%	16.80%	4.60%
TOTAL	100%	100%	100%	100%
Weighted av. (2011 prices)	R8 602	R7 761	R6 690	R11 359

Source: Urban-Econ calculations based on Community Survey 2007, 2011

Table 17 shows the expenditure pattern of households in the study areas. It indicates that households' expenditure largely comprises of spending on non-durable goods and services, amongst which the biggest expenditure items include expenditure on food and beverages, as well as rent. However, there are differences in terms of how much households in different areas spend on these types of goods and services. Households in Kgatelopele tend to spend more on services than on any other type of product. In terms of more detailed expenditure items, though spending on food and beverages accounts for a quarter of households' spending. Overall, in South Africa, the Northern Cape and Siyanda, the trend seems to be the same, households throughout the country are spending more on services in general, whilst the single category spend the most on food, beverages and tobacco.

Table 17: Household expenditure per main groups (2008)

Expenditure item	South Africa	Northern Cape	Siyanda DM	Kgatelopele LM
Durable goods: Total	**8.3%**	**7.5%**	**7.6%**	**8.4%**
Furniture, household appliances, etc	1.7%	1.4%	1.4%	1.6%
Personal transport equipment	4.5%	3.9%	4.0%	4.5%
Recreational and entertainment goods	1.4%	1.6%	1.6%	1.6%
Other durable goods	0.7%	0.6%	0.6%	0.7%
Semi-durable goods: Total	**9.1%**	**8.1%**	**8.1%**	**8.3%**
Clothing and footwear	5.0%	4.2%	4.1%	4.3%
Household textiles, furnishings, glassware, etc	1.4%	1.2%	1.2%	1.3%
Motor car tyres, parts and accessories	1.4%	1.2%	1.2%	1.3%
Recreational and entertainment goods	0.8%	1.0%	1.0%	1.0%
Miscellaneous goods	0.5%	0.6%	0.6%	0.5%
Non-durable goods: Total	**39.8%**	**39.4%**	**38.7%**	**37.6%**
Food, beverages and tobacco	26.3%	27.0%	26.4%	25.3%
Household fuel and power	3.1%	2.6%	2.5%	2.1%
Household consumer goods	4.1%	3.9%	3.9%	3.7%
Medical and pharmaceutical products	1.6%	1.6%	1.7%	1.8%
Petroleum products	4.0%	3.5%	3.5%	3.9%
Recreational and entertainment goods	0.8%	0.8%	0.8%	0.8%

Expenditure item	South Africa	Northern Cape	Siyanda DM	Kgatelopele LM
Services: Total	**42.8%**	**45.0%**	**45.6%**	**45.7%**
Rent	12.4%	15.2%	15.3%	14.7%
Household services, incl. domestic servants	2.6%	2.7%	2.6%	2.6%
Medical services	5.9%	5.9%	5.9%	5.8%
Transport and communication services	9.1%	9.1%	9.3%	9.6%
Recreational, entertainment and education	4.0%	3.7%	3.8%	3.8%
Miscellaneous services	8.8%	8.5%	8.8%	9.2%

Source: Quantec: Household Income and Expenditure, 2008 release

7.2.3.5 Labour market

Employment is the primary means by which individuals who are of working age may earn an income that will enable them to provide for their basic needs. As such, employment and unemployment rates are important indicators of socio-economic well-being. The following paragraphs examine the study area's labour market from a number of angles, including employment rate and sectoral employment patterns.

Information box: Unemployed as per official definition

Unemployed are people, who:

a) did not work during the seven days prior the interview
b) want to work and are available to start work within a week of the interview, and
c) have taken active steps to look for work or to start some form of self-employment in the four weeks prior to the interview.

The composition of the labour force in the primary study area, the Siyanda DM, the Northern Cape and the country is detailed in **Table 18**. Unfortunately, though, since the latest Labour Force Survey does not report on the data for Municipalities, information for the primary study areas is sourced from the Quantec database and represents 2009 figures. This allows for a comparison between the study areas.

Table 18: Labour force statistics (2009)

Indicators	South Africa	Northern Cape	Siyanda DM	Kgatelopele LM
Working age population	31 496 936	704 615	163 008	14 255
Non-Economically Active Population	15 131 133	329 386	71 740	5 372
Labour Force	16 365 803	375 229	91 268	8 883
Employed	*12 260 902*	*271 688*	*68 166*	*6 647*
Unemployed	*4 104 901*	*103 541*	*23 101*	*2 237*
Unemployment rate	25.1%	27.6%	25.3%	25.2%
LF participation rate	52.0%	53.3%	56.0%	62.3%

Source: Quantec, 2011

In 2009, South Africa had about 31.5 million people within the working age population. Of these, about 15.1 million were non-economically active and 16.4 million formed part of the labour force. This means that the labour force participation rate in the country was 52.0%. The number of the employed people in South Africa was about 12.3 million, leaving 4.1 million people or 25.1% of the labour force unemployed.

The Northern Cape accounted for 2.3% of the national working age population, or 704 615 people. In 2009, just over 53% of the provincial working age population participated in the economy or were economically active. These people encompassed a labour force, which was divided into 271 688 employed and 103 541 unemployed people, indicating a 27.6% unemployment rate in the province.

Siyanda DM had a bigger percentage of the working age population participating in the economic activities than that of the province and the country. In Siyanda, 56.0% of the working age population were economically active, with a 25.3% of these people being unemployed.

The Kgatelopele LM had a working age population of about 14 255, making up almost 0.05% of the country's working age population. The labour force participation rate in the primary study area (62.3%) was the highest of the four study areas, whilst the unemployment rate was 25.2%, which was slightly higher than that of South Africa. Overall, 6 647 (74.8% of the labour force) were employed and 2 237 were unemployed in Kgatelopele in 2009.

7.2.3.6 Economic Production and GDP-R

Interpretation of economic impacts requires a sound understanding of the size of the economy and its dynamics in the past. A number of indicators exists that can describe the economy of a region or an area. The most common variables that are used for the analysis include production and Gross Domestic Product per Region (GDP-R). The former represents the total value of sales of goods and services, or the turnover of all economic agents in a region; whilst the latter, using the output approach, means the sum of value added created by all residents within a certain period of time, which is usually a year. The trend at which the GDP-R has been changing in the past is also referred to as economic growth indicator. It is a measure of both the performance of an area and the well-being of the citizens of an area. Faster economic growth than population growth is taken as an indicator of a healthy economy and an improvement in citizens' well-being.

Table 19 provides an indication of the current estimated production and GDP-R values in the study areas. It shows that business sales in South Africa are expected to amount to R5 603 billion in 2011, in current prices which equates to R2 530 billion of gross value added. The Northern Cape accounted for about 2.0% of the national GDP-R in 2011, the Siyanda DM contributed 22.4% to the provincial economy; whilst the Kgatelopele economy equated to 16.2% of the district's economy.

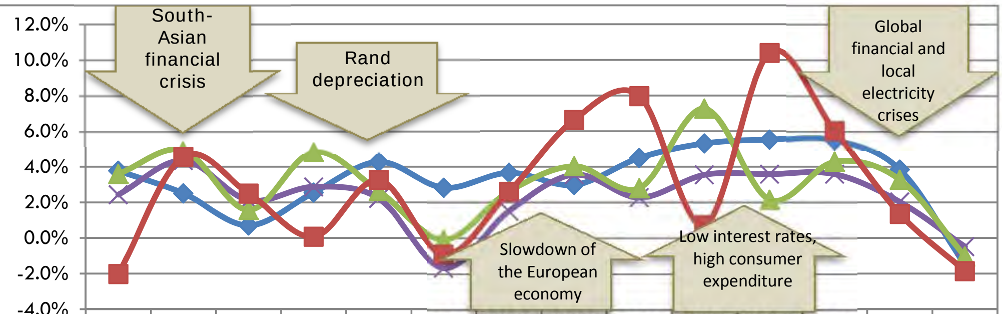
Table 19: Production and GDP-R figures (2011)

Study area	Production (R'ml)		GDP-R (R'ml)	
	Current prices	CAGR 1995-2010	Current prices	CAGR 1995-2010
South Africa	5 603 076	4.6%	2 530 484	3.3%

Study area	Production (R'ml)		GDP-R (R'ml)	
	Current prices	CAGR 1995-2010	Current prices	CAGR 1995-2010
Northern Cape	104 039	3.2%	56 341	2.3%
Siyanda DM	23 380	4.2%	11 776	3.0%
Kgatelopele LM	3 797	3.0%	2 280	2.9%

Source: Quantec, 2011

Figure 30: GDP-R historical trends (1996-2009)



	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
South Africa	3.8%	2.5%	0.7%	2.6%	4.3%	2.8%	3.7%	3.0%	4.5%	5.3%	5.5%	5.5%	3.8%	-1.5%
Northern Cape	2.4%	4.3%	2.1%	2.9%	2.2%	-1.7%	1.5%	3.6%	2.3%	3.5%	3.6%	3.6%	2.0%	-0.5%
Siyanda DM	3.6%	4.9%	1.6%	4.8%	2.6%	-0.1%	2.6%	4.0%	2.8%	7.3%	2.2%	4.3%	3.3%	-1.0%
Kgatelopele LM	-2.0%	4.6%	2.5%	0.1%	3.3%	-0.9%	2.6%	6.6%	8.0%	0.7%	10.4%	6.1%	1.4%	-1.9%

Source: Urban-Econ's calculations based on Quantec, 2011

As illustrated in **Figure 30**, South Africa's economy has been sensitive to the changes on the global and regional arenas. The South Asian financial crisis in 1997-1998, Rand depreciation in 2001, slowdown of the European economy in 2003, and the major global financial and local electricity crises in 2008 all had an influence on the dynamics of the national economy one way or another. It seems that the Rand depreciation in 2001 had a greater effect on the primary and secondary areas, as this were the time when all of them had significantly lower growth rates than South Africa. Fluctuations in the global and regional economies, as well as the spin-off effects of these trends experienced in the country, also affected the growth prospects of provincial, District Municipality's and local municipality's economies.

The domestic electricity and global financial crises in 2008 had a negative impact on the study area's economies the following year, during which the global economy was in recession. This coupled with high interest rates and stricter credit policy had a significant negative impact on the domestic demand. As a result, almost all industries experienced some level of contraction or stagnation in 2009, which ultimately reduced the demand for their outputs and had a negative impact on their growth. As illustrated in **Figure 30**, all of the analysed economies contracted in 2009. The hardest hit sectors in the national, provincial and district's economies were mining, manufacturing and trade. In Kgatelopele, the sector that showed the biggest decline were the mining and quarrying sector, whilst in surrounding economies such as Tsantsabane LM, for instance, the biggest hit was on the manufacturing sector. Nationally, the investment and activity that took place in preparation for the 2010 Soccer World Cup minimised the negative effects of the global recession. These investments though were centred in and on the metropolises and did not have any notable positive effect on the Siyanda DM. Thus, the slump in global demand and subsequently national demand for products and services exported by the District (mining outputs) and the analysed local municipality had a negative effect on these economies.

The global economy, as well as South Africa's economy, is slowly recovering from the turmoil of the past few years, although it will take a few years before it reaches the level of economic growth that was observed before 2008. In 2011, the national economy grew only by 3.8% and the previous year only by 3.0%. It is estimated that the provincial economy and the district's economy would have grown even by smaller percentages in the past couple of years.

The Kgatelopele LM's economy is expected to grow at a steady pace over the next couple of years to come as the global and national demand for locally mined commodities slowly picks up. The Lime Acres quarry has invested in new machinery in 2006 with the objective of increasing the output of the quarry by two times, and the Finsch diamond mine (managed by De Beers Consolidated Mines) has revealed that the mine has sufficient reserves to maintain its mining for the next 27 years.

7.2.3.7 Structure of economies

The structure of the economy provides valuable insight into the dependency of an area on specific sectors and its sensitivity to fluctuations of global and regional markets. Knowledge of the structure and the size of each sector are also important for the economic impact results' interpretation, as it allows the assessment of the extent to which the proposed activity would change the economy, its structure and trends of specific sectors.

Table 20: Structure of the study areas' economies in 2011 in nominal prices

Sectors	South Africa	Northern Cape	Siyanda DM	Kgatelopele LM
Primary sector	**11.1%**	**36.7%**	**39.6%**	**67.8%**
Agriculture, forestry and fishing	3.7%	8.9%	18.8%	1.3%
Mining and quarrying	7.4%	27.7%	20.8%	66.6%
Secondary sector	**23.1%**	**7.1%**	**10.1%**	**10.7%**
Manufacturing	17.2%	3.6%	5.4%	8.9%
Electricity, gas and water	2.0%	1.7%	2.9%	0.1%
Construction	3.9%	1.7%	1.8%	1.8%
Tertiary sector	**65.8%**	**56.3%**	**50.3%**	**21.4%**
Trade	13.4%	11.3%	13.0%	6.3%
Transport, storage & comm..	10.7%	10.0%	10.8%	2.9%
Finance, insurance, & business	22.8%	13.6%	9.6%	5.6%
Com. and gov. services	18.9%	21.5%	16.8%	3.1%
TOTAL	**2 530 484**	**56 341**	**11 776**	**2 280**

Source: Urban-Econ's calculations based on Quantec, 2011

As indicated in **Table 20**, South Africa's economy is a service economy, as the biggest share of its GDP-R is created by tertiary sectors, in particular the finance and business services sector and the community and government services sector. The primary sector that includes agriculture and mining contributes the smallest amount to the national economy, although they are strategically important for ensuring food security in the country, provision of electricity, as well as employment.

The Northern Cape's economy is also largely comprises of the services industries; however the primary sector plays a prominent role in its economy with a contribution of over 36% to its GDP-R in nominal prices. The provincial primary sector largely comprises of the mining sector, which shows a relatively dependency of the Province on the mining output and the global demand for commodities mined within the economy such as diamonds, silver, zinc, manganese, and iron ore. The manufacturing sector of the Province, though, is very small that suggests that little beneficiation activities are taking place in the Province.

The structure of the Siyanda DM's economy is different to that of South Africa, but is quite similar to that of the Northern Cape. It is clear, though, that it is more dependent on the primary and secondary sectors than the Province. Moreover, its agricultural sector makes a greater contribution towards the economy that that in the Province. Siyanda has a very well developed horticulture sector with table grapes, sultanas (for raisins), wine grapes, nuts, dates and other horticultural products being grown in the area. Mining activity in the District largely occurs in the local municipalities of Tsantsabane and Kgatelopele, where manganese, diamonds and the raw materials (ash) for producing cement are found. However, other forms of mining can also be found in the area, such as salt mining, for example. The fact that the local manufacturing sector is very small also suggests that locally mined commodities and grown agricultural products do not undergo extensive processing and beneficiation within the District.

The Kgatelopele LM's economy largely comprises of the primary sector, in particular mining and quarrying. The mining sector comprises mainly of a large-scale limestone and lime quarries around Lime and the Finsch Diamond Mine south of Lime Acres. Other mining activities can also be found in the area, such as marble and asbestos mining, but on a very small-scale compared to the above-mentioned businesses. Agriculture does not make a prominent contribution towards the local economy, but farming with cattle is very common in the area. Overall, mining account for two thirds of the GDP-R produced in the economy. Such a dependency on only one sector puts the entire economy at risk, as any negative changes to the mining sector would have detrimental effects on the other economic sectors in Kgatelopele.

The tertiary sector makes a notable contribution to the municipality's GDP-R, but it will be negatively affected should the primary sector shrink. The manufacturing sector in the municipality is also small, but its share is greater than that in Siyanda and the Northern Cape. Most of the manufacturing activities taking place in the area form part of the petroleum, chemical and plastic industry, whilst the non-metallic metals industry, the metal products industry, and the food and beverages industry make small contributions to the local manufacturing sector.

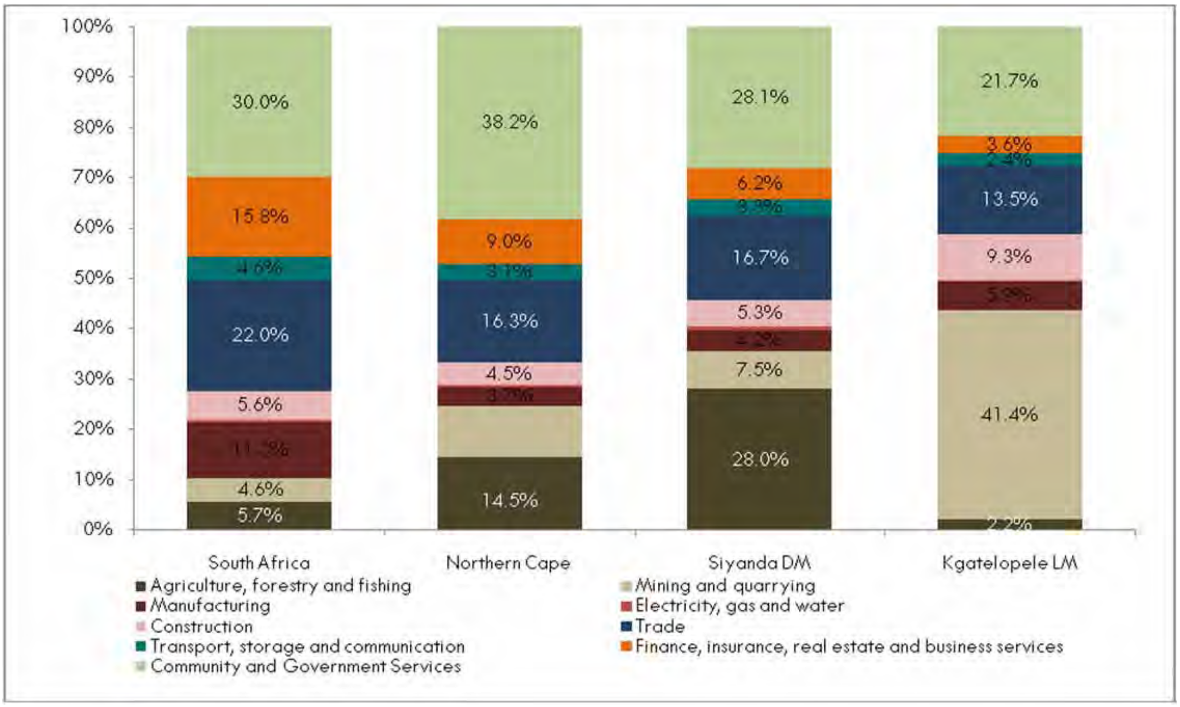
7.2.3.8 Structure of Employment

Figure 31 illustrates the structure of South Africa, Northern Cape, the Siyanda DM, and the Kgatelopele LM's economies from an employment perspective.

- The employment structure presented largely corresponds with the structure of the economy with the tertiary sector making the largest contribution towards employment creation in all areas under analysis.
- More than two thirds of the people employed in South Africa work in the tertiary sector, in particular the community and government services sector and the trade sector. Agriculture, which accounted for 2.3% of the national GDP-R in 2010, on the other hand, provided 5.7% of all employment opportunities; whilst the contribution of the mining industry towards the employment in the country was bigger than its contribution towards GDP-R. Nevertheless, both of the sectors are labour-intensive and create a notable number of employment opportunities in the country, particularly in rural areas.
- Employment structure in the Northern Cape is dominated by the number of people who are working in the tertiary sector, specifically in the trade, finance, community and government services. Its secondary sector creates 8.7% of jobs in the Province, whilst its primary sector creates 24.7%.

- Most of the people employed in the Siyanda DM are working in the tertiary sector, specifically in the community and government services, trade and finance sector. Its secondary sector creates 10.2% of jobs, whilst its primary sector creates 54.3%.
- The Kgatelopele LM's employment structure illustrates a great dependency of the entire economy on the local mining activities. Four out of ten people employed in this municipality are working at the mines and quarries. The rest of the people are largely employed by the services industries, in particular community and government services and trade.

Figure 31: Employment structure (2010)



Source: Urban-Econ calculations based on Quantec, 2011

7.2.3.9 Basic service delivery and access to tenure

Access to basic service delivery and shelter are the indicators that allow understanding the standard of living of the households residing in the study areas. Comprehension of the extent to which households in the area have access to water, sanitation and electricity assists in understanding of the communities' plight and their needs. At the same time, knowledge of the types of dwellings that households reside in is valuable in developing a complete profile of the circumstances in which communities are living. All of above creates a baseline against which the potential impacts of the proposed activity could be assessed.

Table 21 provides information on the types of dwellings in which households live in the study areas. It indicates that 64.3% of households in the primary study area were living in formal dwellings and this figure also means that access to formal dwellings in the primary study area was the lowest amongst all study areas analysed. However, this was not because the greater share of households lived in informal dwellings in the Kgatelopele LM as compared to the other study areas, but because a significantly greater number of households in that municipality resided in workers' hostels owned by the local mines. The need for formal dwelling in the Kgatelopele LM is still high, with one out of ten households living in an informal dwelling.

Table 21: Dwelling types (2010)

Item	South Africa	Northern Cape	Siyanda DM	Kgatelopele LM
Formal dwelling	80.3%	83.2%	79.0%	64.3%
Informal dwelling	14.0%	10.3%	12.8%	10.8%
Other	5.7%	6.5%	8.1%	24.9%
TOTAL	100.00%	100.00%	100.00%	100.00%

Source: Urban-Econ's calculations based on Quantec, 2011

Table 22 provides information on the access of households to electricity, using energy for lighting indictor as a proxy. The information presented in this table suggests that the primary study area's households have the lowest level of access to electricity compared to the other study areas. Only 78.3% of households in the Kgatelopele LM use electricity for lighting compared to 80.8% in South Africa and 84.2% in the Siyanda DM, and again 85.8% in the Northern Cape. The fact that the combination of the percentage of households with access to formal dwellings and other types of dwelling, except for informal, is smaller than the percentage of households who have access to electricity in all areas suggests that some of the households living in these types of dwellings either do not have electricity or are not able to afford it.

Table 22: Energy for lighting (2010)

Item	South Africa	Northern Cape	Siyanda DM	Kgatelopele LM
Electricity	80.8%	85.8%	84.2%	78.3%
Other	19.2%	14.2%	15.8%	21.7%
TOTAL	**100.00%**	**100.00%**	**100.00%**	**100.00%**

Source: Urban-Econ's calculations based on Quantec, 2011

Table 23 shows households' access to water. The situation in this case is quite different to that observed with regard to access to electricity and formal dwellings. Just over 88% of households in the primary study area have access to water inside their dwellings. This is considerably higher than the 64.3% of households living in South Africa who have access to water inside their dwellings. At the same time, almost 79% of households in the Siyanda DM have access to water from inside their yard. Nevertheless, a very small 3.3% of households in the primary study area and 5.6% of households in the Siyanda DM still have to rely on other sources of water which are not very reliable, such as water vendor, rain water, etc.

Table 23: Access to water (2011)

Item	South Africa	Northern Cape	Siyanda LM	Kgatelopele LM
Water inside dwelling or a yard	64.3%	75.0%	78.9%	88.3%
Water from point outside the yard	24.9%	20.0%	15.5%	8.5%
Other water access points	10.9%	5.0%	5.6%	3.3%
TOTAL	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Source: Urban-Econ's calculations based on Quantec, 2011

Table 24 provides information regarding access by households to sanitation. It indicates that a very high rate of 90.2% of households in the primary study area have a toilet, which is significantly higher than the 57.7% reported for South Africa. This is also a higher figure than that reported for the Siyanda DM and is also significantly higher than the percentage calculated for the Northern Cape at 72.2% and 67.6%, respectively. This again is not indicative of the rural nature of these regions, where households who have access to toilets largely have access to pit toilets. Access to a chemical or flush toilet emphasises household's access to water inside their dwellings.

Table 24: Access to sanitation (2011)

Item	South Africa	Northern Cape	Siyanda DM	Kgatelopele LM
Chemical or Flush Toilet	57.7%	67.6%	72.2%	90.2%
Pit Toilet	25.8%	13.9%	9.5%	1.5%
Bucket system	2.7%	5.2%	6.1%	2.1%
Other	13.8%	13.3%	12.2%	6.2%
TOTAL	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Source: Urban-Econ's calculations based on Quantec, 2011

Please refer to attached Socio - Economic Scoping Study **Appendix O.**

7.2.4 Tourism

7.2.4.1 Foreign Tourism in the Northern Cape

The Northern Cape is the least visited province in South African. Of the 8 073 552 foreign tourists to South Africa during 2010, only 1,2% (96 329 tourists) visited the Northern Cape, a decline of 3,5% when compared to 2009 (**Figure 32**).

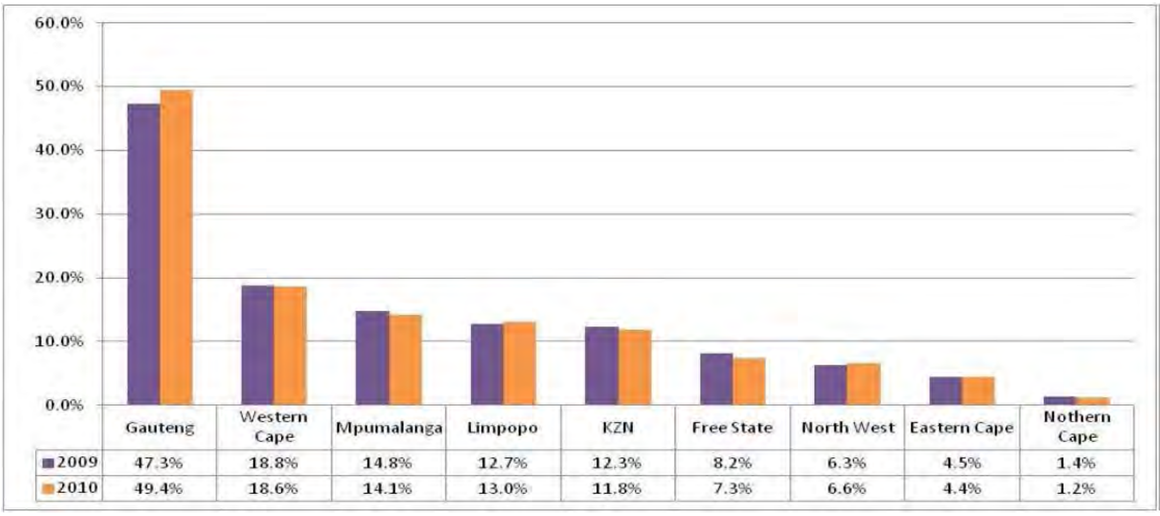


Figure 32: Number of Foreign Tourists to the Northern Cape (2009-2010)

7.2.4.2 Foreign Tourism Source Markets

The Northern Cape receives a large number of visitors from neighbouring Namibia who are usually en-route to the Western Cape, therefore Africa and the Middle East accounts for the most foreign tourists to the Northern Cape in 2010 (60,2%), followed by Europe (28,8%), the Americas (7,7%) and then Asia and Australasia (3,2%) (**Figure 33**).

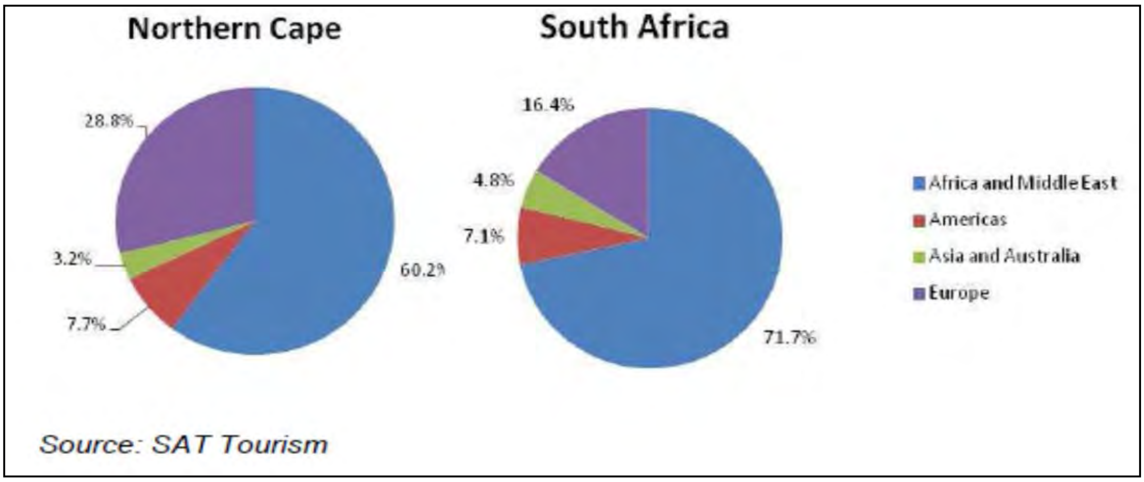


Figure 33: Source Markets of Foreign Tourists (2010)

Interviews with tourism stakeholders has confirmed that foreign visitors to the Northern Cape tend to be repeat leisure visitors to South Africa that wish to explore new destinations within the country. These foreign visitors usually travel to the Northern Cape as couples or in small groups utilising their own transport.

7.2.4.3 Foreign Tourism Bednights

Of the 66 852 503 bednights spent by foreign tourists in South Africa during 2010, 0,8% (528 000) were spent in the Northern Cape, a marginal decline of -0,1% when compared to 2009 (**Figure 34**).

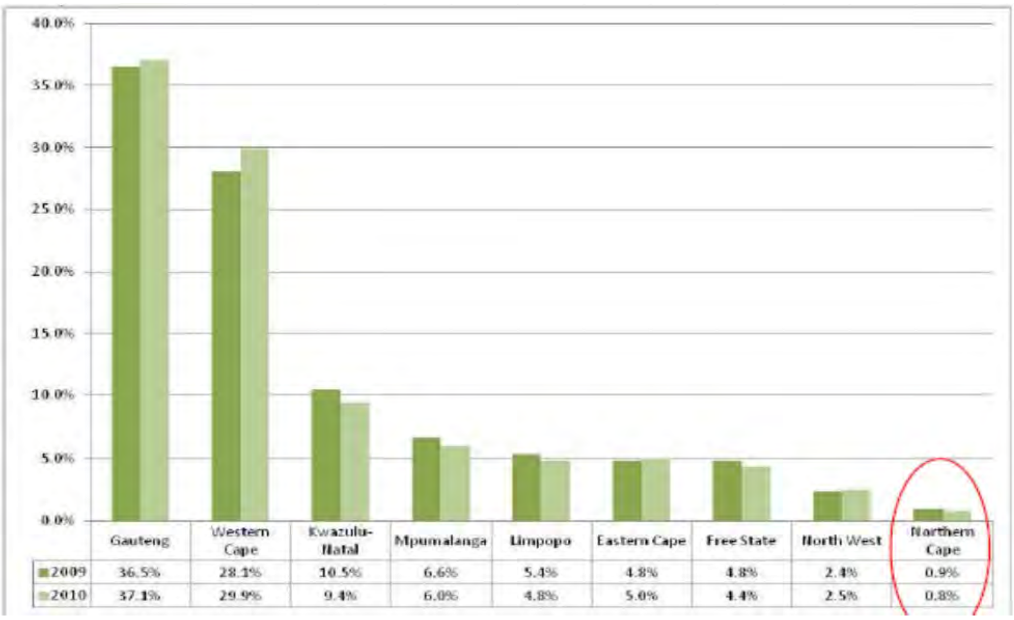


Figure 34: Foreign Tourist Bednights spent in the Northern Cape (2009-2010

7.2.4.4 Foreign Tourism Spend

The total foreign direct spend ("TFDS") excluding capital expenditure ("CAPEX") in South Africa during 2010 was R72,6 billion, of which only R600 million was spent in the Northern Cape.

Table 28 provides a summary of the domestic tourism industry to the Northern Cape from 2007 to 2010.

Table 25: Summary of the Domestic Tourism Industry in the Northern

Indicator	2007	2008	2009	2010
Total Trips	600 000	800 000	600 000	200 000
Total Annual Spend (mm)	R513	R900	R465	R223
Average Spend per Trip	R1 420	R1 170	R830	R1 010
Total Annual Bednights (mm)	2.5	3.1	2.8	0.9
Average Nights per Trip	4.0	3.7	5.0	4.0
Most Visited Cities	Kimberley and Upington			
Most Popular Attractions	The Big Hole and Flea Markets			

7.2.4.5 Number of Domestic Visitors to the Northern Cape

In 2010, the Northern Cape had the lowest share of the total domestic arrivals and revenue from domestic travel across all the provinces. Of the 29.7 million domestic trips undertaken in South Africa during 2010, only 0,7% (200 000 trips) were taken to the Northern Cape. This is a 66,67% decrease from the 600 000 domestic trips undertaken to the Province during 2009 (Table 2.1). The most visited cities in the Northern Cape by domestic tourists were Kimberley and Upington with the most popular attractions visited being The Big Hole and Flea Markets (**Table 28**).

7.2.4.6 Purpose of Visit for Domestic Tourist to the Northern Cape

Visiting Friends and Relatives ("VFR") is the main reason why domestic tourists go to the Northern Cape, followed usually by either business or holiday, expect for in 2009, when religious reasons constituted 18% of all domestic arrivals to the Northern Cape (**Figure 35**).

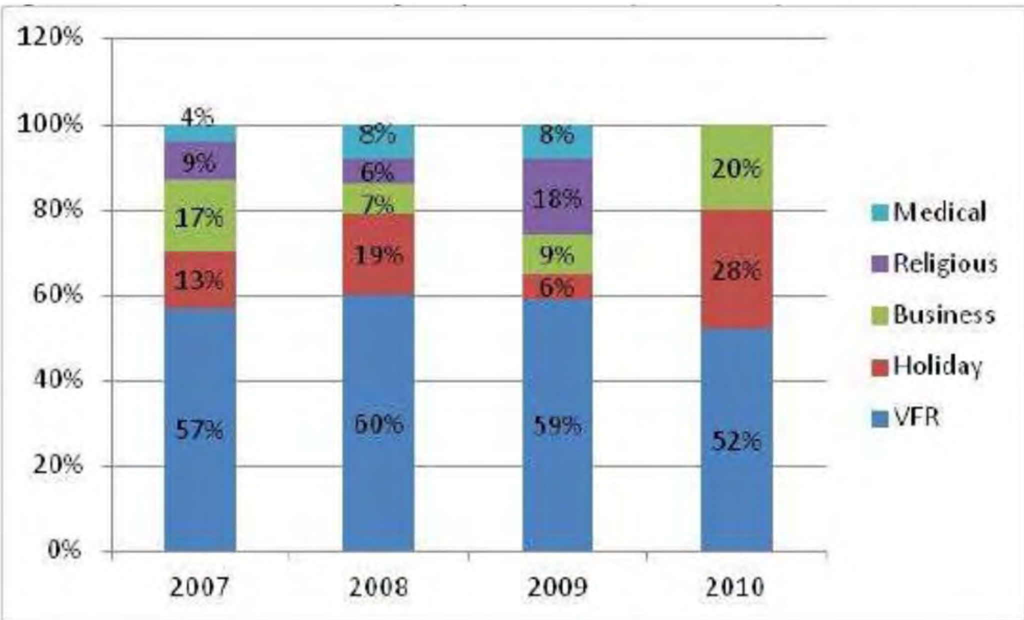


Figure 35: Domestic Arrivals by Purpose of Visit (2007-2010). ***Source: SA Tourism Domestic Scorecard, 2011***

7.2.4.7 Domestic Tourism Spend to the Northern Cape

The total annual spend of domestic tourism to the Northern Cape was only R223 million in 2010 (only 1,1% of the total domestic tourism revenue received in 2010). This is a 52% decrease from the R465 million spent by domestic tourist during 2009 and the lowest recorded total annual spend from domestic tourism in the Northern Cape since 2007. However, the average spend per trip was higher in 2010 than in 2009.

Interesting is that 57% of the revenue received in 2010 from domestic tourists originated from VFR travel. The large differential in the contribution by the various purposes of trips over the years can be attributed to the small survey sample of domestic tourists to the Northern Cape (**Figure 40**).

7.2.4.8 Source Markets for Domestic Visitors to the Northern Cape

The Northern Cape received tourists from all provinces, with the exception of Limpopo in 2009. The biggest share of tourists was, however, from within the province (31,7%). Mpumalanga (26,8%) and Western Cape (26%) are also important domestic source markets for the Northern Cape. Expect for Limpopo, the least domestic tourists came from the Free State (2%) and the North West Provinces (3,2%).

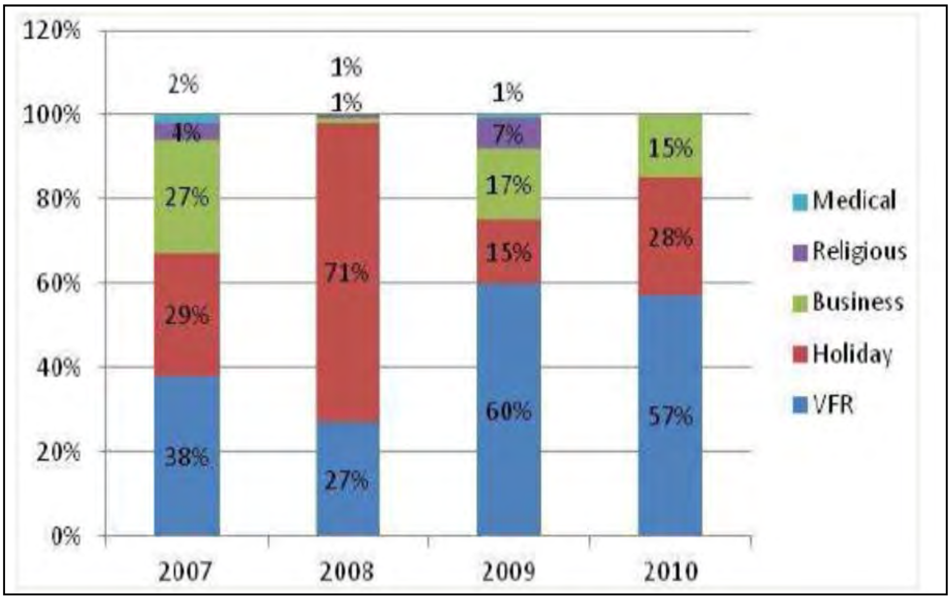


Figure 36: Revenue of Domestic Visitors by Purpose of Visit (2007-2010). ***Source: SA Tourism Domestic Scorecard, 2010***

7.2.4.9 Total Bednights for Domestic Visitors to the Northern Cape

The Northern Cape only received 0,7% (or 900 000 bednights) of the total domestic bednights spent in South Africa during 2010. This is a - 67,9% decrease from the 2,8 million bednights spent in the province during 2009.

7.2.4.10 Average Length of Stay for Domestic Visitors to the Northern

Domestic trips to the Northern Cape lasted an 4 average of 4,0 nights in 2010, a decrease of 1 night from the 2009 average length of stay. This is, just below the national average of 4,4 nights **(Figure 37)**

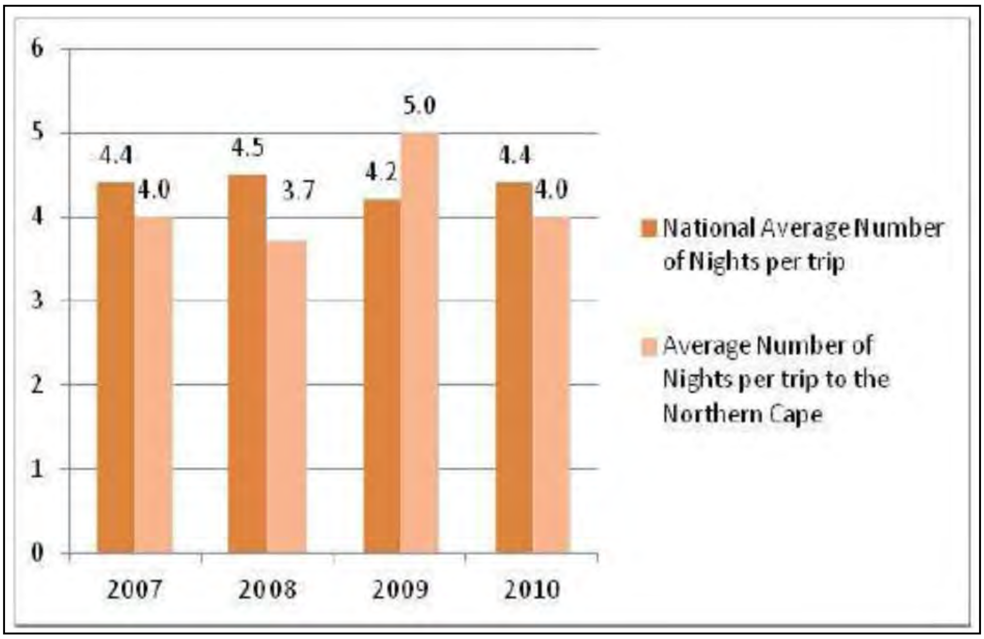
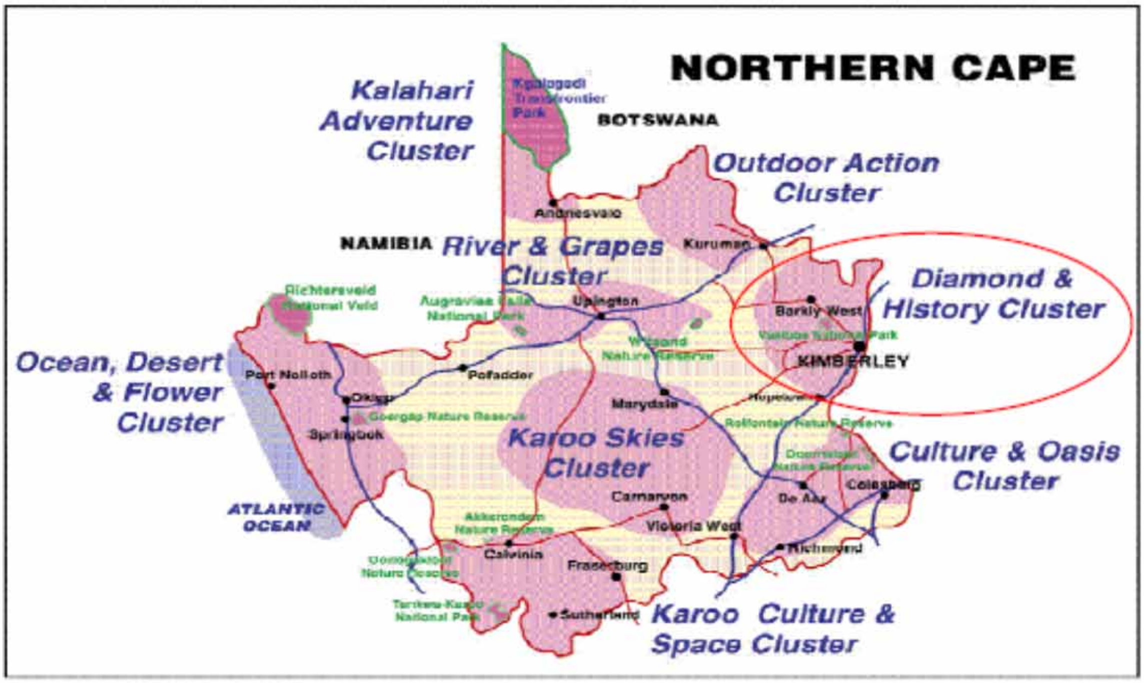


Figure 37: Average Length of Stay of Domestic Trips (Nights). ***Source: SA Tourism Domestic Scorecard, 2010***

7.2.4.11 Tourism Industry in Upington

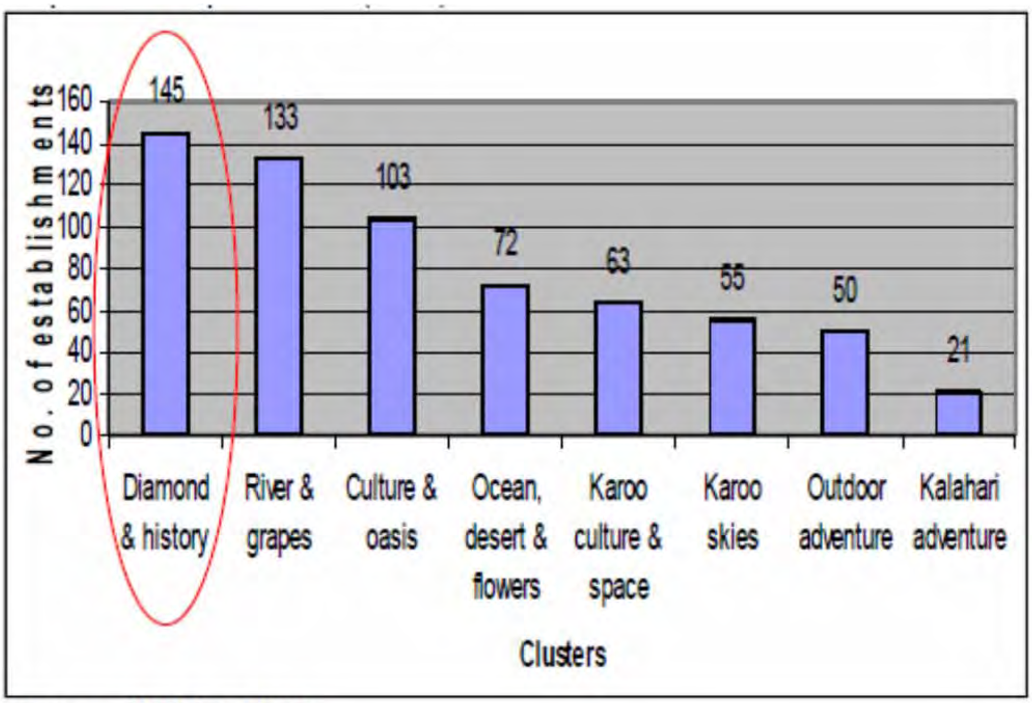
Danielskuil is the closest town to the proposed Solar Power Plant development site. In November 2008, KPMG conducted a Tourism Resource Audit in the Northern Cape. The Audit identified 8 clusters within the Northern Cape. Danielskuil is located in the Diamond and History Cluster (**Figure 38**).



Source: KPMG, 2008

Figure 38: Northern Cape Tourism Product Clusters. ***Source: KPMG, 2008***

According to the Tourism Resource Audit, the Northern Cape had a total of 642 registered accommodation establishments during 2008 of which 133 were within the River and Grapes Cluster (Figure 38)



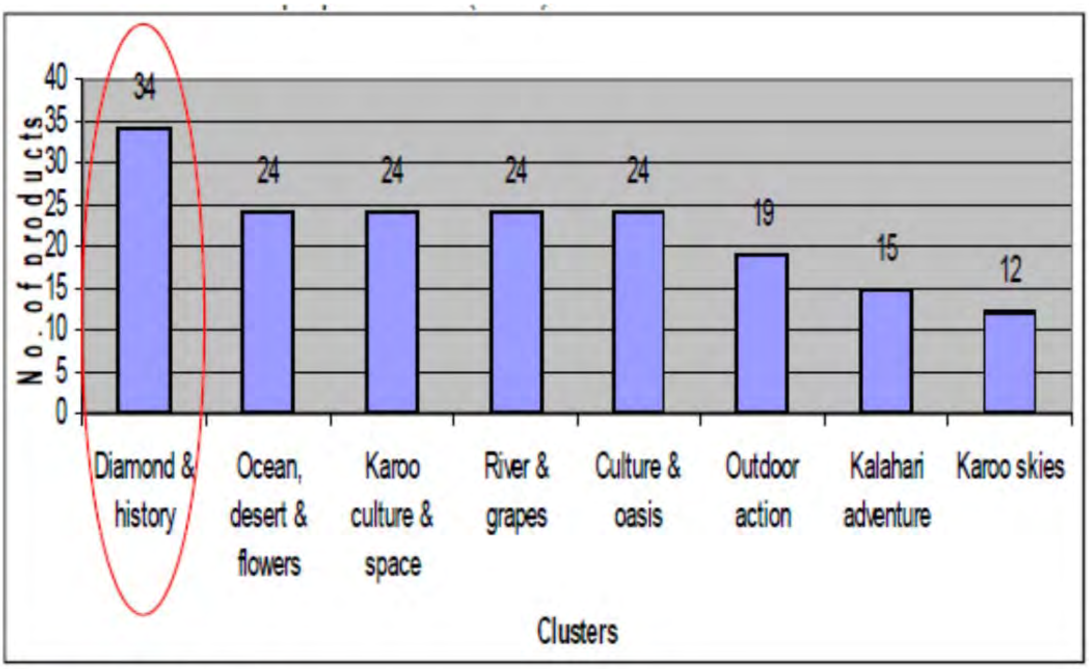
Source: KPMG, 2008

Figure 39: Number of Accommodation Establishments within the Northern Cape Tourism per Cluster (2008). ***Source: KPMG, 2008***

Accommodation establishments included:

- Guest houses;
- Bed and Breakfast ("B&B") establishments;
- Hotels;
- Lodges;
    - Backpacking establishments; and
- Self catering establishments.

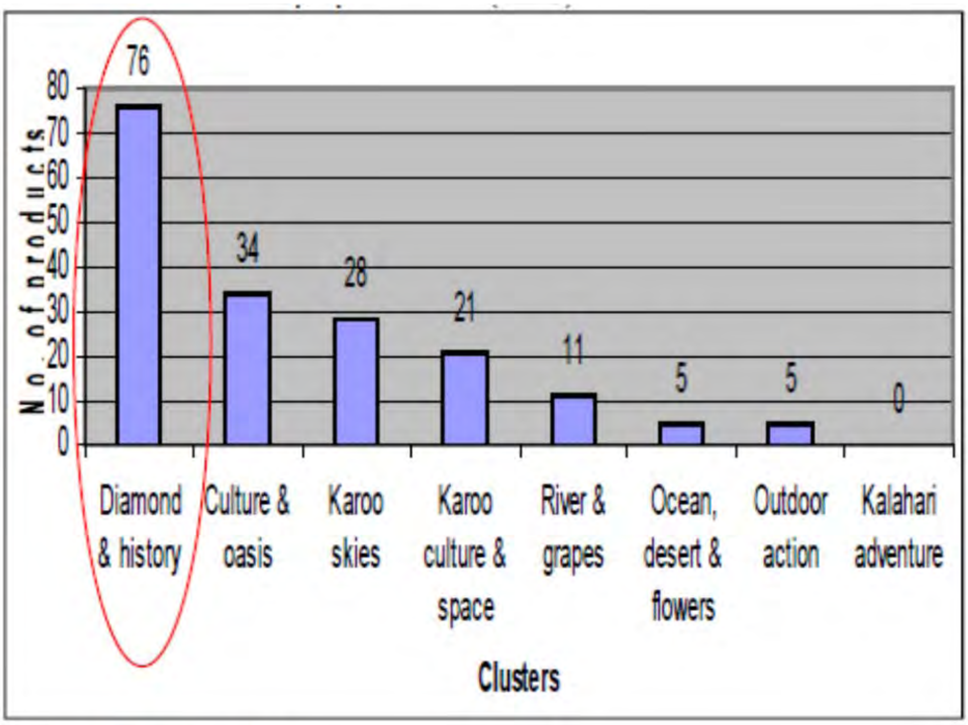
The Tourism Resource Audit identified a total of 176 outdoor and adventure product offerings within the Northern Cape during 2008, of which 44 were situated within the Diamond and History Cluster (**Figure 39**)



Source: KPMG, 2008

Figure 40: Number of Outdoor and Adventure Product Offerings available within the Northern Cape per Cluster (2008). ***Source: KPMG, 2008***

In terms of Culture and Heritage product offerings, the Tourism Resource Audit identified 196 products of which 76 were available within the River and Grapes Cluster during 2008 **(Figure 40**)



Source: KPMG, 2008

Figure 41: Number of Outdoor and Adventure Product Offerings available within the Northern Cape per Cluster (2008). ***Source: KPMG, 2008***

The Tourism Resource Audit identified the following infrastructure crucial to the development of the tourism industry in the Province.

7.2.4.12 Road Infrastructure

Seven national routes, a number of major and minor provincial routes (some unpaved) and an extensive system of paved and unpaved district and local roads. The national roads include:

- the N1 and N12 that interlinks Johannesburg and Cape Town;
- the N7 from Cape Town to the Namibian border at Vioolsdrift;
- the N8 from Bloemfontein to Kimberley;
- the N9 from George to Colesberg;
- the N10 from Port Elizabeth to the Namibian border at Nakop via De Aar and Upington, and

- the N14 from Johannesburg to Springbok via Kuruman and Upington (this is the main access route along which the proposed development site is located)

7.2.4.13 Rail

Extensive railway network including the main Johannesburg- Cape Town line running through Kimberley routes are used for both freight (particularly for the agricultural and mining industries) and passengers, and often carry luxury tourism trains such as the Blue Train and Rovos Rail

7.2.4.14 Air

Accessibility is limited mainly due to the frequency and capacity of scheduled flights.

There are five airports at Kimberley, Upington, Aggeneys, Springbok and Alexander Bay and numerous local airfields distributed across the Province

- local airfields and landing strips are utilised by the mining, agricultural and tourism industries.
- two major airports are at Upington and Kimberley.
- the Upington Airport received a total of 22 858 passengers in 2010 (including domestic and unscheduled passenger arrivals)

The Tourism Resource Audit also identified the Market Readiness of each of the clusters based on the following Market Readiness Matrix (**Figure 42**

Assess the strength of the experience	Weak (1)	Developing (2)	Market ready (3)	Score
Accessibility				
Information provision				
Accommodation				
Food and beverage				
Attraction range and quantity				
Attraction quality				

Figure 42: Market Readiness Matrix used to evaluate each Cluster (2008). ***Source: KPMG, 2008***

The Diamond and History cluster was identified as a Market Ready Cluster, within the following product strengths:

- The Big Hole
- Kimberly Mine Museum
- Hinterland and Douglas Wine Cellars
- The Flamingo Casino
- Wildebeest Kuil Rock Art Centre
- The Anglo Boer War Route and Archaeology Routes

This Market Readiness Evaluation also identified the following tourism product potential within the Diamond and History Cluster:

- Farm stalls
- Story tellers
- Supplying of artefacts
- Traditional dancers
- Take away caravans
- Supply of picnic baskets
- Walking tour guides/operators

In addition the Tourism Resource Audit recommends the following packages to be developed for the Diamond and History Cluster:

- Undiscovered Gems Experience – to raise awareness of other products in the region such as waterfalls, wine cellars, rose farm, etc. and
- Diamond and Heritage Experience – to target the niche market that visits the Diamond and History Cluster

Interviews with local tourism stakeholders revealed the following profile of the tourism industry in and around Danielskuil:

- Majority of visitors to Danielskuil (between 90%-95%) stay in the area for business purposes.
- The majority of business visitors are contract workers or experts working with the many mines in the area, but there is also a lot of training done in the area for private businesses and Government employees (such as the police force or teachers) for which experts are brought in from across the country.
- Business travellers tend to stay between 3-5 nights, but it is also common to have business tourists who stay for 3 months.
- A much smaller percentage of guests (between 5%-10%) are in the area for leisure purposes.
- Of the leisure guests, VFR and transit is the main reason why they visit the area and these guests tend to be domestic South African visitors who stay on average only for a 1-3 nights.
- There is no real leisure holiday market in the Danielskuil area. Because of the high levels of domestic business and VFR guests, the tourism industry in Danielskuil is mostly made up of 60% domestic travellers and 40% foreign guests.
- Foreign tourists tend to be experts coming to work on the mines and tend to come from Europe and the UK.
- Domestic travellers tend to originate mostly from within the Northern Cape, Gauteng or Mpumalanga.

- Because of the high level of business tourism in the area, the tourism industry in Danielskuil tend to be busier during the week than the weekends and have seasonality slumps during the school holidays
- However, the slump period have been decreasing in recent years as the mines in the area have been expanding.

7.2.4.15 Summary and Relevance for the Study

Table 26: Summary and Relevance of Section

Description	Key Findings
Foreign Tourism to the Northern Cape	- The Northern Cape is the least visited province in South Africa - In 2010, the Northern Cape only received 96 329 foreign tourists - Africa and the Middle East is the main source market of foreign tourists to the Northern Cape - Foreign tourists to the Northern Cape tend to be repeat leisure tourists who travel in small groups or as couples - In 2010, only 528 000 bednights were spent in the Northern Cape - In 2010, the TFDS spent in the Northern Cape was only R600 million
Domestic Tourism to the Northern Cape	- Northern Cape receives then lowest share of domestic arrivals and revenue - In 2010, the Northern Cape only received 200 000 domestic trips - VFR is the main purpose of visit for domestic visitors to the Northern Cape - In 2010, the total domestic tourism spend in the Northern Cape was R223 million of which 57% originated from VFR visitors - A large portion of visitors to the Northern Cape originate from within the Province - Other important source markets are Mpumalanga and the Western Cape Provinces

Description	Key Findings
	- ·In 2010, the Northern Cape only received 900 000 bednights and the guests tended to stay an average of 4 nights per trip

Tourism Resource Audit	- Danielskuil is located in the Diamond and History cluster.
	- Based on the Resource Audit, in 2008 this cluster had:
	  - 145 Accommodation establishments;
	  - 34 Outdoor and adventure activities; and
	  - 76 Cultural experiences·
	- The Diamond and History Cluster is seen as a market ready cluster ·
	- Kimberley airport received a total of 65 977 arrivals in 2010

Profile of the Tourism Industry in Danielskuil	- Business is the main reason why tourists go to the Danielskuil area. - · VFR and transit are the reasons why leisure tourists visit the Danielskuil area. - 60% of tourists are domestic and 40% foreign. - Business travellers tend to stay 3-5 nights and there are long stays of 3 months. - Leisure guests stay between 1-3 nights. - Most foreign guests come from the UK and Europe - Most domestic guests originate from the Northern Cape.
Relevance for the study	- The Northern Cape is the least visited province is South Africa, both from a domestic and foreign tourism perspective thus the possible impact that the proposed Solar Power Park could have on the tourism industry in South Africa will be very minimal - The proposed development site is located close to Danielskuil - Upington is located in a market ready tourism

Description	Key Findings
	cluster - There is more business than leisure travel to the Danielskuil area and thus these guests will be less sensitive to any visual impacts of the Plant.

Please refer to attached Tourism Scoping Study **Appendix P**

7.2.5 **Visual**

7.2.5.1 Description of Receiving Environment

The project is located in a semi-arid region with sparse vegetation and exposed soil, which is mostly untransformed. Development is associated with mining and farming activities. Commercial farming is limited to sheep, cattle and game farming. Hunting takes place on some farms in the region. The towns in the study area are mostly associated with mining activity. Danielskuil, Hey and Lime Acres are located between 25 – 27 km west of the site. Koopmanshoop and Ulco are located at a distance of 24 and 40 km from the site respectively. Farmsteads are widely spread, with an associated low population density.

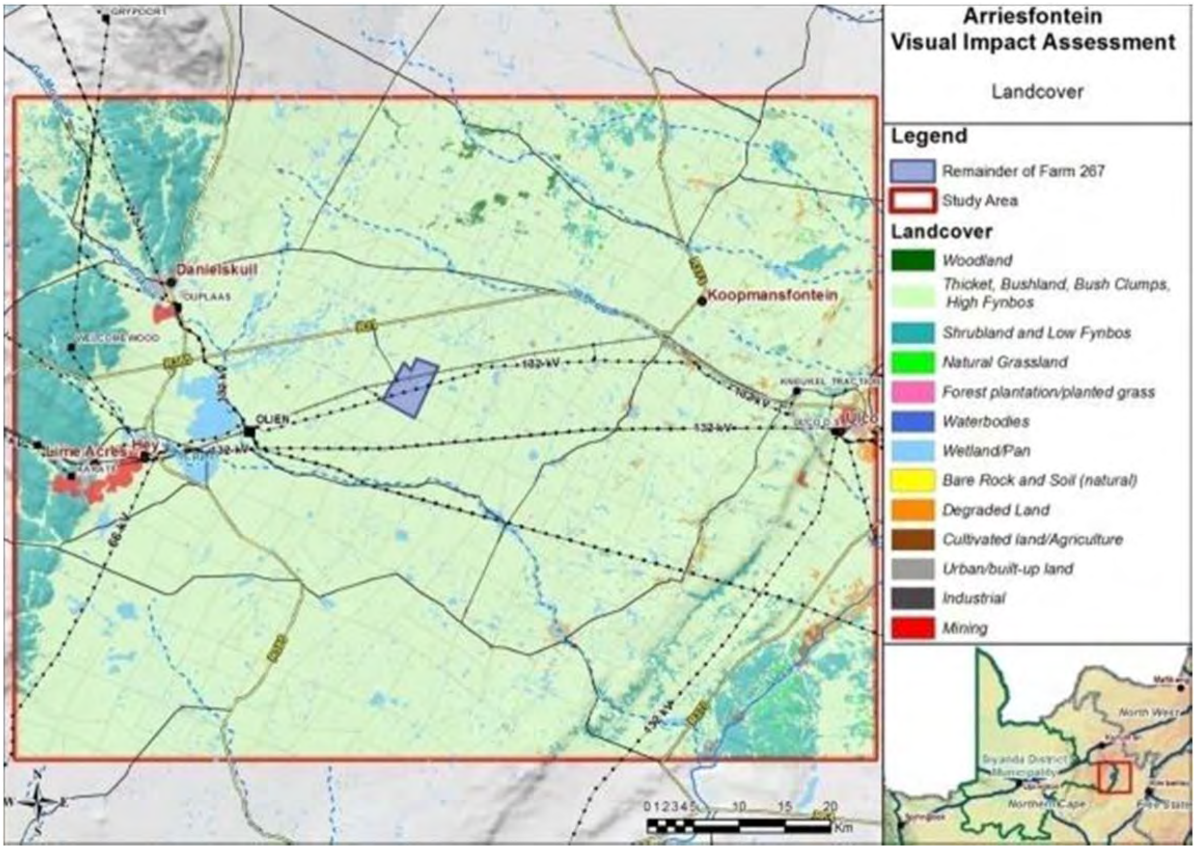


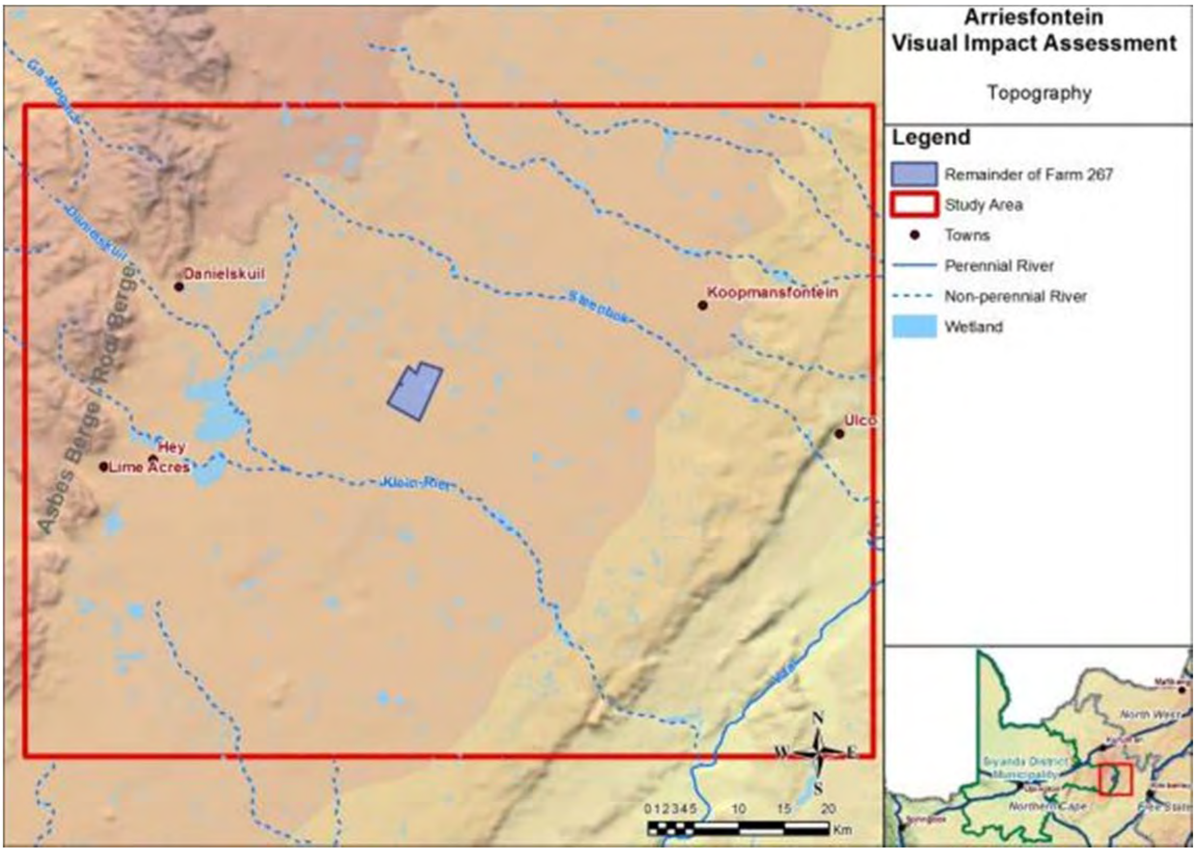
Figure 43: Land use / Land cover around the proposed site.

Infrastructure in the study area consist of a network of roads and powerlines, substations, and a railway line. No major roads occur in the area. The R385 is the closest road at 5km north of the site. Other roads include the R31 and R373, as well as a number of secondary roads and access roads to farms. A 132kV transmission line and a railway line transect the proposed development site from west to east, running more or less parallel to each other.

The natural environment is shaped by topographical features and vegetation. As indicated on the topographical map (**Figure 44**) and vegetation map (**Figure 45**), there is a close correlation between the topography and vegetation types. The proposed development site is located on a large plateau with Ghaap Plateau Vaalbosveld the dominant vegetation type. This plateau is flanked by the Rooiberge / Asbesberge mountain range in the west, and a range of distinct ridges in the east. The plateau slopes gently eastward towards the Vaal River which is approximately 50 – 60 km south east of the site. Being a flat area, drainage lines are limited to a few east flowing non-perennial rivers. Dry pans are a general sight in the area.

The combination of thicket, bushland and bush clumps on a vast flat landscape, together with views of relative high mountains in the west, lend a coherent visual character to the area. Being largely undeveloped for at least 25 km around the site, views in this area are aesthetically pleasing. At night, especially moonless nights, the skies reveal rarely seen clear views of the stars, with particularly the Milky Way etched against a pitch black night sky.

Figure 44: Topography as depicted by a shaded relief map.



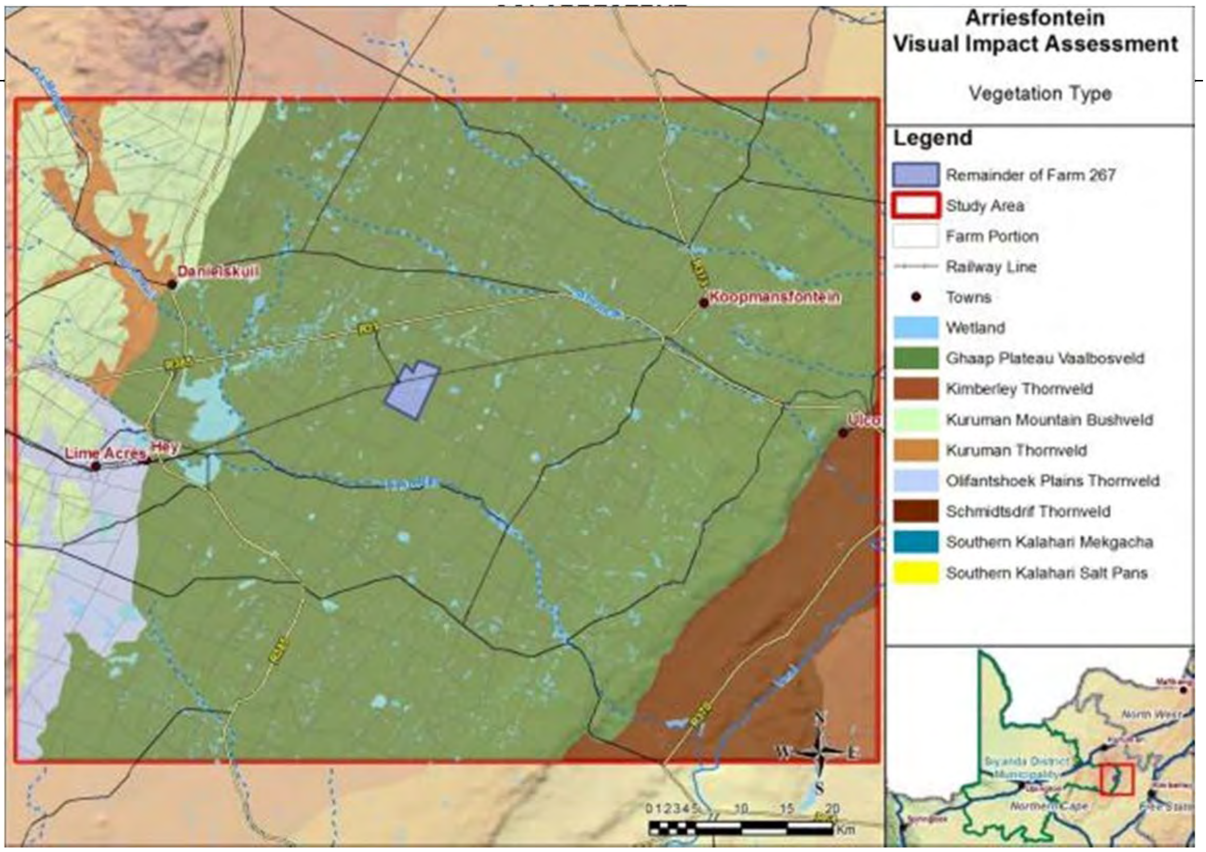


Figure 45: Vegetation types (NBI, 2004).

7.2.5.2 Visibility and Visual Description

Visibility is determined by a line of sight where nothing obscures the view of an object. Exposure is defined by the degree of visibility, in other words "how much" of it can be seen. This is influenced by topography and the incidence of objects such as trees and buildings that obscure the view partially or in total. Visibility can be modelled by making use of a digital terrain model (DTM), and applying a viewshed analysis using GIS software. The map in **Figure 46** shows the result of a viewshed analysis for the heliostat component of the CSP at Arriesfontein.

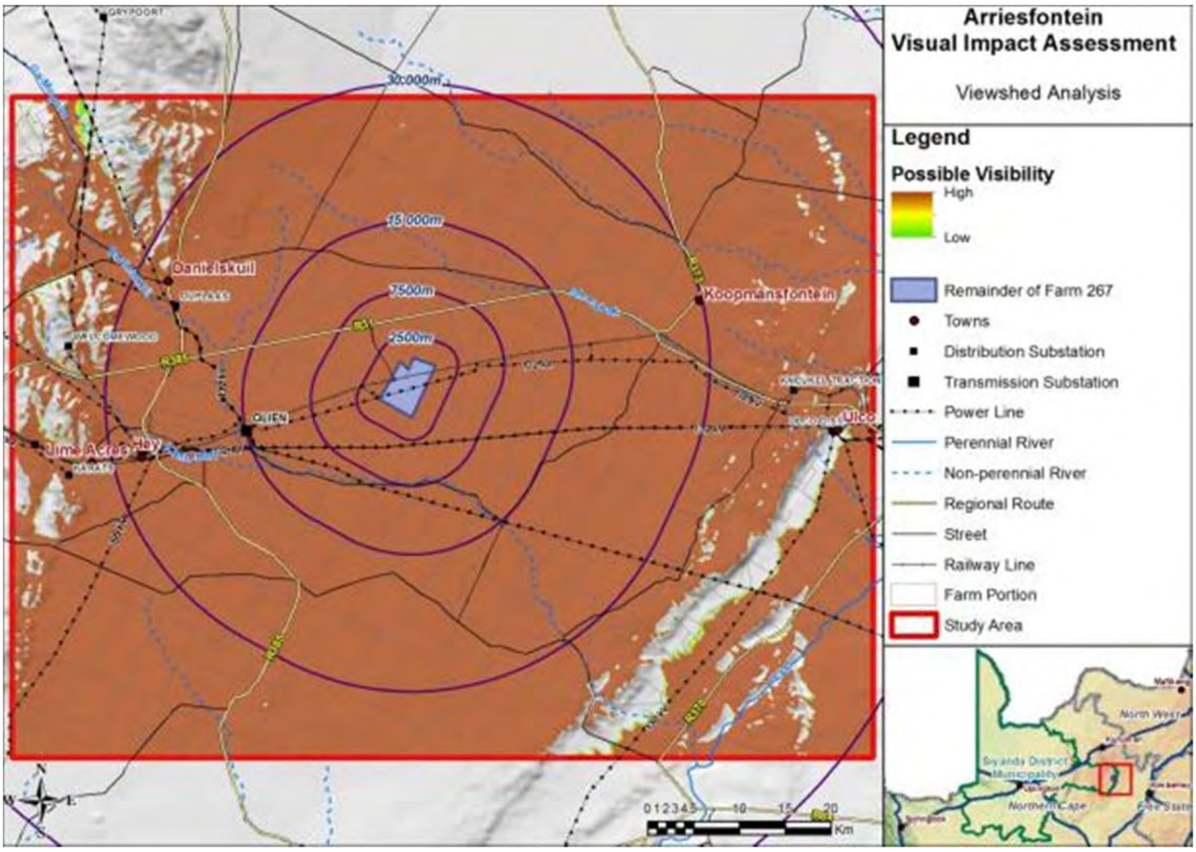


Figure 46: Viewshed analysis of heliostats depicting possible visibility.

The footprint coverage of the heliostat component is 625ha. Due to the extreme flat topography, and with a height of 14m for each heliostat, the visual exposure is expected to be high, as is evident from the map. Possible visibility covers almost the complete study area, and is only shielded by the mountains in the west and ridges in the east.

It is expected that the visibility of the central receiver will be somewhat larger, as it will be a prominent feature, protruding the skyline at 200m above ground.

The modelling of visibility is merely conceptual. Being based on DTM data, it does not take into account the effect of buildings, trees etc. that could shield the facility from being visible. The viewshed analysis therefore signifies a worst-case scenario. The immediate landscape surrounding the observer has a determining influence on long distance views. It is expected that vegetation may offer some degree of visual screening. Information on this aspect is to be obtained and confirmed during a site visit that will be conducted during the EIA phase.

Please refer to attached Visual Scoping Study **Appendix Q**.

8. Potential Environmental Impacts

8.1 Introduction

A key part of the Scoping Process is the preliminary identification and consideration of issues and concerns that may impact (positively and/or negatively) with the biophysical and socio-economic environments. The issues that are identified as potentially significant during the Scoping Phase forms the basis on which the more detailed specialist studies are conducted during the EIA Phase. Each of the potential issues identified in the Scoping Phase will be briefly described in this section.

8.2 Description of Potential Impacts

The potential impacts on environmental and social resources arising from the proposed development include direct and indirect impacts. Potential impacts will also be linked to the different stages of the project which are identified as construction, operation and decommissioning.

Table 26 provides an overview of likely aspects arising from each of the key project activities and considers their likely interaction with socio-economic and environmental resources and receptors.

Table 27: Interaction between Project Activities and Receiving Environment

Project Activities	Receptor/Resource									
	Fauna	Flora	Soils	Hydrology	Traffic and Transport	Air Quality	Land Use and Agricultural Potential	Landscape and Visual Amenity	Heritage/Archaeology/Palaeontology	Socio-economics
Pre-construction and Construction										
Vegetation Clearance										
Construction of Access Roads										
Construction of Temp. Hard Standing										
Site Leveling and Grading										
Preparation of Solar Panel Foundations										
Underground Cables/Overhead lines										
Substation Construction										
Solar Panel Delivery and Erection										
Construction of Service Building										
Hard Standing Area Rehabilitation										
Waste										
Operation										

Project Activities	Receptor/Resource									
	Fauna	Flora	Soils	Hydrology	Traffic and Transport	Air Quality	Land Use and Agricultural Potential	Landscape and Visual Amenity	Heritage/Archaeology/Palaeontology	Socio-economics
Solar Panel Operation	■						■	■		
Use of Access Tracks	■							■		
Use of Buildings	■							■		
Site Maintenance	■						■	■		
Waste	■	■	■	■			■	■		
Decommissioning										
Removal of Solar Panels	■	■						■		■
Removal of Foundations	■	■		■				■		■
Removal of Access Roads	■	■		■				■		■
Removal of Underground Cables	■	■						■		■
Waste	■	■	■	■			■	■		
Site Restoration & Rehabilitation	■	■	■	■		■	■	■		■

Note: This interactions matrix will be continually developed throughout the EIA process.

Key: Shaded box indicates potential interaction between the project and resource or receptor.

8.3 Potentially Significant Impacts

The following section describes potentially significant issues both the PV and CSP based on the initial site visit, discussions with the project team, issues and concerns raised by I&AP's during the PPP and available information about and from experience regarding the environmental effects of similar solar energy developments. These potential impacts will be separately discussed in detail for the PV and CSP in the EIA Report. It is likely that many of these impacts can be adequately addressed through the implementation of appropriate mitigation and management measures, however, some require further specialist investigation as part of the EIA Report as indicated. The aspects that are potentially significant include the following:

8.3.1 Air Quality Impacts

8.3.1.1 Construction Phase

During the construction assessment phase it is expected that, the main sources of impact will result due to the construction of access roads, and the plant area. These predicted impacts cannot be quantified, primarily due to the lack of detailed information related to scheduling and positioning of construction related activities. Instead a qualitative description of the impacts will be provided. This will involve the identification of possible sources of emissions and the provision of details related to their impacts.

Construction is commonly of a temporary nature with a definite beginning and end. Construction usually consists of a series of different operations, each with its own duration and potential for dust generation. Dust emission will vary from day to day depending on the phase of construction, the level of activity, and the prevailing meteorological conditions (USEPA, 1996).

The following possible sources of fugitive dust have been identified as activities which could potentially generate dust during construction operations at the site:

- Product Transport
- Scraping;

- Debris handling;
- Debris stockpiles; and
- Truck transport and dumping of debris.
- Power Plant
- Clearing of area for infrastructure;
- Debris handling;
- Debris stockpiles; and
- Truck transport and dumping of debris.

- **Creation and Grading of Access Roads**

Access roads are constructed by the removal of overlying topsoil, whereby the exposed surface is graded to provide a smooth compacted surface for vehicles to drive on. Material removed is often stored in temporary piles close to the road edge, which allows for easy access once the road is no longer in use, whereby the material stored in these piles can be re-covered for rehabilitation purposes. Often however, these unused roads are left as is in the event that sections of them could be reused at a later stage.

A large amount of dust emissions are generated by vehicle traffic over these temporary unpaved roads (USEPA, 1996). Substantial secondary emissions may be emitted from material moved out from the site during grading and deposited adjacent to roads (USEPA, 1996). Passing traffic can thus re-suspend the deposited material. To avoid these impacts material storage piles deposited adjacent to the road edge should be vegetated, with watering of the pile prior to the establishment of sufficient vegetation cover. Piles deposited on the verges during continued grading along these routes should also be treated using wet or chemical suppressants depending on the nature and extent of their impacts.

A positive correlation exists between the amount of dust generated (during vehicle entrainment) and the silt content of the soil as well as the speed and size of construction vehicles. Additionally, the higher the moisture content of the soil the lower the amount of dust generated.

The periodic watering of these road sections will aid in the reduction of dust generated from these sources. Cognisance should be taken to increase the watering rate during high wind days and during the summer months when the rate of evaporation increases.

- **Preparation of areas identified for the construction of the plant and supporting infrastructure**

Removal of material usually takes place with a bulldozer, extracted material is then stored in piles for later use during rehabilitation procedures. Fugitive dust is generated during the extraction and removal of overlying material, as well as from windblown dust generated from cleared land and exposed material stockpiles. Dust problems can also be generated during the transportation of the extracted material, usually by truck, to the stock piles. This dust can take the form of entrainment from the vehicle itself or due to dust blown from the back of the trucks during transportation.

To avoid the generation of unnecessary dust, material drop height should be reduced and material storage piles should be protected from wind erosion. This can take the form of wind breaks, water sprays or vegetation of piles. All stockpiles should be damped down, especially during dry weather.

It should be noted that emissions generated by wind are also dependent on the frequency of disturbance of the erodible surface. Each time material is added to or removed from a storage pile or surface, the potential for erosion by wind is restored. Any crusting of the surface binds the erodible material (USEPA, 1996). Dust created during the transportation can be limited by watering the road sections that are being used and by either wetting the material being transported or covering the back of the trucks, to limit the windblown dust from the load.

The removed topsoil will have to be transported to a designated collection point from where it can be recovered later during site rehabilitation. The removal of this material for storage should be done along designated roads which are properly maintained (watering), to reduce the amount of vehicle entrained dust which can be kicked up during these activities. In addition to the use of dedicated, treated roads, the material transported can be wet or covered to limit the windblown dust being released from the load.

- **Overview of potential Impacts**

The following components of the environment may be impacted upon during the construction phase:

- Ambient air quality;
- Local residents and neighbouring communities;
- Employees;
- The aesthetic environment; and
- Possibly fauna and flora.

The impact on air quality and air pollution of fugitive dust is dependent on the quantity and drift potential of the dust particles (USEPA, 1996). Large particles settle out near the source causing a local nuisance problem. Fine particles can be dispersed over much greater distances. Fugitive dust may have significant adverse impacts such as reduced visibility, soiling of buildings and materials, reduced growth and production in vegetation and may affect sensitive areas and aesthetics. Fugitive dust can also adversely affect human health. It is important to note that impacts will be of a temporary nature, only occurring during the construction period.

Given the short duration and low level of activity expected during construction, but bearing in mind that no quantitative emission figures exist, no long adverse impacts are anticipated on these receptors. Impact of fugitive dust emissions on employees on site could however be significant during the construction phase, but will vary between phases, with level of activity and meteorological conditions.

8.3.1.2 Operational Phase

This section aims to deal with the predicted air quality impacts which result due to the proposed operations. Details regarding the source characteristics will be obtained from site layout plans and process specific information provided and a questionnaire filled in by the client. The sources to be included in this assessment can be categorised as follows:

- Material handling;
- Plant Installation; and

- Equipment Transport.

Once all site layouts and final geotechnical works are complete, information will then be sufficient for dispersion modelling and will be included in the Environmental Impacts Report.

8.3.1.3 Decommissioning Phase

The decommissioning phase is associated with activities related to the demolition of infrastructure and the rehabilitation of disturbed areas. The total rehabilitation will ensure that the total area will be a free draining covered with topsoil and grassed. The following activities are associated with the decommissioning phase (US-EPA, 1996):

- Existing buildings and structures demolished, rubble removed and the area levelled;
- Remaining exposed excavated areas filled and levelled using overburden recovered from stockpiles;
- Stockpiles and tailings impoundments to be smoothed and contoured;
- Topsoil replaced using topsoil recovered from stockpiles; and
- Land and permanent waste piles prepared for revegetation.

Possible sources of fugitive dust emission during the closure and post-closure phase include:

- Smoothing of stockpiles by bulldozer;
- Grading of sites;
- Transport and dumping of overburden for filling;
- Infrastructure demolition;
- Infrastructure rubble piles;
- Transport and dumping of building rubble;
- Transport and dumping of topsoil; and
- Preparation of soil for revegetation – ploughing and addition of fertiliser, compost etc.

Exposed soil is often prone to erosion by water. The erodability of soil depends on the amount of rainfall and its intensity, soil type and structure, slope of the terrain and the amount of vegetation cover (Brady, 1974). Revegetation of exposed areas for long-term dust and water erosion control is commonly used and is the most cost-effective option.

Plant roots bind the soil, and vegetation cover breaks the impact of falling raindrops, thus preventing wind and water erosion. Plants used for revegetation should be indigenous to the area, hardy, fast-growing, nitrogen-fixing, provide high plant cover, be adapted to growing on exposed and disturbed soil (pioneer plants) and should easily be propagated by seed or cuttings.

8.3.2 **Impacts on Avifauna Species and Habitats**

8.3.2.1 Disturbance of birds and barrier effects

The disturbance of avifauna during the construction (and thereafter during maintenance and operation) of the facility and associated infrastructure is likely to occur. Disturbance could also contribute to a habitat fragmentation effect during the operational phase of this project, since certain bird species will be displaced from the site, and forced to find alternative territories.

Mitigation measures for the short term disturbance at construction will be detailed in the EIA Phase and in the EMP. It is suggested that in order to better understand the displacement effects once operational, a bird monitoring programme should be undertaken on this site.

8.3.2.2 Collision of birds with panels and other infrastructure

As described earlier in this report, there is a chance that birds will collide with the PV panels and CSP heliostats, as they do with the windows of buildings. This could be during the normal course of their daily activities or when they are attracted to the panels, perhaps mistaking them for water sources. It is important to stress that this impact will probably only become significant when large numbers of birds are in the vicinity of the facility. For this reason, the more sensitive species in terms of this impact are likely to be the gregarious, flocking species which are mostly not threatened species in this study area. This is a new impact, the likes of which has not been seen in South Africa to date.

8.3.2.3 Burning of birds in standby or focal points

As described above in 7.1.3, this is possible at the CSP plant, but the likelihood of it occurring is fairly low, unless there is a reason for birds to congregate on site. Species likely to be affected are those which spend a lot of time flying. This will be elaborated on in the EIA Phase.

8.3.2.4 Nesting and other use of infrastructure by birds

Certain species, in particular Sociable Weaver, are likely to use some of the facility infrastructure for nesting, perching ad roosting. Nesting is particularly problematic, as it may make maintenance difficult for staff, and also poses a fire risk since nests present abundant fuel for fires. This will require management on site, and will be elaborated on in the EIA phase.

8.3.2.5 Habitat destruction associated with the construction of the facility

During the construction and maintenance phases of this project, a certain amount of habitat destruction and disturbance will take place. The nature of the proposed facility means that the majority of the site will be transformed.

8.3.2.6 Altered run off patterns

Depending on how the vegetation beneath the photovoltaic and heliostat array is managed, this could create a new micro habitat for birds. It is likely that water used to wash the panels will fall to the ground and will effectively increase the amount of moisture, thereby stimulating plant growth. This could attract certain bird species to the site, particularly in winter when green vegetation is scarce in the area. Alternatively, erosion of the site by water runoff could be a concern. It is likely that these aspects would be discussed in more detail in the botanical specialist study. A better understanding of this aspect can be acquired through detailed on site avifaunal monitoring, as proposed elsewhere in this report. Although an interesting issue to investigate further in the EIA phase, this is certainly not a significant impact of the proposed development.

8.3.2.7 Water treatment works

Although not an impact in itself, the way in which water is treated and managed on site is a potential aggravating factor for other impacts. Most of the direct impacts described above rely on birds congregating in numbers or regularly frequenting the site in order for the impact to have a high likelihood of occurring. In this arid environment, it is likely that any new surface water sources will do exactly that, attract and concentrate various bird species on site, thereby increasing the risk of direct impacts. Mention is made of water treatment works in the BID, but more detail will be required for the EIA phase assessment.

8.3.2.8 New power lines

Collision of large terrestrial birds with overhead power lines is likely to occur and is anticipated to be the most significant threat posed by associated infrastructure. Species most likely to be affected are korhaans and other large terrestrial species. The significance of this impact depends on the length of new line to be built. In this case it appears that new line will be required from the Solar Park to a substation connecting with the High Voltage Line running to the South West of the site. The exact routing of this new line was not available at the time of the site visit, and the impact therefore cannot be fully assessed at this stage.

Electrocution of birds on pylons will depend entirely upon the exact pylon structure that for the new line – detail of which was not available at the time of this study. Electrocution risk is determined by the phase-phase and phase-earth clearances on a pole structure which differ greatly between different structures. Again, if the structure used is dangerous to birds, the significance of this impact will vary with the length of the line. Nesting of birds on pylons is in fact a positive impact on avifauna, but may impact negatively on the quality of electrical supply by causing electrical faults. In the case of Sociable Weaver nests, the nest material may pose problems to the pylons structural integrity through added weight, and there is an increased fire risk due to the fuel load of these massive nests. Disturbance of avifauna through construction and maintenance activities associated with the power line is not likely to be significant. Habitat destruction by construction activities is likely to occur, but not likely to be significant.

8.3.2.9 New roads

Disturbance of avifauna is likely to occur to some extent, but not likely to be too significant as there is already a gravel district road (along the rail line to the west of the site) as well as various tracks through the farm and it is unlikely that extensive new roads would be, again depending on the exact layout of the CSP and PV Plant within the farm.

Habitat destruction caused by road construction will have some impact on avifauna, but as discussed elsewhere the habitat in this landscape is relatively uniform and so this impact is unlikely to be too significant.

8.3.2.10 New pipe lines

This infrastructure is likely to have very similar impacts to the roads discussed above, except on a smaller scale. Should new pipelines be required for water supply to the CSP and PV plant impacts of this on avifauna will be minor habitat destruction and minor disturbance.

8.3.3 Impacts on Fauna and Flora (Biodiversity)

No impacts were identified that could lead to a beneficial effect on the ecological environment since the proposed development is largely destructive as it involves the alteration of natural habitat. A list of expected impacts were compiled from a generic list of possible impacts derived from previous projects of this nature and from a literature review of the potential impacts of similar facilities on the ecological environment. The major expected negative impact will be due to loss of habitat that may have direct or indirect impacts on individual organisms and communities.

Impacts resulting from the construction and operation of solar plants are largely restricted to the physical impacts on biota or the habitat in which they occur. Direct impacts, such as habitat destruction and modifications, are regarded immediate, long-term and of high significance. These impacts are mostly measurable and easy to assess since the effects are immediately visible and can be determined to an acceptable level of certainty. In contrast, indirect impacts (operation, waste handling & potential spillages, leaching, long-term changes in surrounds) are not immediately evident and can consequently not be measured immediately or accurately. A measure of estimation is therefore necessary in order to evaluate these impacts.

Lastly, impacts of a cumulative nature places direct and indirect impacts of this projects into a regional and national context, particularly in view of similar or resultant developments and activities. The following impacts were identified that are of relevance to the proposed development. Not all of these impacts might occur, or the extent of impact might be limited.

8.3.3.1 Impacts on Threatened & Protected Flora & Fauna Species & Habitat

This impact is regarded a direct impact as it results in the physical damage or destruction of Red Data or Threatened species or areas that are suitable for these species, representing a significant impact on the biodiversity of a region. Threatened species, in most cases, do not contribute significantly to the biodiversity of an area in terms of sheer numbers as there are generally few of them, but a high ecological value is placed on the presence of such species in an area as they generally only occur in pristine habitat. Conversely, the presence of pristine habitat conditions can frequently be accepted as an indication of the potential presence of species of conservation importance, particularly in moist habitat conditions.

Red Data species are particularly sensitive to changes in their environment, having adapted to a narrow range of specific habitat requirements. Habitat changes, mostly a result of human interferences and activities, are the greatest reasons for these species having a threatened status. Surface transformation/ degradation activities within habitat types that are occupied by species of conservation importance will ultimately result in significant impacts on these species and their population dynamics. Effects of this impact are usually permanent and recovery or mitigation is generally not perceived as possible.

One of the greatest drawbacks in terms of limiting this particular impact is that extremely little information is available in terms of the presence, distribution patterns, population dynamics and habitat requirements of Red Data flora species in the study area. In order to assess this impact, it is necessary to assess the presence/ distribution of habitats frequently associated with these species. In addition, by applying ecosystem conservation principles in this assessment and subsequent planning and development phases, resultant impacts will be limited largely. The likelihood that this impact will occur is high and will be of high significance.

8.3.3.2 Destruction of Sensitive/ Pristine Habitat Types

The loss of pristine habitat types or habitat that are regarded sensitive as a result of restricted presence in the larger region (atypical habitat) represents a potential loss of habitat and biodiversity on a regional scale. Sensitive habitat types include mountains, ridges, koppies, wetlands, rivers, streams and localised habitat types of significant physiognomic variation and unique species composition. It also includes forest, fynbos and wetland vegetation that leads to direct or indirect loss of such habitat. These areas represent centres of atypical habitat and contain biological attributes that are not frequently encountered in the greater surrounds. A high conservation value is generally ascribed to floristic communities and faunal assemblages that occupy these areas as they contribute significantly to the biodiversity of a region.

Furthermore, these habitat types are generally isolated and are frequently linear in nature, such as rivers and ridges. Any impact that disrupts this continuous linear nature will risk fragmentation and isolation of existing ecological units, affecting the migration potential of some fauna species adversely, pollinator species in particular.

Microhabitat conditions are changed because of the removal of the vegetation layer, affecting shade conditions, habitat competition, germination success of the herbaceous layer, etc. This is likely to result in the establishment of a species composition that is entirely different from original conditions and the immediate surrounds, in many cases also comprising species of an invasive nature, particularly shrubs. The likelihood that this impact will occur is high and will be of medium-high significance.

8.3.3.3 Direct Impacts on Common Flora & Fauna Species & Regional Habitat

The extent and location of a development generally determines the significance of this impact. Larger developments situated within areas of natural or undisturbed habitat is likely to have a much higher effect on the commonly occurring flora and fauna species of an area. This impact results from the disruption of migration movements, loss of foraging and breeding habitat and, in the case of vegetation, fragmentation and isolation of remaining areas of natural vegetation. Continued impacts on species could potentially result in a change in the conservation status of certain species. While plant species are unable to avoid the point of impact, most fauna species are able to migrate away from unfavourable areas. The tolerance levels of some animal species are also of such a nature that surrounding areas will suffice in habitat requirements of species forced to move from areas of impact.

Conversely, the location of a development within areas of low biodiversity sensitivity or where few biodiversity attributes of importance are likely to occur, will largely limit the significance of this impact. The likelihood that this impact will occur is high and will be of high significance.

8.3.3.4 Changes to Surrounding Habitat/ Sensitive Features

This impact represents an indirect impact. The transformation of natural habitat during the construction process will inevitably result in the establishment of habitat types that are not considered representative of the region, in this case on the fringes of the development. This impact is generally regarded to be of low severity, impacted areas are frequently invaded by species not normally associated with the region (exotic and invasive species), but are easily mitigated. In addition, many species that are not necessarily abundant in the region will increase in abundance because of more favourable habitat conditions being created because of habitat manipulation activities (encroacher species). This effect is more pronounced in the floristic component, but changed habitat conditions in the habitat will inevitably imply minor changes in the faunal component that occupies the habitat.

If left unmitigated, this risk could result in decreased habitat on a local or regional scale, increased competition and lower numbers of endemic biota, the genetic pool of species might eventually be influenced by the introduction of non-endemic species. Different faunal assemblages and plant communities have developed separate gene structures as a result of habitat selection and geographical separation and the introduction of individuals of the same species that might be genetically dissimilar to the endemic species might lead to different genetic selection structures, eventually affecting the genetic structure of current populations and assemblages. The likelihood that this impact will occur is high and will be of moderate significance

8.3.3.5 Impacts on Surrounding Flora & Fauna Species

Surrounding species of importance present in the direct vicinity of the study area could be affected by indirect impacts resulting from construction and operation activities. This indirect impact could potentially include all of the above impacts, depending on the sensitivity and status of surrounding habitat and species as well as the extent of impact activities. This impact becomes particularly significant in the event where sensitive species are known to occur near the development. The likelihood that this impact will occur is high and will be of moderate significance.

8.3.3.6 Faunal Interactions with Structures, Servitudes & Personnel

It should be noted that animals generally avoid contact with human structures, but do grow accustomed to structures after a period. While the structures are usually visible, injuries and death of animals do occur sporadically because of accidental contact. An aspect that is of concern is the presence of vehicles on access and infrastructure roads, leading to road kills, particularly amongst nocturnal animals that abound in the study area. This impact was frequently observed in the study area during the site investigation period. Alteration of habitat conditions within the development areas does not necessarily imply a decrease in faunal habitation. These areas are frequently preferred by certain fauna species.

The presence of personnel within the development area during construction and maintenance periods will inevitably result in some, but normally limited, contact with animals. While most of the larger animal species are likely to move away from human contact, dangerous encounters with snakes, scorpions and possibly scavengers always remain likely. Similarly, the presence of humans within areas of natural habitat could potentially result in killing of animals by means of snaring, poaching, poisoning, trapping, etc. The likelihood that this impact will occur is high and will be of medium-high significance.

8.3.3.7 Impacts on SA's Conservation Obligations & Targets

This impact is regarded a cumulative impact since it affects the status of conservation strategies and targets on a local as well as national level and is viewed in conjunction with other types of local and regional impacts that affects conservation areas. The importance of regional habitat types is based on the conservation status ascribed to vegetation types. The loss of any area of natural habitat, however insignificant, implies that the conservation status of this vegetation type can be further affected. It is therefore imperative to ensure that the conservation of pristine grassland habitat be prioritised. The likelihood that this impact will occur is high and will be of moderate significance.

8.3.3.8 Increase in Local & Regional Fragmentation/ Isolation of Habitat

Uninterrupted habitat is a precious commodity for biological attributes in modern times, particularly in areas that are characterised by moderate and high levels of transformation. The loss of natural habitat, even small areas, implies that biological attributes have permanently lost that ability of occupying that space, effectively meaning that a higher premium is placed on available food, water and habitat resources in the immediate surrounds. This, in some instances might mean that the viable population of plants or animals in a region will decrease proportionally with the loss of habitat, eventually decreasing beyond a viable population size.

The danger in this type of cumulative impact is that effects are not immediately visible and normally when these effects become visible, they are beyond repair since the development represents a destructive activity. The likelihood that this impact will occur is high and will be of moderate significance.

8.3.3.9 Increase in Environmental Degradation

Cumulative impacts associated with this type of development could lead to initial, incremental or augmentation of existing types of environmental degradation, including impacts on the air, soil and water present within available habitat. Pollution of these elements might not always be immediately visible or readily quantifiable, but incremental or fractional increases might rise to levels where biological attributes could be affected adversely on a local or regional scale. In most cases are these effects are not bound and is dispersed, or diluted over an area that is much larger than the actual footprint of the causal factor.

Similarly, developments in untransformed and pristine areas are usually not characterised by visibly significant environmental degradation and these impacts are usually most prevalent in areas where continuous and long-term impacts have been experienced. The likelihood that this impact will occur is high and will be of moderate significance.

8.3.4 Noise Impacts

During the construction phase construction vehicles including excavation equipment and trucks may produce a noticeable increase in noise disturbance. Construction vehicles may create some noise and vibration along access routes.

Noise levels during operation are low. Noise associated with maintenance activities may create some disturbance but this will be low level and localised.

Potential noise impacts will be addressed in the EIA Report and appropriate mitigation measures will be included in the EMP.

8.3.5 Loss of Agricultural Land

The major impact on the natural resources of the study area would be the loss of arable land due to the construction of the various types of infrastructure. However, this impact would in all probability be of limited significance (due to the low potential soils and the fact that construction of the infrastructure will not involve deep excavations or large-scale topsoil removal) and would be local in extent. At the end of the project life, it is anticipated that removal of the structures would enable the land to be returned to more or less a natural state, with little impact, especially given the low prevailing agricultural potential.

The impact can be summarized as follows:

Table 28: Impact significance

Nature of impact	Loss of agricultural land	Land that is no longer able to be utilized due to construction of infrastructure
Status of impact	Neutral (N)	No cost or benefit to receiving environment

Nature of impact	Loss of agricultural land	Land that is no longer able to be utilized due to construction of infrastructure
Spatial Scale of impact	Low (1)	Confined to site boundary
Time Scale of impact	High (4)	Lifespan of project
Probability of impact	Probable (4)	Likely to materialise
Severity of impact	Average (4)	Mitigation & rehabilitation will be possible
Significance of impact	Medium (36)	
Mitigation factors	Mainly due to low potential of area, as well as nature of infrastructure.	

It does not appear, from a soils aspect, that there are any especially sensitive areas ("fatal flaws") within the site that should be avoided. In conclusion, due mainly to the low potential soils and prevailing climatic limitations for agriculture, it is extremely unlikely that any sort of detailed soil investigation will be necessary.

8.3.6 Loss of, or Damage to Archaeological or Cultural Resources

Impact on archaeological sites - As concluded from the archival research, the possibility of archaeological finds have been identified as being high and thus further field work is required to develop a comprehensive Heritage Management Plan. Unidentified archaeological sites and the discovery of such sites during construction can seriously hamper construction timelines. Field work can thus provide valuable information on such site in the study area and provide timeous management of such site through realignment of development or mitigation of such sites where needed; Excavations required for the installation of heliostats, building and road construction, laying of cables etc and land clearing could disturb or destroy features of cultural heritage interest. These potential impacts will be assessed through a heritage specialist study in the EIA phase along with the required submissions to South African Heritage Resource Agency (SAHRA).

8.3.7 Visual and Aesthetic Landscape Impacts

Visual resource impacts would result from the construction, operation, and maintenance of the proposed Solar Power Park. Specifically, impacts would result from project components being seen from sensitive viewpoints and from effects to the scenic values of the landscape. Impacts to views would be the highest when viewers are identified as being sensitive to change in the landscape, and when their views are focused on and dominated by the change. Visual impacts would occur when changes in the landscape are noticeable to viewers observing the landscape from their homes or from tourism / conservation areas, travel routes, and important cultural features and historic sites, especially when the project occurs in foreground a middle ground views. The visual impacts that could result from the project would most likely be direct, adverse, and long-term and must be addressed in the assessment phase of the project.

A specialist visual impact assessment will be undertaken during the EIA phase to assess the visual impacts of the development and the identification of appropriate mitigation and management measures to be included in the EMP.

Dust generation may occur during vegetation clearance, site grading, transportation of materials for construction, and the construction of the solar power facility.

Dust will be a temporary impact associated with the construction phase of the project. Sensitive local receptors may need to be protected from dust through the implementation of certain management measures by the contractors responsible for the construction of the facility. No dust generation is expected to occur during the operational phase of the project, except for minimal dust created by maintenance vehicles along gravel roads, which will be infrequent.

Appropriate measures to manage impacts associated with dust generation will be developed during the EIA phase of the project and identified in the EMP.

8.3.8 Impact on Traffic during Construction

There may be a minor increase in traffic during the construction of in the facility as some trucks and earth-moving vehicles will bring infrastructure, equipment and construction materials onto site and undertake construction activities.

Further information regarding traffic levels and an assessment of significance will be provided in the EIA Report.

8.3.9 Impacts due to Waste Generation

Waste from the construction activities may arise from a range of sources producing the following:

- Construction waste;
- Sanitary waste;
- Excavated material (e.g. rock and soil), and
- Domestic waste from construction workers and offices.

Following the construction phase, there will be limited waste production during the operational phase. The anticipated wastes during operation will include:

- Domestic waste;
- Industrial waste (oil, oily rags, scrap metal replaced machine components etc.)
- Sanitary waste from the septic tanks, and
- Residue from the evaporation ponds.

Specific requirements for waste management and disposal will be identified in the EMP developed during the EIA phase of the project. The waste license application process runs concurrent to the EIA process and a complete waste management plan will be compiled to fulfil the waste license authorization requirements.

8.3.10 **Soils, Geology, Hydrology and Erosion Potential**

The potential effects on soils and geology from construction and decommissioning include:

- The potential for soil properties at the site to be permanently altered due to site preparation (e.g. compaction of soil);
- Alteration of topography on a local scale through clearing and grading; and
- Site preparation and vegetation clearance activities which could cause instability and increased erosion potential.

It is not anticipated that any major watercourses or water-bodies will be directly impacted by the proposed development during construction and the water during this phase of the project will be sourced from Vaal Gamagara Pipeline. The project is expected to require large water-inputs during operation and the utilization of groundwater is being investigated and a detailed assessment will be conducted as part of the EIA. However, removal of vegetation and the development on access roads, areas and non-permeable hard standing surfaces may impact surface water flow and run off within the site area and near surrounds during both the construction and operation phases.

The potential impacts discussed above will be investigated in the EIA Report which will be accompanied by the identification of appropriate mitigation and management measures, such as specific measures to manage surface run-off and stormwater designs, will be developed during the EIA phase and identified in the EMP.

8.3.11 **Surface Water and Groundwater Contamination**

The potential for surface water contamination is an important consideration in relation to the construction of the facility since increased sediment load in surface water runoff could impact on watercourses and drainage channels in the local area. The potential for groundwater contamination is associated with uncontrolled spills of hydrocarbons from construction vehicles during the construction phase. The extent and impact of potential groundwater or surface water contamination is largely dependent on the nature of the subsurface soil conditions, their transmissivity and susceptibility to erosion. The substrate in the area generally has low permeability although groundwater contamination could occur through joints, fractures and contact zones which are associated with the inter-granular and fractured aquifer of the area.

Basic precautions to prevent groundwater and surface water contamination during construction will be identified in the EMP developed during the EIA phase of the project.

8.3.12 **Socio-Economic Impacts**

The proposed Arriesfontein Solar Park is to be located in the Kgatelopele Local Municipality about 35 kilometres from Danielskuil in the Northern Cape. Due to the site being located within the Kgatelopele Local Municipality, it has been chosen as the primary study area. The secondary and tertiary study areas for the project, i.e. the areas where some of direct, indirect, and induced effects are expected to take place include the Siyanda DM, the Northern Cape Province and South Africa. The farm is currently being leased to a third party for cattle grazing, so potential small loss of income derived from this agricultural activity could be lost.

The following findings can be highlighted from the review of the socio-economic profiles of the study areas:

- The population of the primary study area consists of about 21 941 people, which represents a mere 8.9% of the district's population. In the past, the number of residents in the Kgatelopele LM has been growing at a relative high rate, which can be attributed to the expansion of the mining and quarrying industries in the area.
- Households in Kgatelopele earn on average 1.5 times more than what an average South African household earns, and at the same time more than average households in the Siyanda DM and the Northern Cape.
- The employment situation in the primary study area was better than the employment situation in the country or in the Province in 2009, due to Kgatelopele's high labour force participation rate and unemployment rate similar to that of South Africa. Overall, 6 647 people were employed in the primary study area with 2 237 people being unemployed in 2009.

- The Kgatelopele economy is highly dependent on the mining and quarrying sector that generates two thirds of its value added. Given that this sector is very dependent on the demand for diamonds globally and the demand for lime products locally, the entire economy is put at risk during global and national economic recessions and stagnation periods. Thus, it is very important that the economy becomes more diversified which will allow to spread such risks.
- The economy of Kgatelopele has been growing in the past below the growth rate of the national economy. In the last couple of years – following the global recession of 2008/2009 - it is expected that the economy of Kgatelopele would grow at a steady but slow pace as the global and national economies continue to recover.
- The employment distribution in the primary area mirrors the composition of the economy, with mining and quarrying providing the greatest number of employment opportunities in Kgatelopele and the agricultural sector employing the greatest number of people in the surrounding municipalities.
- With respect to services; access to water, sanitation and electricity in this municipality is generally better than in the rest of the country. Many of the households in the area stay in hostels provided by the mines; the situation with informal dwellings though is similar to the rest of the country with about one out of ten households living in informal dwellings.

Based on the information presented above and the current knowledge about the project and activities taking place on site, the potential socio-economic impacts that could be predicted at this stage and that will need to be investigated in the specialist study include:

- Strategic macro-economic impacts:
    - Assistance in achieving government objectives
    - Impact on balance of payment due to the possibility that certain equipment and machinery will be imported
    - Provision of electricity without putting additional pressure on water resources
    - Potential to reduce carbon footprint in generating electricity
    - Potential to establish new manufacturing industries
- During the construction phase:

    - Temporary increase in production and GDP-R in industries that provide services and materials to enable construction
    - Temporary employment creation in affected industries
    - Temporary increase in government revenue due to the establishment of the solar park
    - Temporary increase in households' income levels
    - Permanent loss of agricultural production created by the current agricultural activities taking place on site (stock farming)
    - Permanent loss of jobs associated with the existing agricultural activities on site
    - Influx of job seekers and associated crime concerns
    - Pressure on housing provision
    - Possible negative health impacts associated with migrants
- During the operational phase:
    - Increase in production and GDP-R due to the solar park's operations
    - Creation of sustainable employment opportunities at the plant and supporting industries
    - Increase in government revenue
    - Skills development
    - Improvement of living standards of positively affected households (through employment)
    - Increase in households' income levels
    - Change in standards of living of the directly affected households
- Any other socio-economic effects that will be raised by the Interested and Affected Parties, as well as effects that might result from impacts determined by other specialists, including visual, noise, and tourism

A specialist study will be undertaken in the EIA phase to assess the potential impacts of the project including those related to direct and indirect employment opportunities.

8.3.13 Human Health and Safety

As with any construction project, there is potential for impacts on human health and safety to occur as a result of accidents and unplanned events that may occur during the construction of the Solar Power Park.

The risk of injury associated with the construction of the facility will be mainly limited to the subcontractors (as the site will be secured to avoid public incursion into the active development area), but there remains some risk of injury to other site users (i.e. farm workers). Basic safety precautions and protective measures will be specified in the EMP which, in turn, will be incorporated into subcontractor health and safety plans.

8.3.14 Potential Impacts on the Tourism Industry

- The presence of the R31 route in proximity to the proposed Solar Power Plant would have a minimal impact, as the route is more than 15 km away from the main road.
- Given the high employments rates that the plant could possibly generate during the construction phase, there would be a definite increase in traffic to the area and especially on the R31.
- However, once the Plant is operational, the employment rates are expected to be much lower and thus the impact on traffic would be minimal.
- Visually, it is expected that the Plant would have a minimal impact on the Danielskuil area as there are already two mines located close to the proposed site and although the proposed Solar Power Plant will be highly visible, the mines have already detracted from the visual appeal of the surroundings thus the expected visual impact of the Solar Power Plant will be less.
- The tourism industry in the area, tend to be mostly business travel, with no real leisure holiday market and thus the tourist would also be less sensitive to the visual impact of the Plant.
- Constantia Safaris is the only tourist attraction currently located within the tourism assessment area which could be negatively impacted on by the development of the Plant.

- However, because Constantia Safaris only receives approximately 200 guests per year, the expected extra business travel bed nights the Plant could generate to the area will outweigh the possible negative impact to Constantia Safaris.
- In addition there is the potential for the Plant to attract tourists who are interested in solar power. Being one of the few of its kind in the world, and the only solar power plant in Africa, the plant will undoubtedly attract interested parties, who will in turn be contributing to the tourism economy and who could even be attracted to stay at Constantia Safaris because of its location so close to the proposed Plant.
- It is our believe that the overall impact of the Plant would be positive in this area, as the Plant would bring in substantial business tourism, offering an opportunity to grow the accommodation sector in the area.
- Based on our research, there are no plans for development on the land adjacent to the proposed Plant and thus the potential impact of the Plant on the future development of the Tourism Industry in the area will be minimal, if any.

8.3.15 **Cumulative Impacts**

As a result of an increase in interest and the number of EIAs for renewable energy developments (solar and other renewable technologies) it is important to follow a precautionary approach in accordance with NEMA to ensure that cumulative impacts are addressed or avoided. The following aspects have been identified as potentially significant cumulative impacts that may result from the proposed development of the three PV and one CSP for the proposed Solar Power Park:

- Visual intrusion;
- Change in sense of place and character of the area;
- An increase in the significance of ecological impacts; and
- An increase in the significance of geological and hydrological impacts.

9. Plan of Study for EIA

9.1 Process Phases

The environmental studies required for the proposed project will be undertaken within the two phases, as follows:

9.1.1 Environmental Scoping Study

A desk-top issues-based Environmental Scoping Study has been undertaken for the proposed project. Existing information and input from specialists, the Authorities and Interested and Affected Parties (I&APs) was used to identify and evaluate potential environmental impacts (both social and biophysical) associated with the proposed project. No environmental fatal flaws associated with the proposed project were identified through the Environmental Scoping Study, although a number of potentially significant environmental impacts have been identified as requiring further in-depth study. Therefore, the EIA is required to be undertaken in order to provide an assessment of these potential impacts and recommend appropriate mitigation measure, where required. The EIA will also be used as an instrument to further identify, discuss and evaluate alternatives (i.e. site, technology and layout).

9.1.2 Environmental Impact Assessment (EIA)

All potentially significant environmental impacts (social and biophysical) associated with the proposed project have been identified in the Scoping Study and will be further investigated during the EIA through various specialist studies, and their significance assessed. Mitigation measures will be proposed, where required.

The EIA will aim to adequately investigate and address all environmental issues associated with the proposed CSP and PV developments in order to provide the DEA and Northern Cape Department of Environmental Affairs and Conservation with sufficient information to make an informed decision regarding the proposed project.

9.2 Particulars of the Applicant

The particulars of the applicant representing all shareholders are as follows:

Applicant:	SolarReserve SA (Pty) Ltd
Contact Person:	Terence Govender
Telephone Number:	(011) 784 7539
Facsimile Number:	(011) 7847549
E-mail address:	terence.govender@solarreserve.com

9.3 Environmental Consultant

The particulars of the Environmental Assessment Practitioner are as follows:

Consultant:	**Worley Parsons RSA**
EAP[4]:	Francois Humphries
Telephone Number:	(012) 425 6300
Facsimile Number:	(012) 460 9978
E-mail address:	Francois.humphries@worleyparsons.com

9.4 Environmental Study Team

Worley Parsons RSA has been appointed by SolarReserve SA (Pty) Ltd as independent Environmental Assessment Practitioners, to undertake the Environmental Impact Assessment

[4] EAP – Environmental Assessment Practitioner

for the proposed Arriesfontein Solar Thermal Energy Power Plant project. Details of the environmental study team and their associated tasks are as follows:

Team Member	Responsibility
Leanna Rautenbach (Worley Parsons RSA)	Leanna will be mainly responsible for the overseeing of the Environmental Investigative process as a whole. Her is responsibilities will include regular liaison with the Client and the environmental authorities and the various stakeholders, and on-going review of progress of all aspects of the project. She will be responsible for reviewing all Environmental Impact related reports on behalf of the client. This will include recommendations regarding appropriate mitigation measures. She will provide support in the management of the public participation process for the project and other project related issues.
Francois Humphries (Worley Parsons RSA)	Francois will be mainly responsible for the compilation of all Environmental Impact Reporting. His responsibilities will further include regular liaison with the Client, stakeholders, environmental authorities, and on-going review of progress of all aspects of the project. In addition, he will be responsible for the compilation of a consolidated EIA Report and an EMP for the Project. This will include recommendations regarding appropriate mitigation measures. He will provide support in the management of the public participation process for the project.

9.5 Specialist Studies

The appointment of specialists to conduct specialist studies as part of an EIA exercise is done to fulfil the minimum requirements of Regulation 32 in the Government Notice No.R543 of June 2010.The contents of the specialist reports is determined in compliance with the requirements of Regulation 33(3) outlined in the same notice referred to above.

The various specialist reports for the proposed project will be appended to the Environmental Impact Report. The following specialists are sub-contracted to assist in investigating certain aspects of the environment that might be impacted by the proposed project.

Table 29: Specialist studies undertaken as part of the Scoping Study

Specialist Field	Organisation
Agricultural / Soils Potential	Agricultural Research Council - Institute for Soil, Climate and Water,
Air Quality Impact Assessment	AirShed Professional Planning
Avi-fauna Impact Assessment	Endangered Wildlife Trust
Biodiversity Assessment	Bathusi Environmental Consulting
Geohydrological Assessment	SRK Consulting
Heritage Impact Assessment	PGS Heritage & Grave Relocation Consultants
Hydrological Assessment	Knight Pieshold
Noise Impact Assessment	Jongens Keet and Associates
Visual Impact Assessment	MetroGIS
Socio-Economic Impact Assessment	Urban-Econ Development Economists
Tourism Assessment	GrantThornton
Wetland Delineation and Assessment	Wetland Consulting Service (Pty) Ltd

The findings of the above-mentioned specialists will assist with:

- Nomination/selection of preferred project alternatives based on the detailed impact assessment to be undertaken during the EIA Phase; and
- Recommending measures to mitigate the impacts identified during the EIA Phase for inclusion in the Environmental Management Programme.

9.6 Agricultural / Soils Potential

The scoping level assessment conducted by the Agricultural Research Council concluded no areas of high agricultural significance ("fatal flaws") occur within the site. The assessment further concluded that that mainly due to the low potential soils and prevailing climatic limitations for agriculture, no detailed assessment during the EIA Phase will be required.

9.7 Air Quality Assessment

The terms of reference of the study includes the following:

- Determine and depict the baseline information (air quality) for the area whereby the existing state and climate is characterised;
- Characterise the likely ambient air quality that would prevail during normal and abnormal operations of the project;
- Formulation of emissions inventory and calculation of emissions to atmosphere emanating from the proposed operations:
- Identify which atmospheric emissions hold the potential to impact negatively on human health and the environment and describe the effects associated with each and relevant community health and environmental guidelines/standards.
- Characterise and quantify all forms of atmospheric emissions expected or proposed during the various phases of the proposed project life – construction, operations and decommissioning:
- To identify potential dust emissions from the proposed development during its various phases; and
- Ensure that fugitive emissions from evident sources are characterised and quantified as well as possible.
- Characterise existing air quality for the area, as well as significant other sources of emission that may act cumulatively in resulting in potential impacts;

- Identify and characterise sensitive potential receptors – these would include both human and ecological receptors, as well as to predict the health and nuisance impact of emissions on sensitive receptors in the area;
- To determine the cumulative impact of the proposed development on sensitive receptors in the area and the ambient air quality in general;
- Present mitigation and monitoring plan:
- To propose management and mitigation measures for air quality impacts from o the proposed development;
- To provide details regarding dust suppression methods and dust monitoring; and
- Detail whether the mitigation will reduce the intensity of the impact or the probability of the impact and revise the impact significance accordingly.
- Simulation/Modelling:
- Dispersion simulation to predict increases in ground level concentrations illustrated through contour plots and projected emissions dispersion;
- Simulate the potential dispersion of potential pollutants and compare predicted ambient concentrations with internationally and locally defined standards, limits or other appropriate thresholds; and
- Quantify the uncertainty of the model predictions as a result of incorrect input emissions data; inaccurate meteorological data and inadequate scientific formulation of the model. Present a statistical evaluation of the accuracy of the results; and
- Greenhouse gas emissions.
- Attend a specialist integration workshop to be held with the specialist project team during the EIA phase of the project prior to the finalisation of the respective specialist reports. The aim of this workshop will be to:
- Discuss and evaluate the findings of each of the various specialist studies;
- Integrate findings to identify workable solutions;
- Recommend appropriate mitigation measures, where required;
- Formulate final recommendations; and

- Following the phase-specific specialist workshop, specialists will be required to finalise the various specialist reports for inclusion in the EIA Report.

9.8 Avifauna

The objective of the study is to define and quantify the possible impacts that the construction and development of the proposed plant may have on avifaunal species.

The terms of reference provided to the specialist included the following:

- All applicable legislation and guidelines are to be duly considered during the assessment process;
- Describe the affected environment and determine the status quo: The existing environment must be described and the bird communities most likely to be impacted are to be identified. Different bird micro-habitats (foraging and / or breeding) must be described as well as all species associated with such identified habitats. The following information and sources must as a minimum be utilised:
- Satellite imagery;
- Red data information; and
- Bird Sensitivity Index associated with a relevant entity or presiding body.
- A description of the current state of avifauna in the study area, outlining important characteristics and components thereof, including species-specific habitats, existing bird populations, and roosting/nesting sites, which may be influenced by the proposed project or which may influence the proposed project during the construction and operational phases of the CSP and PV developments. The identification of Red Data, threatened, and vulnerable species potentially affected by the proposed project;
- Mapping of sensitive avifaunal habitats and known locations of sensitive avifaunal populations;
- Assessment of impacts: The potential impacts (positive and negative, particularly cumulative impacts) on avifaunal habitats and populations during each project phase must be assessed and evaluated in terms of the assessment methodology prescribed by the

environmental technical team project manager. Particular attention should be paid to avifauna mortality associated to direct collisions with CSP plant infrastructure (e.g. 200m tower, stacks and power lines) and electrocution via contact with planned power lines. Attention should also be given to bird pollution and mitigation measures (for impacts on birds and impacts on the power lines from birds) and cumulative impacts;

- Identification of a preferred alternative (e.g. plant location, power line alignment or site): It will in particular be required that a preferred power line alignment is identified for consideration in the integration process. Recommendations on route alternatives where additional alternatives could be identified need to be made, to avoid negative impacts;
- Propose and explain mitigation measures: Practical mitigation measures will be recommended, discussed and included in the EMP. The identification of mitigation measures for enhancing benefits and avoiding or mitigating negative impacts and risks (to be implemented during planning, construction and operation of the proposed project);
- Provide a brief description of current conservation plans and initiatives contained in relevant municipal and provincial documentation and include these in the avifaunal assessment. Such documentation includes: Environmental Management Frameworks (EMF), Metropolitan Open Space System (MOSS) plans, and Integrated Development Plans (IDP) for each area. There may be plans for new environmental targets and conservation initiatives, which could be put into operation in the future. Please consider these conservation initiatives as integral components of the impact assessment;
- Conduct a “walk-through”: Prior to construction, a detailed “walk-through” of the line will be conducted, whereby sections of line will be identified on a span to span basis for mitigation with bird flight diverters; and
- Attend a specialist integration workshop to be held with the specialist project team during the EIA phase of the project prior to the finalisation of the respective specialist reports. The aim of this workshop will be to:
- Discuss and evaluate the findings of each of the various specialist studies;
- Integrate findings to identify workable solutions;
- Recommend appropriate mitigation measures, where required, and

- Formulate final recommendations.
- Following the phase-specific specialist workshop, specialists will be required to finalise the various specialist reports for inclusion in the EIA Report.

9.9 Biodiversity

The objective of the biodiversity assessment is to identify and motivate the choice or requirements posed for each of the development alternatives that could avoid or minimize impacts on biodiversity. The terms of reference are:

- Undertake a desktop assessment of all relevant documentation and databases available. Review all previous faunal and floral reports/work applicable to the study area. This should include a consideration of all relevant biodiversity plans prepared in terms of the National Environmental Management Biodiversity Act ((No 10 of 2004) or under the auspices of SANBI or relevant provincial ordinance(s) etc.;
- Liaison with relevant environmental and / or nature conservation authorities and /or management bodies with regards to specific requirements that may be required for the biodiversity assessment. All communications need to be kept on record and provided in the report;
- Liaison with I&APs. All communications need to be kept on record and provided in the report. The specialists may be required attend Public Meetings scheduled as part of the EIA process in order to give a one-on-one account of the biodiversity assessment findings;
- Undertake the required field work within the designated timeframes and report thereon;
- Provide a description of the broad ecological characteristics of the site and its surrounds;
- In terms of biodiversity pattern, the following shall as a minimum be identified and described where appropriate:
- Community and ecosystem level;
- Species level; and
- Other pattern issues.
- In terms of biodiversity process, the following shall as a minimum be identified or described:

- The key ecological 'drivers' of ecosystems on the site and in the vicinity, such as fire and grazing;
- Environmental gradients (e.g. upland-lowland), biome boundaries, soil interfaces or sand movement corridors on the site or in its vicinity; and
- Any possible changes in key processes e.g. increased fire frequency or drainage/artificial recharge of aquatic systems.
- The condition and functioning of rivers and wetlands (if present) in terms of: possible changes to the channel, flow regime and naturally-occurring riparian vegetation;
- Undertake a desktop and field-based investigation of the flora and fauna of the site (excluding avifauna), integrating on site information with available data from atlases, research reports and other published sources;
- Assess the impacts on flora and fauna that are associated with the proposed development and describe relevant mitigation measures to reduce, avoid or minimise negative impacts to flora, fauna and habitats. The impact assessment methodology prescribed by the environmental technical team project manager must be used;
- Reflect time period when specialist assessment was undertaken;
- Aspects to be included in the report:
- The nature of the project, possible development alternatives and a summary of the activities likely to affect the receiving areas' biodiversity;
- The local and regional context of the fauna and flora species within the affected area, taking cognizance of the relevant biodiversity plans and bioregional planning documents for the study areal
- The fauna and flora species that is present in the area. Depicting the rare, endangered, threatened and red data species present;
- The current status of the environment as well as the local and regional conservation value of the various fauna and flora species;
- Assessment of the receiving environment in terms of the expected biophysical changes (in soil, water, air, flora, fauna) resulting from proposed activities. Assessing of the ecological / biodiversity processes that could be affected (positively and/or negatively) by the

proposed development. The specialist needs to identify, from a biodiversity perspective, the fatal flaws of the project, uncertainties and risks associated with the activities as well as the underlying assumptions and limitations of the assessment;

- A description and assessment of the significance of the impacts associated with the proposed activities on faunal and floral species. This should include consideration of the extent to which the development will result in the fragmentation of natural habitats;
- The Specialist need to predict, assess and evaluate potentially significant direct, indirect and cumulative impacts in terms of biodiversity patterns, processes and ecosystem services. The significance of these need to be calculated with and without the implementation of practicable management actions. The evaluation of significance should be linked to the thresholds of significance. Clear definition of these thresholds need to be rendered in the Methodology;
- Possible measures to avoid, minimize, and or compensate for significant biodiversity damage or loss, making reference to any legal requirements need to be identified and allocated. This section should entail a detailed description of the appropriate and practicable mitigation measures required to address and possibly limit and/or enhance the significance of impacts in terms of the construction and operational phase for the proposed development;
- In order to assess and address the expected environmental impacts adequately, remedial actions need to be included in the report – these measures need to be practicable, implementable, sustainable and affordable. It is no use if mitigation measures are recommended to the clients that are unattainable or impracticable. Mitigation measures need to be identified in terms of:
- Avoidance and or prevention, where by the impact is addressed during the construction or development phase – as to eliminate remedial or mitigation measures at later stages in the propjet;
- Mitigation which include actions such as restoration, reduction and rehabilitation of sites. These mechanisms should aim to reducing negative impacts and maximise benefits, or

alternative to rectify negative impacts by restoring the affected environment to its previous condition, or rehabilitating it for a different land use;

- Compensation of offsets - the least favoured approach and or last resort. These types of mitigation measures are only to be included into the Report if there is no other option. Compensation or offsets do not aim to positively enhance the biodiversity of the receiving environment, it merely compensates financially for its degradation;
- Spatial and temporal scale of the developments' impact. All direct, indirect and cumulative impacts need to be identified, defined, significance determined;
- Identify, map (vegetation and conservation value / sensitivity map) and describe the flora present, if any; and
- Identify any species of special concern viz. species with conservation status, endemic to the area or threatened species that exist or may exist on site. Provide a conservation importance rating of the vegetation on site (in local, regional and national terms). Mapping or modelling of the receiving environment in terms of sensitivity – the Specialist needs to assess the proposed site as a whole, identifying areas suitable for development as well as no-go zones which are not to be disturbed. These components have to be delineated in terms of community and sensitive areas from a faunal and floristic perspective using GPS to fix locations (GIS).
- Attend a specialist integration workshop to be held with the specialist project team during the EIA phase of the project prior to the finalisation of the respective specialist reports. The aim of this workshop will be to:
- Discuss and evaluate the findings of each of the various specialist studies;
- Integrate findings to identify workable solutions;
- Recommend appropriate mitigation measures, where required;
- Formulate final recommendations; and
- Following the phase-specific specialist workshop, specialists will be required to finalise the various specialist reports for inclusion in the EIA Report.

9.10 Geohydrology

The terms of reference for this study are:

- To provide a detailed description of the site topography, geological and geo-hydrological characteristics of the study area;
- Depiction and characterization of the groundwater regime in a regional geological and geo-hydrological context indicating the overall characteristics of the geological settings and aquifer parameters, and identification of immediate groundwater users;
- Data obtained from hydro census survey as well as the data obtained from the NGDB to be mapped:
- A desktop study to be undertaken for the analysis of data obtained from the National Department of Water Affairs' National Groundwater Database (NGDB);
- Site visit for purposes of the hydro census; and
- Consultation with relevant landowners to obtain additional borehole data, if available.
- Determination of pre-project groundwater quality by means of baseline groundwater quality monitoring and sampling;
- Assess the potential impacts (direct, indirect and cumulative) of the proposed development and the significance thereof on groundwater resources and downstream water users in the general area;
- Description of groundwater management measures related to all project phases;
- Groundwater monitoring protocols and a report containing groundwater monitoring data and analysis;
- A groundwater model illustrating the above mentioned analysis will be required; and
- Attend a specialist integration workshop to be held with the specialist project team during the EIA phase of the project prior to the finalisation of the respective specialist reports. The aim of this workshop will be to:
- Discuss and evaluate the findings of each of the various specialist studies;
- Integrate findings to identify workable solutions;
- Recommend appropriate mitigation measures, where required;

- Formulate final recommendations; and
- Following the phase-specific specialist workshop, specialists will be required to finalise the various specialist reports for inclusion in the EIA Report.

9.11 Heritage

The objectives of the study are to identify, assess and evaluate the potential heritage, cultural, paleontological and archaeological impacts associated with the construction, development, operation and decommissioning of the proposed Solar Power Park.

The terms of reference for this study are:

- Undertake a desktop study with the purpose of gathering data regarding the known occurrence and distribution of heritage, cultural, paleontological and archaeological resources / sites and artefacts within and surrounding the study area. This study should include archival and literature research. The desktop study must in addition include a review of previous heritage investigations undertaken in the area, where relevant;
- Undertake a site survey of the development area with the purpose of identifying and defining areas of heritage, cultural, paleontological and archaeological interest. The areas of interest identified during the survey must be recorded (GPS coordinates) and documented (photographs);
- Provide a detailed description of the heritage, cultural, paleontological and archaeological areas of interest('status quo') documented during the site survey that could be affected by the proposed project;
- Generate a sensitivity map representing all identified heritage, cultural, paleontological and archaeological resources / sites using a GIS platform. The sensitivity map must indicate all 'no-go' / 'no-development' areas;
- Identify and assess the significance of the likely impacts (i.e. direct, indirect and cumulative) of the proposed project (including all project alternatives) on heritage, cultural, paleontological and archaeological resources / sites. The impact assessment component of

the scope of works must be conducted according the prescribed impact assessment methodology;

- Outline any further studies that may be required during or after the EIA process;
- Make recommendations on the protection and management of any significant cultural, heritage and/or archaeological sites that occur within the study site;
- Provide recommendations for any ongoing monitoring that may be necessary for all phases of the project life-cycle (i.e. planning, construction, operation and decommissioning phases);
- Identify practicable mitigation measures to reduce negative impacts and enhance positive impacts on heritage, cultural, paleontological and archaeological resources and indicate how such measures can be implemented for the various phases of the project life-cycle (i.e. planning, construction, operation and decommissioning phases). The mitigation measures proposed will be included in the project Environmental Management Programme;
- Provide guidance on any permitting or any other relevant requirements that may be necessitated by the South African Heritage Resources Agency (SAHRA), the National heritage Resources Act (Act 25 of 1999) or any other relevant regulations and / or by-laws; and
- Attend a specialist integration workshop to be held with the specialist project team during the EIA phase of the project prior to the finalisation of the respective specialist reports. The aim of this workshop will be to:
- Discuss and evaluate the findings of each of the various specialist studies;
- Integrate findings to identify workable solutions;
- Recommend appropriate mitigation measures, where required;
- Formulate final recommendations; and
- Following the phase-specific specialist workshop, specialists will be required to finalise the various specialist reports for inclusion in the EIA Report.

9.12 Hydrology

The terms of reference for the hydrological study are:

- Undertake a desktop study to review all existing information available for the study area and relevant catchment;
- Undertake a site survey to identify all surface water resources occurring within the study area. It is recommended that an aerial photographic study to assess the extent of watercourses (perennial / non-perennial) occurring within the study area must initially be undertaken. The findings of this study must be verified and further complimented by the site survey findings;
- Mapping of all surface water resources identified during the desktop study and site survey using a GIS platform;
- Calculate the 1:50 and 1:100 year flood lines for all perennial and non-perennial watercourses occurring within the study area;
- Provide a baseline description of the hydrological and associated physical characteristics of the study area that may be affected by the proposed project activities.
- Identify impacts on watercourses (surface water) and run-off associated with the proposed project;
- Identify impacts associated with the proposed development on watercourses and provide mitigation measures for the identified impacts;
- Determine the variability in the amount of water required on an annual and seasonal basis as the project is implemented; and
- Determine and assess the expected, cumulative effects on water losses/gains resulting from the project operations;
- Mitigation measures to be identified for ensuring efficient use of water including alternatives to reduce the consumption of water such as water use minimisation, recycling, conservation and technological improvements;
- Identify all relevant legislation, permits and standards that would apply to the development;
- Describe the surface water conditions for all stages of the project, including:

- Assessment of water requirements in terms of, process water, potable water and non-potable, water requirements and sources for construction start-up, normal and emergency operating situations as well as decommissioning;
- Design factors considered;
- Permanent and temporary alterations or realignments of watercourses, wetlands and other water bodies. Identify the volume of water to be withdrawn from each source, considering plans for waste water re-use;
- Determine the location of sources/intakes and associated infrastructure (e.g. pipelines for water supply); and
- Describe best practice approaches to be considered for the crossings of watercourses or water bodies which may be required and provide example diagrams of each type crossing.
- Provide recommendations for a surface water monitoring programme to be implemented during the construction and operational phases of the project; and
- Attend a specialist integration workshop to be held with the specialist project team during the EIA phase of the project prior to the finalisation of the respective specialist reports. The aim of this workshop will be to:
- Discuss and evaluate the findings of each of the various specialist studies;
- Integrate findings to identify workable solutions;
- Recommend appropriate mitigation measures, where required, and
- Formulate final recommendations.
- Following the phase-specific specialist workshop, specialists will be required to finalise the various specialist reports for inclusion in the EIA Report.

9.13 Noise Impact Assessment

The scope of work for the Noise Impact Assessment will be guided by SANS 10328:2003 (Edition 2) which specifies the methods to assess the noise impacts on the environment resulting from the operations of the Solar Power Park that might affect the receiving environment. The minimum requirements include –

- Purpose of the investigation;
- Description of the exiting environment – topography, surface conditions and meteorological conditions etc. during measurements;
- Define and identification of primary noise sources along with their respective levels – where applicable operating cycles and nature of the sound emission, composition and directional characteristics;
- Identification of noise sensitive developments or receptors and the impact of the noise on these – focusing on cumulative. Determine the sound emission and nature of the sound emission from each of the identified noise sources;
- Location of measuring or calculating points;
- Quantification of the noise impacts. Calculate the expected rating level of sound at the identified noise sensitive sites from the combined sound power level emanating from identified noise sources;
- Alternatives considered and the results of those recommendations.
- All applicable legislation and guidelines are to be duly considered during the assessment process;
- Assess the noise impacts at identified noise sensitive sites in terms of the requirements of SANS 10103.The measurement and rating of environmental noise with respect to land use, health, annoyance and to speech communication; the Noise Control Regulations; the World Health Organisation; the World Bank;
- Investigate alternative noise mitigation procedures, if required;
- The calculation, analysis and assessment of noise impact requires details of the plant layout and quantitative data of all sources of noise of the power plant associated with the electrical power generation process including noise emission data of each of the noise sources, their location within the plant and the material of the bounding structures. The propagation of sound from each noise source through the bounding structures and subsequent propagation through the atmosphere is calculated to predict and subsequently assess the rating levels of combined noise at identified noise sensitive sites; and

- Attend a specialist integration workshop to be held with the specialist project team during the EIA phase of the project prior to the finalisation of the respective specialist reports. The aim of this workshop will be to:
- Discuss and evaluate the findings of each of the various specialist studies;
- Integrate findings to identify workable solutions;
- Recommend appropriate mitigation measures, where required;
- Formulate final recommendations; and
- Following the phase-specific specialist workshop, specialists will be required to finalise the various specialist reports for inclusion in the EIA Report.

9.14 **Socio-Economic Impact Assessment**

The objective of the Socio Economic Impact Assessment should allow for a better understanding of the proposed development in terms of the local context. The study should present the baseline data on demographic, economic, employment and infrastructure requirements.

The terms of reference for study include the following:

- Obtain baseline information on the social conditions characterising the study area (individual, community, institutional and organisational level) with regards to future trends, current changes which will occur when the development is implemented. A baseline rendering of the area is to be presented in terms of demographic, labour and employment, economic and infrastructure components;
- Desktop study: present a baseline description will be derived from secondary data and primary data collection (using a combination of telephonic, face-to-face and focus group interviews):
- Census 2001 and Community Survey 2007 data to determine any significant social trends in the area;
- A desktop aerial study of the affected area through the use of Google Earth;
- Integrated Development Plans (IDP) of the affected District and Local Municipalities;

- Local Economic Development Plans for affected District and Local Municipalities;
- Spatial Development Frameworks (SDF) of the affected District and Local Municipalities; and
- Growth and Development Strategies/Plans of the affected District and Local Municipalities.
- Identify and assess socio-economic impacts (direct, indirect and cumulative) that may result from the construction and operation phases of the project, as well as to define how this will change the local economic and social composition. Assess the social benefits of the proposed project in terms of development opportunities, improved safety and security, job opportunities and empowerment;
- Analysis of the following components in terms of the expected impacts to be generated and the change anticipated in the local community and economy:
  - Demographic:
  - Size and composition of the population;
  - Population growth;
  - Educational level of the local community;
  - Level of poverty; and
  - Health status of the community.
  - Labour and employment:
  - Economically active population;
  - Unemployment status and rates;
  - Labour absorption and employment rates; and
  - Number of jobs created – direct and indirect.
  - Economic:
  - Economic sectoral composition;
  - GDP contribution; and
  - Macro economic impact of the proposed development on the local economy.
  - Infrastructure:
- Assessment and overview of existing infrastructure in terms of water, sanitation accessibility, electricity etc.

- Recommend mitigation measures that address the local context and needs;
- Attend a specialist integration workshop to be held with the specialist project team during the EIA phase of the project prior to the finalisation of the respective specialist reports. The aim of this workshop will be to:
- Discuss and evaluate the findings of each of the various specialist studies;
- Integrate findings to identify workable solutions;
- Recommend appropriate mitigation measures, where required;
- Formulate final recommendations; and
- Following the phase-specific specialist workshop, specialists will be required to finalise the various specialist reports for inclusion in the EIA Report.

9.15 Tourism Assessment

The terms of reference for study include the following:

- Determine the tourism assessment area, i.e. the area likely to be impacted by the proposed Solar Park and associated infrastructure;
- Assess the existing and proposed future tourism product(s) within the tourism assessment area;
- Assess existing or potential tourism products that may be negatively impacted by the proposed project;
- Assess the future tourism appeal and/or prospects for the tourism assessment area;
- Determine the current and projected future average demand for tourism products in the tourism assessment area;
- Develop a tourism impact assessment (demand and economic impact) of the proposed project on the tourism industry specific to the study area. The methodology to be used for the impact assessment will be prescribed by the environmental technical team project manager;
- Recommend practicable and appropriate mitigation measures to reduce or mitigate potential impacts and/or enhance benefits; and

- Attend a specialist integration workshop to be held with the specialist project team during the EIA phase of the project prior to the finalisation of the respective specialist reports. The aim of this workshop will be to:
- Discuss and evaluate the findings of each of the various specialist studies;
- Integrate findings to identify workable solutions;
- Recommend appropriate mitigation measures, where required;
- Formulate final recommendations, and
- Following the phase-specific specialist workshop, specialists will be required to finalise the various specialist reports for inclusion in the EIA Report.

9.16 Visual Impact Assessment

Depict and assess the visual aesthetic character of the study and general area in order to interpret and quantify the possible impacts of the proposed development on the receiving landscape and to identify potential sensitive receptors. The rationale for this study is that the construction and the operation of the Solar Park may alter the landscape character and sense of place of the local environment.

The terms of reference for study include the following:

- Identify all legislation, permitting requirements and standards that may be relevant to the proposed development;
- Describe the visual character of the site by evaluating components such as topography and current land use activities as examples. This will provide an overview of the status quo of the visual environment;
- Undertake a viewshed analysis in order to determine the visual exposure of the project. The viewshed analyses must take into account the dimensions of the relevant CSP plant structures and associated infrastructure;
- Identify farms/neighbouring properties affected by viewsheds and provision of outputs in Excel spreadsheets;

- Identify elements of particular visual quality that could be affected by the proposed project and determine the extent of the visibility of the project from surrounding areas;
- Identify sensitive receptors that occur within the project viewsheds including towns, lodges, tourist routes etc.;
- Determine the visual absorption capacity by means of graphic representation (photomontages) of the proposed development on 2D photographs taken from key locations surrounding the site;
- Describe and evaluate the visual impacts of the individual components of the proposed project from identified critical areas and view fields as well as the cumulative impacts which will be generated. The impact assessment component of the scope of works must be conducted according the prescribed impact assessment methodology;
- Weigh the resultant envisaged impacts of all project alternatives and create an alternative-ranking table, stipulating the potential impacts of each proposed alternative.
- Visual rendering – indicates the key visual attributes and considerations graphically and provide client with layers;
- Collate all available spatial data for at least an 80 km radius around the study area. Data to include the following vector layers: farms, road, rivers, wetlands, informal settlements, towns, land use data and elevation and the following raster data: topographic maps and aerial photos;
- Develop a 3D model of the study area using available aerial photos and 20 m contour data;
- Recommend mitigation measures to reduce the potential visual impacts generated by the components of the proposed project for inclusion into the Environmental Management Programme (EMP). Describe relevant and implementable mitigation measures to reduce, avoid, or minimise negative impacts and enhance positive impacts and recommendations - propose relevant aspects to be included in a visual monitoring programme;
- Detailed guideline measures to mitigate any visual impacts and an assessment of their likely effectiveness. These site-specific guidelines should include appropriate recommendations to ensure that any structures conform to the surrounding environment through the appropriate use of architectural style, layout, building materials and scale; and

- Attend a specialist integration workshop to be held with the specialist project team during the EIA phase of the project prior to the finalisation of the respective specialist reports. The aim of this workshop will be to:
- Discuss and evaluate the findings of each of the various specialist studies;
- Integrate findings to identify workable solutions;
- Recommend appropriate mitigation measures, where required;
- Formulate final recommendations; and
- Following the phase-specific specialist workshop, specialists will be required to finalise the various specialist reports for inclusion in the EIA Report.

9.17 Wetland Delineation and Assessment

Undertake the required field work and desktop analysis in order to compile a report that considers the following aspects:

- A broad description of the wetland ecology of the study area and surrounding areas – this must include water abstraction sites;
- Delineation of possible wetlands and associated riparian habitat occurring within the study area and determining of appropriate buffer zones. Wetland delineation must be conducted in accordance with the Department of Water Affairs' approved methodology;
- Identification and description of biodiversity patterns at community and ecosystem level (plant and animal communities in vicinity and threatened/vulnerable ecosystem species) species level (Red Data Book species, presence of alien species) and in terms of significant landscape features that is likely to be impacted by the proposed CSP plant and associated infrastructure;
- To assess the ecological importance and sensitivity of wetland associated ecosystems in the vicinity of the site in terms of construction, operations and water abstractions; and the classification of habitat;

- Identification of potential direct, indirect and cumulative impacts and recommendations to prevent or mitigate these in both the construction, operational and decommissioning phases;
- To describe and map the freshwater ecosystems in the vicinity of the proposed site and the conservation status;
- To determine the impact that the proposed development will have on the conservation status and functioning of freshwater ecosystem on site;
- To propose management and mitigation measures for impacts on freshwater ecosystems; and
- Attend a specialist integration workshop to be held with the specialist project team during the EIA phase of the project prior to the finalisation of the respective specialist reports. The aim of this workshop will be to:
- Discuss and evaluate the findings of each of the various specialist studies;
- Integrate findings to identify workable solutions;
- Recommend appropriate mitigation measures, where required;
- Formulate final recommendations; and
- Following the phase-specific specialist workshop, specialists will be required to finalise the various specialist reports for inclusion in the EIA Report.

9.18 Approach to Undertaking the Project

In order to obtain the required Record of Decision for the Environmental Scoping Study and Plan of Study for EIA from DEA for the project, the following activities will be undertaken:

9.18.1 Authority Consultation

Consultation with all relevant authorities initiated during the Scoping Phase will continue throughout the duration of the project. The representatives from the relevant Departments will be requested to formally provide input into the EIA Process. The authorities to be consulted include:

- National and Provincial Government Representatives:
    - Department of Environmental Affairs (DEA);
    - Department of Water Affairs (DWA);
    - Department of Agriculture, Forestry and Fisheries (DAFF);
    - South African Heritage Resources Agency (SAHRA); and
- Relevant Northern Cape Provincial Authorities (ex. Environment & Conservation, Agriculture).
- Relevant Local and District Municipalities:
    - Siyanda District Municipality;
    - Kgatelopele Local Municipality; and
    - Kai Gharib Local Municipality.

9.18.2 **Environmental Impact Assessment**

The EIA will aim to achieve the following:

- To provide an overall assessment of the social and biophysical environments of the area affected by the proposed establishment of a CSP Plant, PV developments and associated infrastructure;
- To undertake a detailed assessment of the portion of the Farm Arriesfontein 617 Gordonia RD (Arriesfontein) considered for the Solar Park development, in terms of environmental criteria and impacts (direct, indirect and cumulative), and recommend a preferred location for the proposed CSP Plant, PV developments and associated infrastructure (based on environmental sensitivity);
- To identify and recommend appropriate mitigation measures for potentially significant environmental impacts; and
- To undertake a fully inclusive PP Process to ensure that I&AP issues and concerns are recorded.

9.18.3 **Public Participation Process for the EIA Phase**

9.18.3.1 On-going Consultation with all I&APs

On-going consultation with key stakeholders (e.g. local authorities, relevant government departments, local business), and other identified I&APs will ensure that I&APs are kept informed regarding the EIA findings and proposed mitigation measures. Networking with I&APs will effectively continue throughout the duration of the project until the closure of the EIA phase. Where required, key stakeholders and I&APs will be engaged on an individual basis. The database and issues trail will be continually updated throughout the process.

9.18.3.2 Public Involvement

Public Meetings will be held to provide the general public with feedback regarding the findings of the EIA, and to provide detail regarding mitigation measures proposed. In accordance with the requirements of the EIA Regulations, the public meetings will be advertised 10 days prior to the event. I&APs registered on the project database will be notified of this public meeting by letter. In addition, key stakeholders will be personally invited to attend separate Focus Group Meetings. Formal minutes of the Public and Focus Group Meetings will be compiled and distributed to the attendees. These proceedings will also be included in the final EIA Report.

9.18.3.3 Social Issues Trail

Issues and concerns raised during the public participation process of the EIA Phase will be compiled into an Issues Trail. Proceedings of meetings and comments received will also form part of the document. This record of issues will provide a consolidated list in order to ensure that all issues and concerns raised by I&APs are considered within the EIA Process.

9.18.4 **Compilation of the Environmental Impact Report**

The EIA Report will include and address the following:

- A project description (including a description of the proposed activity, plans illustrating the study area and proposed site, and detailed technical details regarding the proposed project);
- A description of the pre-construction environment;
- A description of the public participation process, including the identification of I&APs, a record of the procedures followed, and the perceptions and views of the I&APs regarding the activity;
- A description of environmental (biophysical and social) issues identified and potential impacts of each of the CSP and PV developments of the proposed solar power park on these aspects (i.e. how the environment may be affected as a result of the proposed activity)
- Assessment of impacts identified in the Scoping Study which were determined to be significant. These impacts will be assessed in terms of the nature, extent, duration, intensity, severity and probability of the impact occurring; and
- Conclusions and recommendations regarding the presence of any environmental fatal flaws and recommendations (including a preferred site and mitigation and management measures) regarding the proposed project.

Furthermore, the EIA Report will comply with Regulation 31(2) of Government NoticeR543 and other applicable regulations/guidelines insofar as content and issues addressed are concerned. The integration of the specialist studies into a consolidated report will allow for easy assessment of the potential environmental aspects. In order to evaluate the significance of the identified impacts, the following characteristics of each potential impact will be identified:

- The nature, which shall include a description of what causes the effect, what will be affected and how it will be affected;
- The extent, wherein it will be indicated whether the impact will be local (limited to the immediate area or site of development) or regional;
- The duration, wherein it will be indicated whether the lifetime of the impact will be of a short duration (0–5 years), medium-term (5–15 years), long term (> 15 years) or permanent;

- The probability, which shall describe the likelihood of the impact actually occurring, indicated as improbable (low likelihood), probable (distinct possibility), highly probable (most likely), or definite (impact will occur regardless of any preventative measures);
- The significance, which shall be determined through a synthesis of the characteristics described above and can be assessed as low, medium or high; and
- The status, which will be described as either positive, negative or neutral.

SolarReserve SA (Pty) Ltd has the responsibility to avoid or minimise impacts and plan for their management (in terms of the 2010 EIA Regulations), the mitigation of significant impacts will be discussed and conclusions and recommendations regarding the preferred corridor.

9.18.5 **Review of Environmental Impact Report**

9.18.5.1 Public Review of the Draft Environmental Impact Assessment Report

The draft EIA Report will be made available at public places for public review and comment, in accordance with the EIA Regulations. A 30-calendar day period will be allowed for this review process.

An advert indicating the availability of this report and the information regarding the public meeting will be placed in the local newspaper. In addition, all I&APs registered on the project database will be notified of the Public and/or Focus Group Meetings and the availability of this report by either post, e-mail, facsimile or telephonically.

Furthermore copies of the draft EIA Report will be submitted to the DEA prior to the commencement of the public review period.

9.18.6 **Authority Review of the Final Environmental Impact Assessment Report**

The Environmental Impact Report will be submitted to DEA and Northern Cape Department of Environmental Affairs for review and commenting purposes. All I&AP comments received during the 30-calendar day public review period will be incorporated into the final EIA Report. This final report will be submitted to the Authorities for their review and consideration.

9.18.7 **Environmental Authorisation**

On receipt of the Environmental Authorisation for the project, the I&APs registered on the project database will be informed of this Environmental Authorisation and its associated terms and conditions in writing via either post, e-mail, facsimile. In addition the availability of the Environmental Authorisation will be advertised in relevant the local newspapers.

10. Recommendation

The Environmental Scoping Study aimed to identify and evaluate potential environmental impacts associated with all aspects of the proposed project, including the proposed alternatives, for detailed study within the EIA phase. The conclusions and recommendations of this Scoping Study are the result of on-site inspections, the evaluation of impacts identified by specialists, and the parallel process of public participation. The public consultation process has been extensive and every effort has been made to include representatives of all stakeholders in the study area.

It is believed that the both beneficial and adverse impacts were thoroughly assessed, the needs and the benefits for this project has been assessed so as to give it a go ahead. Based on the above-mentioned information supplied and the conclusions that were made, it is suggested that the Scoping Report be accepted, that the Plan of Study for EIA be approved and that the applicant be allowed to commence with the EIA Phase of the project. The Scoping process has not revealed any environmental fatal flaws associated with any of the alternatives under consideration.

The purpose of the detailed assessments will be to identify site specific environmental “opportunities and constraints” in order to nominate/select preferred project alternatives.

Furthermore, to ensure that the required mitigation measures are implemented, it is recommended that an EMP be compiled for the project, and attached to the final EIA Report, in order to transfer the findings of the environmental studies into practical measures. This EMP should form part of the contract for the construction and operation of the proposed Solar Park.

The completed EIA must, amongst others, include the following information/comply with the following documents:

- The approved Plan of Study for EIA;
- The specialist reports listed by EIA team in this Scoping Report;
- The specialist inputs as listed in the Plan of Study for EIA; and

Additional specialist inputs and other relevant information listed by the relevant authorities.

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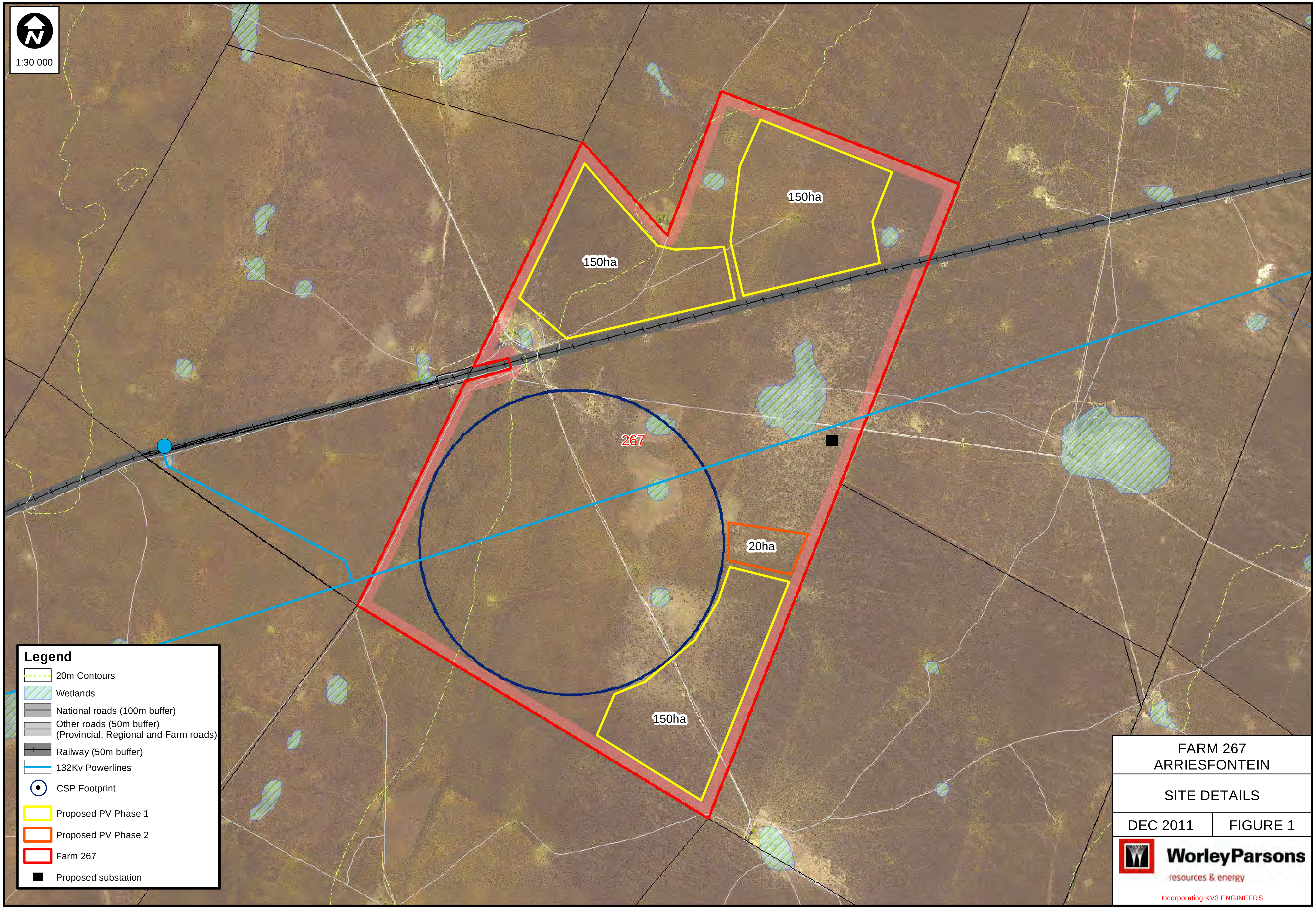
Appendix A – Site Photographs

Appendix B – Site Layout Options



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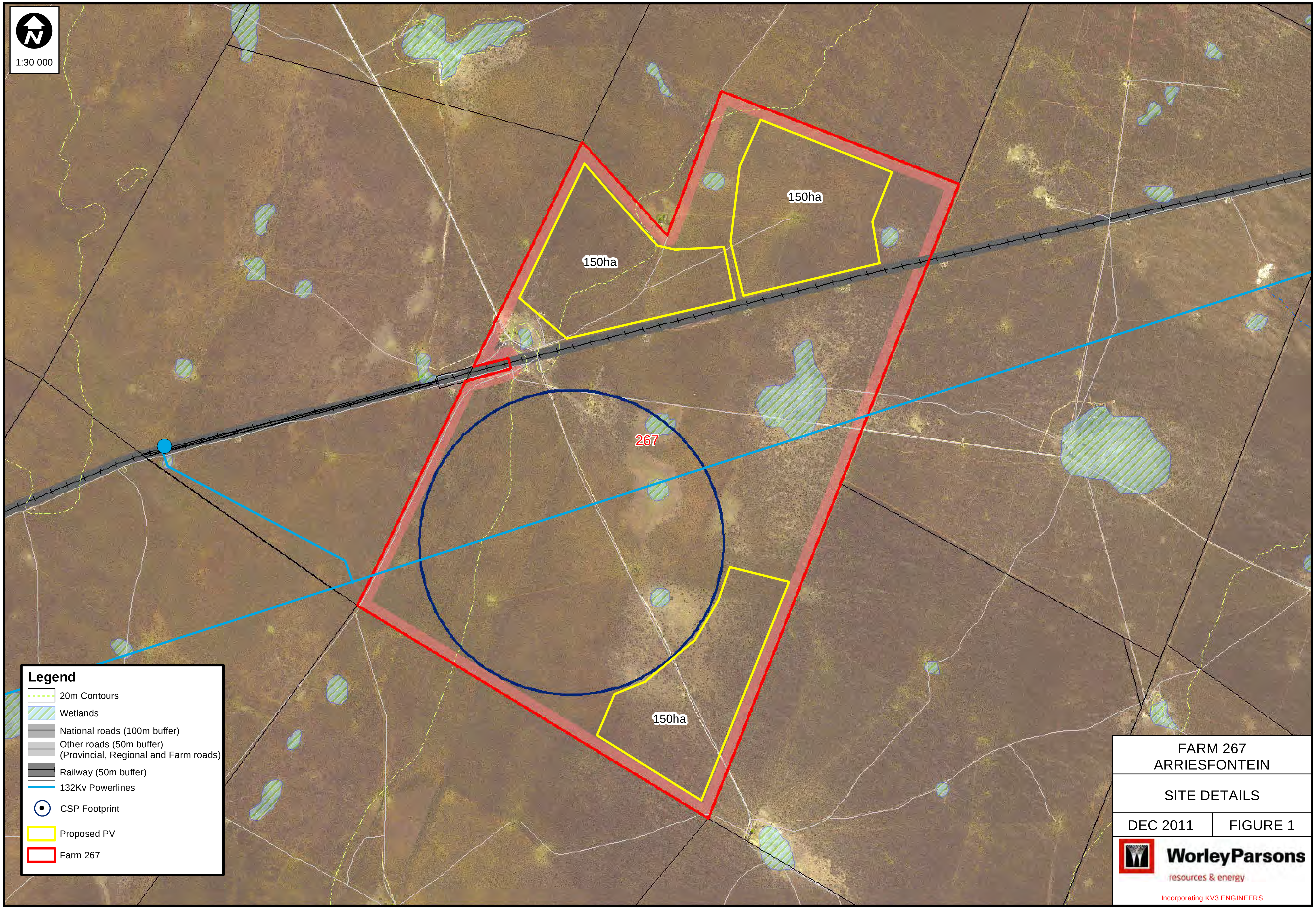
Other roads (50m buffer)
(Provincial, Regional and Farm roads)
Railway (50m buffer)
132Kv Powerlines
CSP Footprint
Proposed PV Phase 1
Proposed PV Phase 2
Farm 267
Proposed substation
FARM 267
ARRIESFONTEIN
SITE DETAILS
DEC 2011
FIGURE 1
WorleyParsons
resources & energy
Incorporating KV3 ENGINEERS



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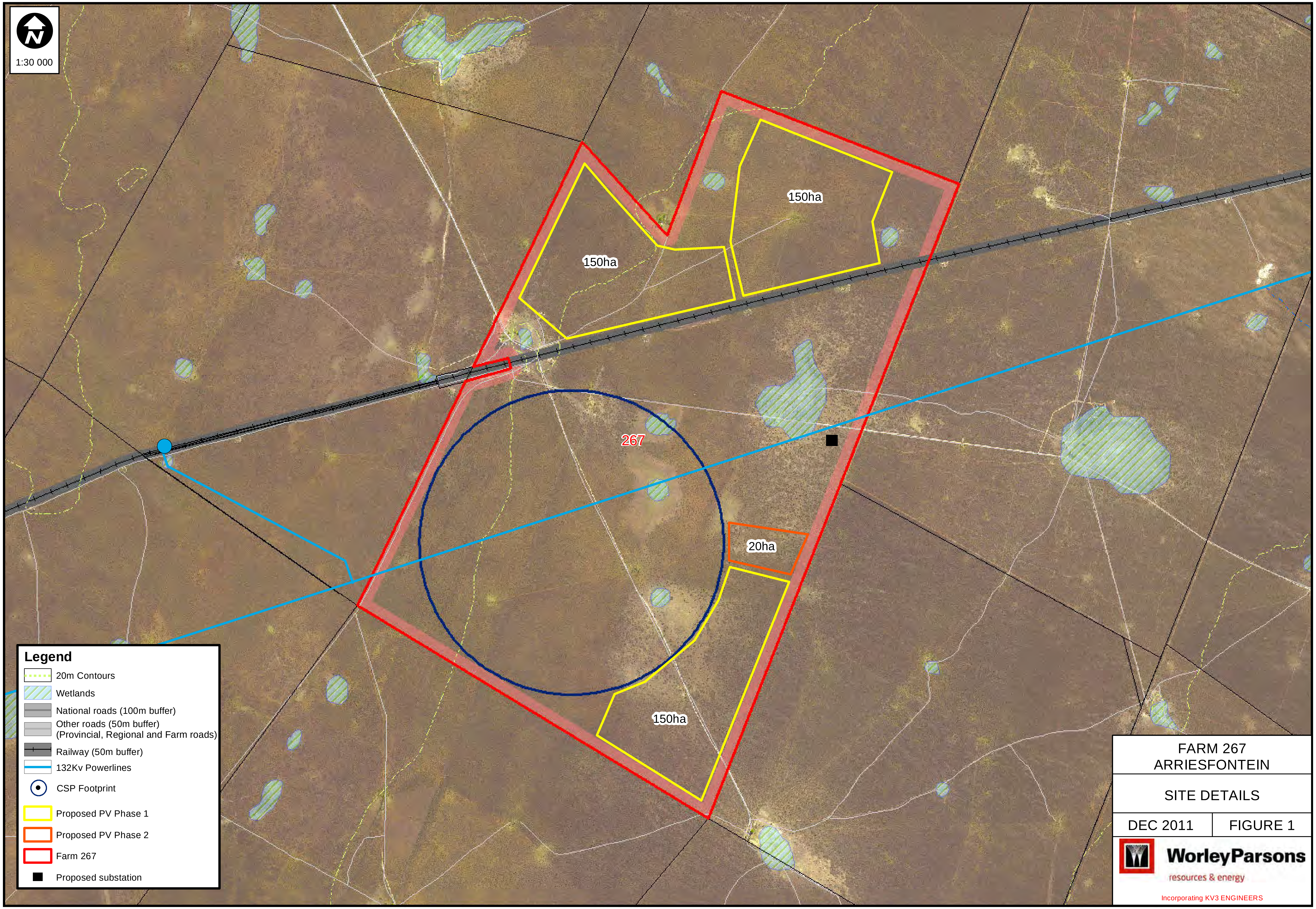

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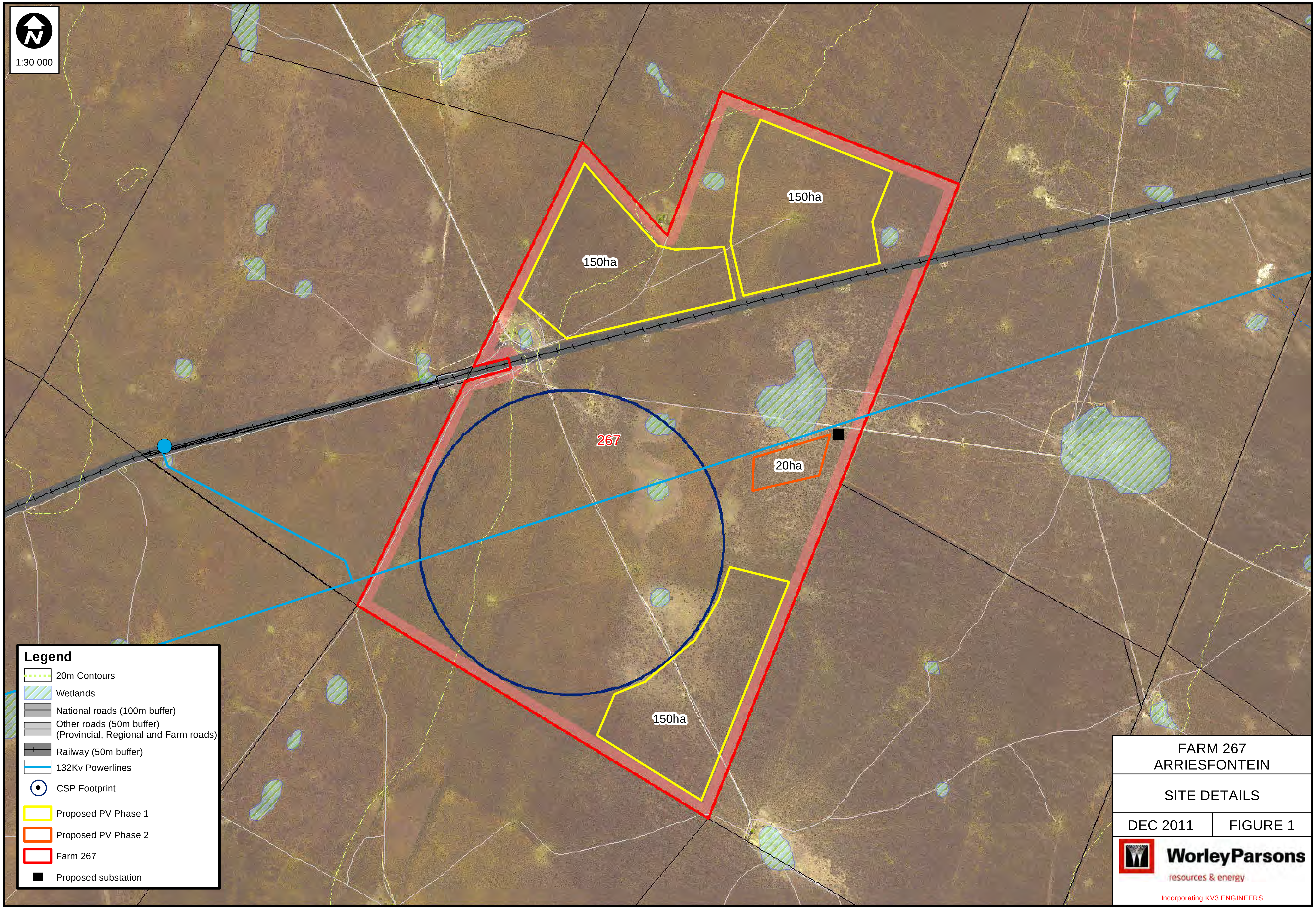
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SITE DETAILS
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FIGURE 1
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resources & energy
Incorporating KV3 ENGINEERS

Appendix C – Newspaper Adverts

11150
Town Planning

NOTICE OF APPLICATIONS IN TERMS OF SECTION 5(5) OF THE GAUTENG REMOVAL OF RESTRICTIONS ACT, 1996 (ACT NO.3, 1996)

I, Leyden Rae Gibson, being the authorised agent of the owner of Erf 209 Bruma, hereby give notice in terms of section 5(5) of the Gauteng Removal of Restrictions Act, 1996 that I have applied to the City of Johannesburg for the removal of certain conditions in the Title Deed of Erf 209 Bruma, situated at 16a Hans Pirow Road, Bruma, and the amendment of the town planning scheme known as the Johannesburg Town Planning Scheme, 1979 in order to rezone the property from "Residential 4" to "Residential 4" as amended, subject to conditions.

The application will lie for inspection during normal office hours at the office of the Executive Officer: Development Planning and Urban Management, 8th Floor, Metropolitan Centre, 158 Loveday Street, Braamfontein, for a period of 28 days from 04 January 2012.

Any person who wishes to object to the applications may submit such objections or representations in writing to the Executive Officer: at the above address or at P.O Box 30733 Braamfontein 2017, within a period of 28 days from 04 January 2012.

Address of agent: Leyden Gibson Town Planners, P.O. Box 652945, Benmore 2010, Tel: 0861- LEYDEN (539336) Cell: 082-410-4566

01LV04

TENDER NOTICE

NKANGALA DISTRICT MUNICIPALITY

WIDENING OF BHEKUMUZI MASANGO DRIVE: EMAKHAZENI LOCAL MUNICIPALITY PROJECT 2306/12

Tenders are hereby invited for a project as detailed below in the Nkangala District Local Municipality.

Prospective tenderers must be registered with the CIDB and have a grading of **4 CE or higher**. Potentially emerging contractors who meet the criteria stated in the tender data may submit tenders. Joint ventures or companies which are part of a joint venture must also be registered with the CIDB.

Tender documents must be pre-booked with Consulting Engineers, **Perozz Consulting, Mr M Bizure** (013) 755 4026/fax (013) 755 4026 and will be available from **16 JANUARY 2012**, from the Nkangala District Municipal Offices, 2A Walter Sisulu Street, Middelburg, upon payment of a non-refundable deposit of R250. Only cash or bank guaranteed cheques made payable to Nkangala District Municipality will be accepted.

A compulsory briefing session will be held at **10H00 on 17 JANUARY 2012**, at Emakhazeni Local Municipality. No tender documents will be available at the briefing session.

Completed tenders, in ink, in a sealed envelope and clearly marked with the indicated contract number and description, must be placed in the tender box, Ground Floor, Nkangala District Municipality, 2A Walter Sisulu Str, Middelburg, Mpumalanga, not later than **12H00 on 27 JANUARY 2012**, at which hour and date the tenders will be opened in public in Room D22, Ground Floor, Block D, Nkangala District Municipality Building.

Enq : Trudie van Niekerk - 013 249 2123 during office hours : 07h30-13h00 and 13h45-16h15.

Tenders shall remain valid for a period of 90 days from closing date. No late, faxed, e-mailed or other form of tender will be accepted. Tenders will be evaluated in terms of the Supply Chain Management policy of the Nkangala District Municipality. The lowest tender will not necessarily be accepted and the right to accept the whole or part of any tender or not to consider any tender not suitably endorsed is fully reserved by the Nkangala District Municipality.

TC Makola - Municipal Manager

pr comm 2009

BOJANALA PLATINUM DISTRICT MUNICIPALITY

RE - ADVERTISEMENT: OFFICE OF THE EXECUTIVE MAYOR

Bids are hereby invited from qualified and relevant experienced service providers for the following bids:

BID NO	Description	Dept.	Contact Person	Evaluation criteria	Closing date
BPDM/OEM/TRAVEL/AGENTS/11/12	Appointment of a service provider for the pre-selection of Travel Agent(s) to service Bojanala Platinum District Municipality on a rotational base for the period of 2years	OEM	Mr F Molotsi 014 590 4500/07	90 points = Price 10 points = No franchise	02 Feb 2012 @ 10:00

Bid documents are obtainable as from **16 February 2012 from 08h00 to 16h00 (Mondays to Fridays) at the offices of BPDM,** corner Beyers Naude and Fatima Bhayat street, Rustenburg, Tel (014) 590 4500. Duly completed bids and supporting documents must be deposited in the bid box situated at the Bojanala Platinum District Municipality offices, Corner Beyers Naude and Fatima Bhayat Street, Rustenburg, ***not later than 10h00 on the 02 February 2012*** where bids will be opened in public. A non-refundable bid deposit of **R200.00** payable in cash. The payment must be deposited to ***Bojanala Platinum District Municipality bank account. ABSA bank, acc no: 011 20000272, Branch Rustenburg.*** **THE DEPOSIT SLIP MUST BE SUBMITTED AS PROOF OF PAYMENT ON COLLECTION OF A BID DOCUMENT.** *Queries relating to the issue of these documents may be addressed to Ms B Pule, Tel No 014 590 4500 Fax No 014 590 4576 e-mail brendap@bojanala.gov.za and technical queries may be addressed to Mr F Molotsi, Tel No 014 590 4600/07 Fax No 014 597 0306 e-mail frederickm@bojanala.gov.za.*

BIDS RECEIVED AFTER THE CLOSING DATE AND TIME WILL NOT BE CONSIDERED.

BPDM does not bind itself to accept the lowest or any other bid in whole or in part.

Municipal Manager

Bojanala Platinum District Municipality , P.0. Box 1993, Rustenburg, 0300

WorleyParsons resources & energy — EcoNomics

NOTICE OF ENVIRONMENTAL IMPACT ASSESSMENT: PUBLIC PARTICIPATION PROCESS

Notice is hereby given in terms of the Environmental Impact Assessment (EIA) Regulations, published in Government Notices No. R543 to 546 (2010), promulgated in terms of Section 24(5) of the National Environmental Management Act (Act No 107 of 1998) and the National Environmental Management: Waste Act (Act No 59 of 2008), of the availability of the Draft Scoping Report for public review and comment and the hosting of a public meeting for the proposed project:

ARRIESFONTEIN SOLAR ENERGY POWER PARK
DEA REF: 12/12/20/2649, 12/12/20/2647, 12/12/20/2648, 12/12/20/2646

PROJECT DESCRIPTION

SolarReserve SA (Pty) LTD is proposing to construct a 325 MegaWatt (MW) Solar Energy Power Park on the Farm Arriesfontein 267, Barkley Wes RD, Siyanda District Municipal Region, comprising of both Photovoltaic (PV) and Concentrated Solar Power (CSP) Technology. The proposed development site is situated an approximate 32 km outside of the town Danielskuil. The development site is located within the institutional boundaries of the Kgatelopele Local and Siyanda District Municipalities.

PUBLIC PARTICIPATION PROCESS

All interested and affected parties (I&APs) wishing to participate in the Public Participation Process are invited to comment on the Draft Scoping Report and to attend a public meeting. All I&AP comment must be included and addressed in the final report prior to submission to the competent authority. This includes comments from the public meetings as well.

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- Tsantsabane and Kgatolopele Local Municipal Offices
- Postmasburg and Daniëlskuil Public Libraries

Registered I&APs can submit comments/ or concerns in relation to the project to the WorleyParsons RSA contact person below on or before 25 February 2012.

HOW TO REGISTER

Parties or persons wishing to register as an I&AP are requested to forward their contact details and comments/or concerns in relation to the project to the WorleyParsons RSA contact person provided below.

PUBLIC MEETING

All I&APs are invited to the public meetings to be hosted at the following:
Date: 8 February 2012
Venue: Danielskuil Community Hall
Time: 17:30

DATE OF NOTICE

12 January 2010

ENVIRONMENTAL ASSESSMENT PRACTITIONER

WorleyParsons RSA
Mr. Francois Humphries

P.O. BOX 36155
Menlo Park
0102
Telephone: 012 425 6300
Fax: 012 460 9978
Email: francois.humphries@worleyparsons.com

Incorporating KV3 ENGINEERS — SOLARRESERVE

Sparrow SCHOOLS

Sparrow Foundation School is inviting learners to be enrolled for 2012:

Primary School

Requirements :

- Learners who are 6 years old, turning 7 in their Grade 1 year of school is the minimum age for admission
- Learners who would meet the requirements yet would have difficulty with the transition into mainstream primary school
- Learners who would find mainstream schooling challenging and may have to repeat these grades
- The Primary school offers the following learning areas/ programmes as per National Curriculum in a supported smaller class environment :
  ° English as Home Language ° Afrikaans as First Additional Language ° Mathematics ° Natural Sciences ° Technology (vocational skills) ° Social Sciences ° Economic and Management Sciences ° Arts and Culture ° Life Orientation

Please call Leslie at 011-482-3520 for further information or to book a placement interview for admission in 2012.

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Requirements :

- Learners who are 13 years old, turning 14 in their first year of High school is the minimum age for admission
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- Learners who would meet the requirements yet would have difficulty with the transition into High School
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College

Requirements :

- Learners who are 16 years old is the minimum age for admission
- Learners who are proficient in English and Maths at Grade 9 level
- Learners who would meet the requirements yet would have difficulty with the transition into Grade 10, 11 or 12
- Grade 9 learners who find mainstream schooling challenging and would prefer a vocational skills route
- The College offers courses at NQF level 2 in vocational skills

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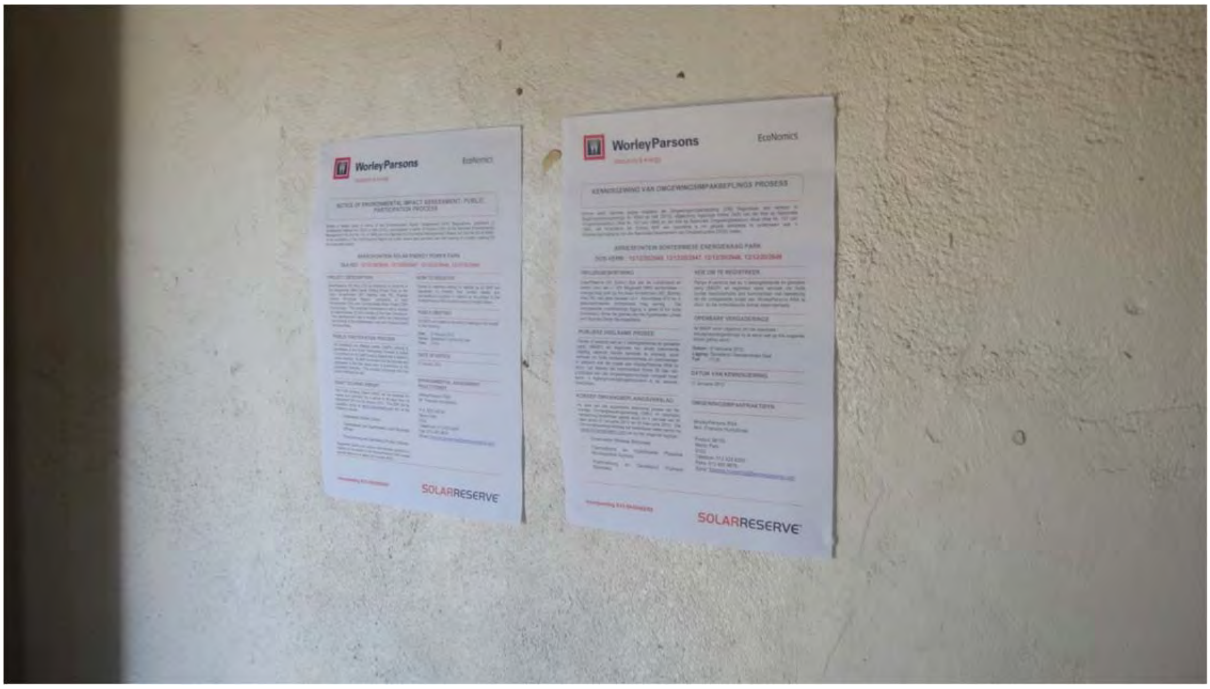
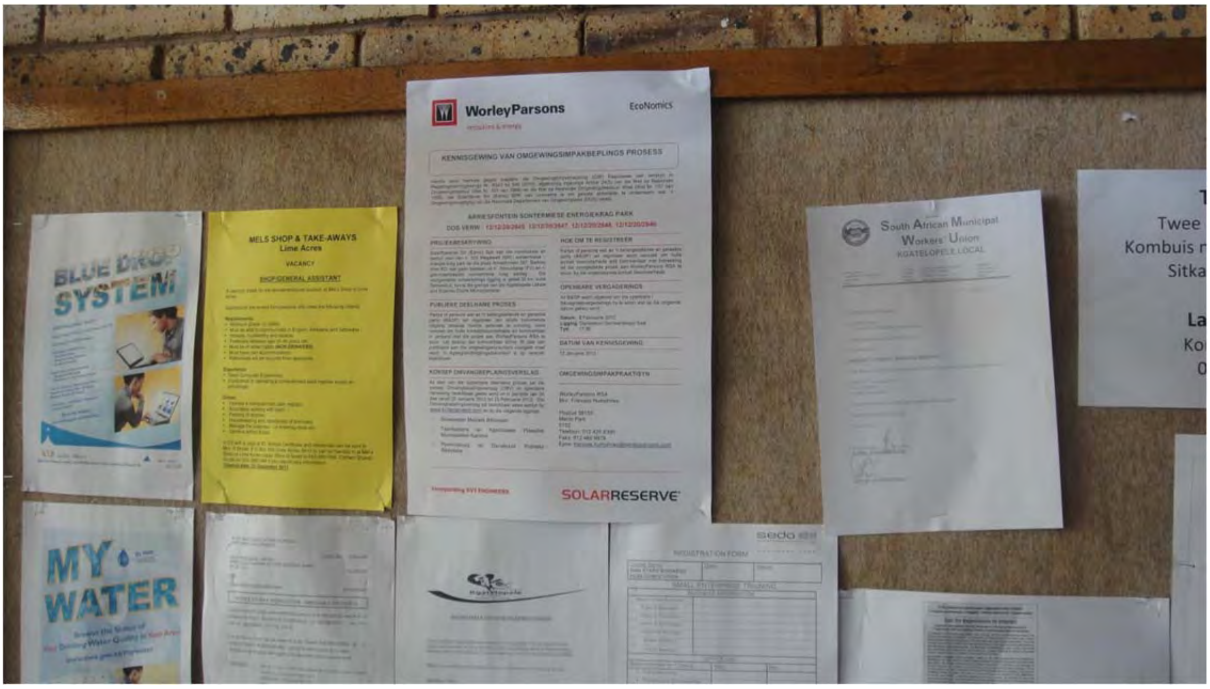
Appendix D – Photographs of Notices and Flyers

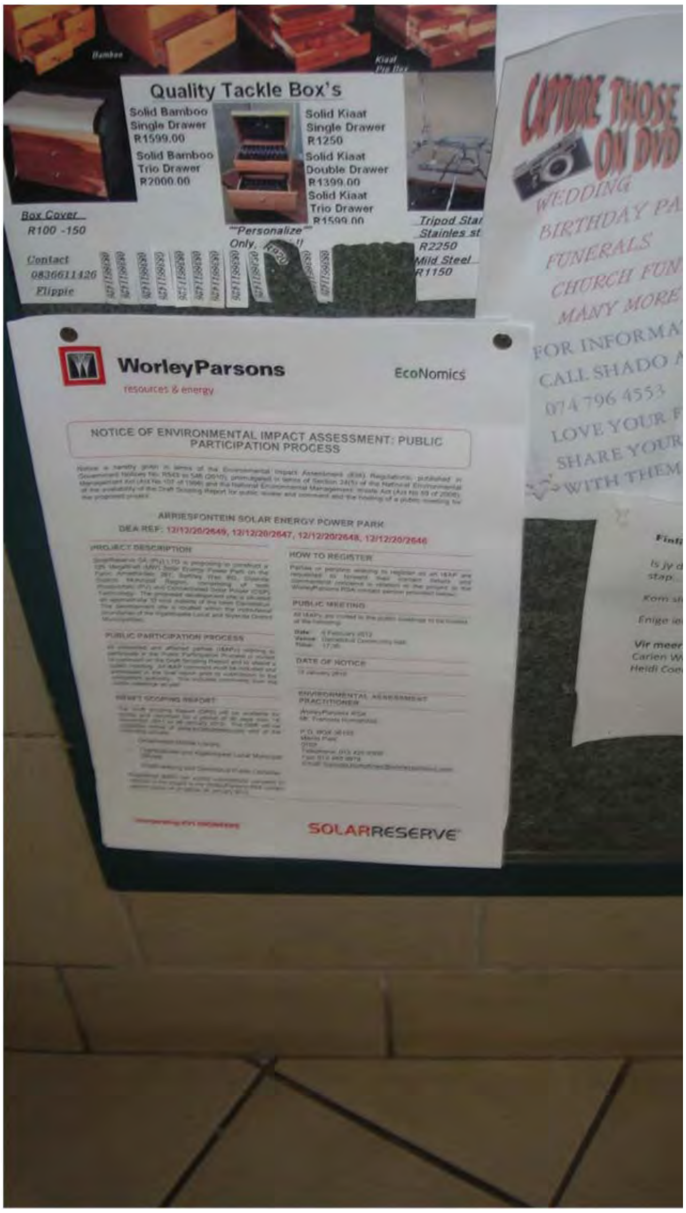


Notices at Groenwater Super Store

Notices at Lime Acres Shopping Area



Notices at Danielskuil Library



Notice at OK Store Danielskuil

Notice at Postmasburg Public Library

Appendix E – Comments and Response

WorleyParsons

resources & energy

EcoNomics

SOLARRESERVE SA

SOLARRESERVE

ARRIESFONTEIN SOLAR POWER PARK

COMMENTS AND RESPONSE REPORT : SCOPING PHASE

256990PWE – SolarReserve - Upington

COMPILED FOR:

SolarReserve RSA (Pty) Ltd

Contact person : Terence Govender

Director- Development: Southern Africa

Telephone: +27 83 440 0433

Facsimile: +27 11 784 7539

Email: Terence.Govender@solarreserve.com

COMPILED BY:

WorleyParsons RSA (Pty) Ltd

Contact person: .Francois Humphries

31 Allen Drive, Loevenstein 7530

PO Box 398, Bellville 7535

South Africa

Telephone: +27 (0)21 912 3000

Facsimile: +27 (0)21 912 3222

email: corrie.retief@worleyparsons.com

Incorporating KV3 ENGINEERS

WorleyParsons
resources & energy

EcoNomics

SOLARRESERVE SA

Disclaimer

This report has been prepared on behalf of and for the exclusive use of SolarReserve SA , and is subject to and issued in accordance with the agreement between SolarReserve SA and WorleyParsons RSA. WorleyParsons RSA accepts no liability or responsibility whatsoever for it in respect of any use of or reliance upon this report by any third party.

Copying this report without the permission of SolarReserve SA and WorleyParsons RSA is not permitted.

PROJECT 256990PWE - ROOIPUNT SOLAR POWER PARK

REV	DESCRIPTION	ORIG	REVIEW	WORLEY-PARSONS APPROVAL	DATE	CLIENT APPROVAL	DATE
A	Issued for internal review	Author	A Reviewer	N/A	2012-03-05	N/A	

CONTENTS

Appendices

1. INTRODUCTION

The ever increasing and growing demand for energy as well the need to find more sustainable and environmentally friendly energy resources have prompted developers to explore new energy generation options.

In an effort to utilise renewable energy resources, SolarReserve SA (Pty) LTD is proposing to construct a 325 MegaWatt (MW) Solar Power Park on the Farm Rooipunt 617, Gordonia RD, Siyanda District Municipal Region, comprising of both Photovoltaic (PV) and Concentrated Solar Power (CSP) Technology. The proposed development site is situated an approximate 32 kms outside of the town Danielskuil. The development site is located within the institutional boundaries of the Kgatelopele Local and Siyanda District Municipalities.

In terms of the Environmental Impact Assessment ("EIA") Regulations (August 2010) promulgated under Sections 24 and 24D of the National Environmental Management Act (Act No. 107 of 1998) [NEMA] and the National Environmental Management: Waste Act (Act No. 107 of 1998) [NEM: WA], various aspects of the intended development are considered listed activities which may have an impact on the environment, therefore requiring authorisation from the National Department of Environmental Affairs (DEA) prior to the commencement of such activities.

SolarReserve SA (Pty) LTD (the applicant) has appointed Worley Parsons RSA as independent Environmental Assessment Practitioners to the project in fulfilment of legislative requirements in support of an application for Environmental Authorisation

2. PURPOSE OF THE COMMENTS AND RESPONSE REPORT

The purpose of the Comments and Response Report is to create a single document that records all the comments and/or queries that were highlighted and aired by the I&AP's during the investigative process and the responses thereto.

3. OBJECTIVES OF THE COMMENTS AND RESPONSE REPORT

The objective of this Comment and Response Report is to:

- Provide a formal account of the Public Participation Process undertaken as part of the EIA Process for the proposed Arriesfontein Thermal Solar Energy Power Plant.
- Reflect the views, comments questions or concerns of all I&AP's on the proposed project as well as the actions taken by the Environmental Assessment Practitioner to address these issues and queries.
- Establish an efficient communication channel between the project proponent, Governing Authorities, Specialists and Environmental Assessment Practitioners.
- Allow for all issues to be recorded on the database verbatim and then summarised in the report.

4. PUBLIC PARTICIPATION PROCESS

4.1 OVERVIEW OF THE PUBLIC PARTICIPATION PROCESS UNDERTAKEN DURING SCOPING PHASE

The Public Participation Process (PPP) for the project is conducted in accordance with Chapter 6 of the EIA Regulations. The primary aims of the PPP during the Scoping Phase were:

- To inform Interested and Affected Parties (I&APs) of the proposed project;
- To identify issues, comments and concerns as raised by I&APs;
- To promote transparency and an understanding of the project and its consequences;
- To serve as a structure for liaison and communication with I&APs; and
- To provide local knowledge and input in identifying potential environmental (biophysical and social) impacts and "hotspots" associated with the proposed development.

4.2 IDENTIFICATION OF KEY STAKEHOLDERS

The first step in the PP Process was to identify key stakeholders, including:

- National and Provincial Government Representatives:
    - Department of Environmental Affairs (DEA);
    - Department of Water Affairs (DWA);
    - Department of Agriculture, Forestry and Fisheries (DAFF);
    - South African Heritage Resources Agency (SAHRA); and
    - Relevant Northern Cape Provincial Authorities (ex. Environment & Conservation, Agriculture).
    - Relevant Local and District Municipalities:
    - Siyanda District Municipality;
- Parastatals – Eskom, Civil Aviation Authority;
- Affected and surrounding landowners;
- Environmental Non-Governmental Organizations (e.g. Wildlife Society of South Africa, BirdLifeSA);
- Other (i.e. Air Traffic and Navigation Systems)

All I&AP information (including contact details), together with dates and details of consultations and a record of all issues raised is recorded within a comprehensive project database. This database will be updated on an on-going basis throughout the project, and will act as a record of the communication/public consultation process.

Please Refer to Appendix D for the database of potential I&AP's contacted and for the I&AP's registered.

4.3 ADVERTISING

As per the statutory requirements of the 2010 EIA Regulations, the project was advertised in the following local newspapers on 12th of February and 26th of February 201:

- *Sowetan (English); and*
- *Die Gemsbok (Afrikaans).*

The advertisement provided an abstract on key aspects of the proposed project (project description, location, application process and contact details of the Environmental Assessment Practitioners). Furthermore the advertisement requested I&APs to register, and to become involved in the project by submitting comments and highlighting issues of concern to the WorleyParsons RSA. The primary aim of the newspaper advert was to ensure that the widest possible group of I&APs were informed of the project.

The notification of the availability of the Draft EIAR for public review will be published in the same newspapers in conjunction with the notification of any public meetings to be hosted.

4.4 SITE NOTICES

Site notices were prepared according to the requirement set out in the EIA Regulations. The site notices included basic information regarding the proposed project, application process, I&AP registration and contact details of the Environmental Assessment Practitioners. Three site notices (English and Afrikaans) were place at the entrance of the development site and at the Maine road (N14) turnoff to the site– refer to Figure 1

Figure 1: Site notice

4.5 PAMPHLETS AND NOTICES

The site notice was printed on A5 sized paper (pamphlets) and distributed via the South African Post Office Services post boxes in Danielskuil, Postmasburg and Lime Acres..

Furthermore sets of A3 site notices were placed on notice boards at the following amenities frequented by I&APs in Danielskuil, Postmasburg, Lime Acres and Groenwater:

- Danielskuil:
  - Danielskuil Public Library
  - OK Store
- Postmasburg:
  - Outside Post Office
  - Public Library;
  - Pick & Pay
- Lime Acres
  - Outside SPAR notice board
- Groenwater
  - Groenwater Super Store

Photographs of the notices and flyers are attached to this report as Appendix B.

4.6 REVIEW OF THE DRAFT SCOPING REPORT

4.6.1 Public Review of Draft Environmental Scoping Report

The draft Environmental Scoping Report was available for public review at the following locations in close proximity to the study area, which were identified as readily accessible to I&APs:

- Kgatelopele Local Municipal Offices;
- Tsantsabane Local Municipal Offices
- Danielskuil Public Library

- Postmasburg Public Library
- Groenwater Mobile Library

The availability of this draft report was advertised in the Kalahari Bulletin and Sowetan. On-site notices were also placed on the perimeter of the site, pamphlets were distributed in the post boxes of Danielskuil, Postmasburg and Lime Acres and posters were placed on community notice boards at the following venues:

- Danielskuil:
    - Danielskuil Public Library
    - OK Store
- Postmasburg:
    - Outside Post Office
    - Public Library;
    - Pick & Pay
- Lime Acres
    - Outside SPAR notice board
- Groenwater
    - Groenwater Super Store

A 30-calendar day period will be allowed for this review process from 25 Januery 2012 to 25 February 2012. Stakeholders and I&APs on the project database were notified of the availability of this report via post or e-mail. The report was also distributed to all the commenting authorities for review and comment in electronic or hard copy format.

Please refer to Appendix E for proof of email and registered mail send to I&AP's. The report was also distributed to all the commenting authorities for review and comment in electronic or hard copy format. Please refer to Appendix E for proof of Draft Scoping Report for review.

4.6.2 Final Environmental Scoping Report

The compilation of the Final Scoping Report entailed the consideration and inclusion of all relevant comments received from the public during the review of the Draft Scoping Report. The final document was submitted to DEA as well as Northern Cape Provincial Department of Environment Affairs and Conservation for authority review and decision-making and/or commenting purposes.

4.7 CONSULTATION AND PUBLIC INVOLVEMENT

Through consultations with I&AP's and Stakeholders, issues for inclusion within the Final Scoping Report will be identified and recorded. Consultations will take place in the form of formal meetings with I&AP's and other stakeholders. The primary aims of the meetings will be to:

- Disseminate background information regarding the proposed project to I&APs;
  - Supply more information regarding the EIA Process and the findings of the specialist studies undertaken during the Scoping Phase;
  - Answer questions regarding the project and the EIA Process;
  - Obtain feedback from I&APs with respect to the proposed project; and
  - Receive input regarding the Public Participation Process.

One public meeting with I&APs was held during the public review period of the Draft Scoping Report. The meetings will be held at:

- The Danielskuil High School on 8 February 2012 at 17:30; and

The purpose of the public meeting was to discuss the key findings of the Scoping Phase and provide the representatives with an additional platform to provide input to the EIA Process.

Stakeholders and I&APs were notified of the public meetings through the following methods:

- Invitation letter sent via either e-mail, registered mail and/or fax;
- Telephonic dialogue with key Stakeholders;
- Distribution of pamphlets; and
- Liaison with the relevant Ward Councillors and Ward Committee Representatives.

Attendance Registers and Minutes of all public meetings are attached as Appendix C of this report. Networking with I&APs, will further continue throughout the duration of the project.

All comments and queries aired during the public meetings were noted and addressed in the meetings. Please refer to the minutes of the meetings in Appendix C.

5. Comments and Responses

All written comments received from registered I&APs were noted and are contained in Appendix F and will be addressed in the EIA Report.

No written comments were received on the Scoping Report by the time of admission to DEA. Should any comments be received after submission these will be included in the EIA Report.

6. Conclusion

No issues of great concern was raised during the public participation with regards to environmental concerns related to the proposed project which was not sufficiently addressed during the public meetings nor covered by the specialist assessments. The majority of all issues raised were of a commercial or technical nature and did not hold great relevance towards the EIA and environmental concerns.

Appendix A Copy of Newspaper Advertisements'

11150
Town Planning

NOTICE OF APPLICATIONS IN TERMS OF SECTION 5(5) OF THE GAUTENG REMOVAL OF RESTRICTIONS ACT, 1996 (ACT NO.3, 1996)

I, Leyden Rae Gibson, being the authorised agent of the owner of Erf 209 Bruma, hereby give notice in terms of section 5(5) of the Gauteng Removal of Restrictions Act, 1996 that I have applied to the City of Johannesburg for the removal of certain conditions in the Title Deed of Erf 209 Bruma, situated at 16a Hans Pirow Road, Bruma, and the amendment of the town planning scheme known as the Johannesburg Town Planning Scheme, 1979 in order to rezone the property from "Residential 4" to "Residential 4" as amended, subject to conditions.

The application will lie for inspection during normal office hours at the office of the Executive Officer: Development Planning and Urban Management, 8th Floor, Metropolitan Centre, 158 Loveday Street, Braamfontein, for a period of 28 days from 04 January 2012.

Any person who wishes to object to the applications may submit such objections or representations in writing to the Executive Officer: at the above address or at P.O Box 30733 Braamfontein 2017, within a period of 28 days from 04 January 2012.

Address of agent: Leyden Gibson Town Planners, P.O. Box 652945, Benmore 2010, Tel: 0861- LEYDEN (539336) Cell: 082-410-4566

01LV04

TENDER NOTICE

NKANGALA DISTRICT MUNICIPALITY

WIDENING OF BHEKUMUZI MASANGO DRIVE: EMAKHAZENI LOCAL MUNICIPALITY PROJECT 2306/12

Tenders are hereby invited for a project as detailed below in the Nkangala District Local Municipality.

Prospective tenderers must be registered with the CIDB and have a grading of **4 CE or higher**. Potentially emerging contractors who meet the criteria stated in the tender data may submit tenders. Joint ventures or companies which are part of a joint venture must also be registered with the CIDB.

Tender documents must be pre-booked with Consulting Engineers, **Perozz Consulting, Mr M Bizure (013) 755 4026/fax (013) 755 4026** and will be available from **16 JANUARY 2012**, from the Nkangala District Municipal Offices, 2A Walter Sisulu Street, Middelburg, upon payment of a non-refundable deposit of R250. Only cash or bank guaranteed cheques made payable to Nkangala District Municipality will be accepted.

A compulsory briefing session will be held at **10H00 on 17 JANUARY 2012**, at Emakhazeni Local Municipality. No tender documents will be available at the briefing session.

Completed tenders, in ink, in a sealed envelope and clearly marked with the indicated contract number and description, must be placed in the tender box, Ground Floor, Nkangala District Municipality, 2A Walter Sisulu Str, Middelburg, Mpumalanga, not later than **12H00 on 27 JANUARY 2012**, at which hour and date the tenders will be opened in public in Room D22, Ground Floor, Block D, Nkangala District Municipality Building.

Enq : Trudie van Niekerk - 013 249 2123 during office hours : 07h30-13h00 and 13h45-16h15.

Tenders shall remain valid for a period of 90 days from closing date. No late, faxed, e-mailed or other form of tender will be accepted. Tenders will be evaluated in terms of the Supply Chain Management policy of the Nkangala District Municipality. The lowest tender will not necessarily be accepted and the right to accept the whole or part of any tender or not to consider any tender not suitably endorsed is fully reserved by the Nkangala District Municipality.

TC Makola - Municipal Manager

prcomm 2009

Bojanala Platinum District Municipality

Home of Tourism and Economic Development

BOJANALA PLATINUM DISTRICT MUNICIPALITY

RE - ADVERTISEMENT: OFFICE OF THE EXECUTIVE MAYOR

Bids are hereby invited from qualified and relevant experienced service providers for the following bids:

BID NO	Description	Dept.	Contact Person	Evaluation criteria	Closing date
BPDM/OEM/TRAVEL/AGENTS/11/12	Appointment of a service provider for the pre-selection of Travel Agent(s) to service Bojanala Platinum District Municipality on a rotational base for the period of 2years	OEM	Mr F Molotsi 014 590 4500/07	90 points = Price 10 points = No franchise	02 Feb 2012 @ 10:00

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WorleyParsons resources & energy

EcoNomics

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DATE OF NOTICE

12 January 2010

ENVIRONMENTAL ASSESSMENT PRACTITIONER

WorleyParsons RSA
Mr. Francois Humphries

P.O. BOX 36155
Menlo Park
0102
Telephone: 012 425 6300
Fax: 012 460 9978
Email: francois.humphries@worleyparsons.com

Incorporating KV3 ENGINEERS

SOLARRESERVE

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- Grade 9 learners who find mainstream schooling challenging and would prefer a vocational skills route
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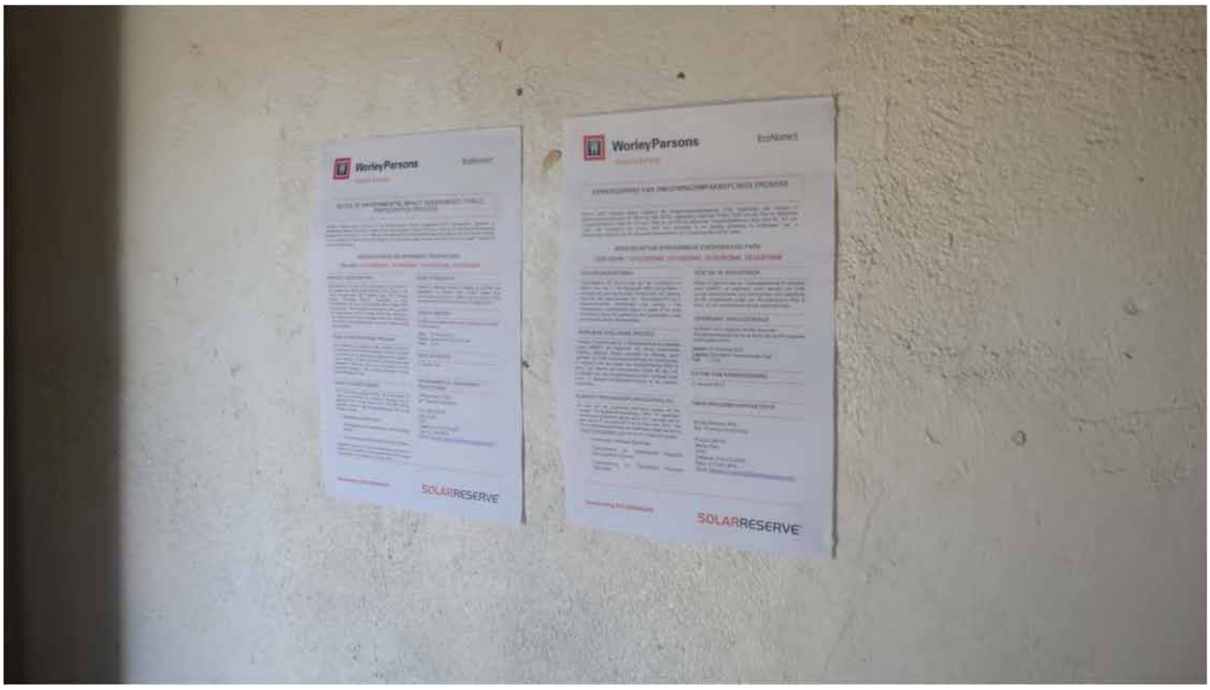
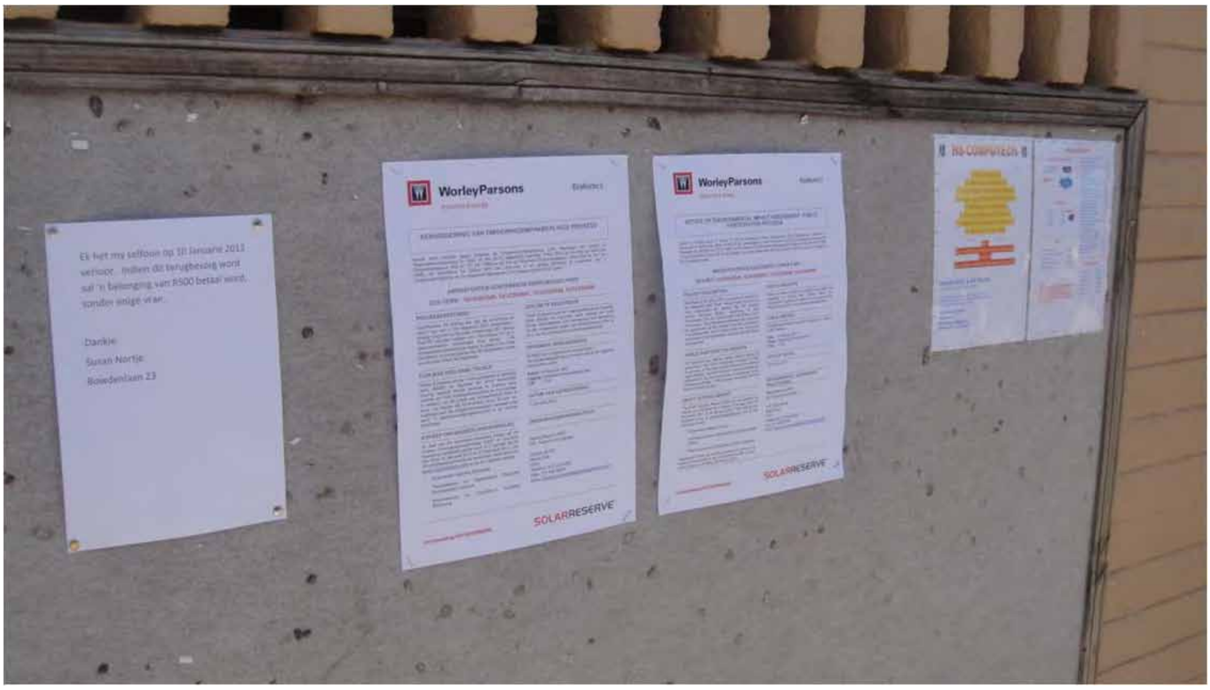
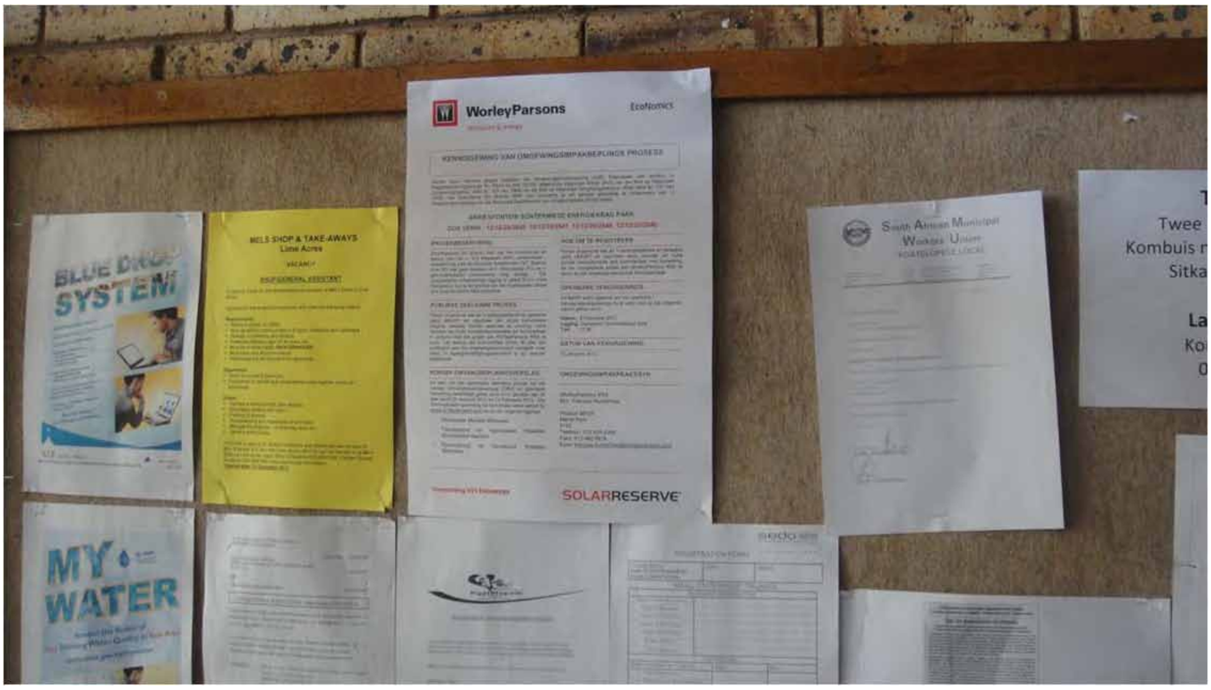
Appendix B Photographs of site notices, Posters and Pamphlets



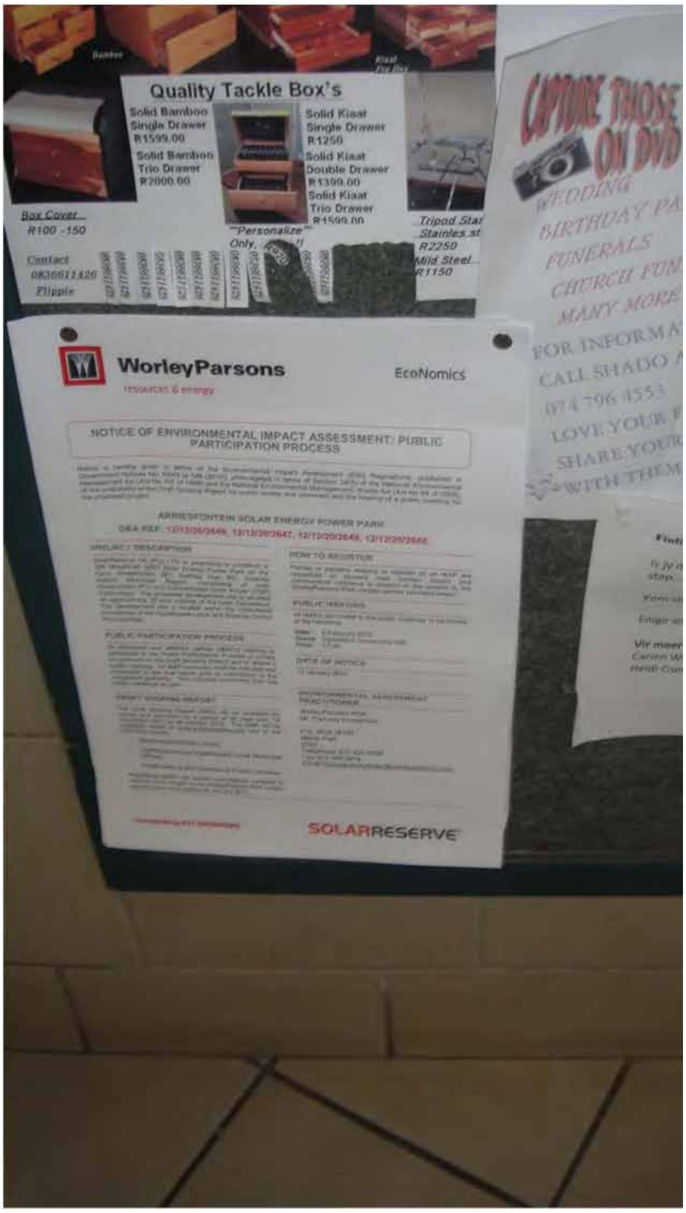
Notices at Groenwater Super Store



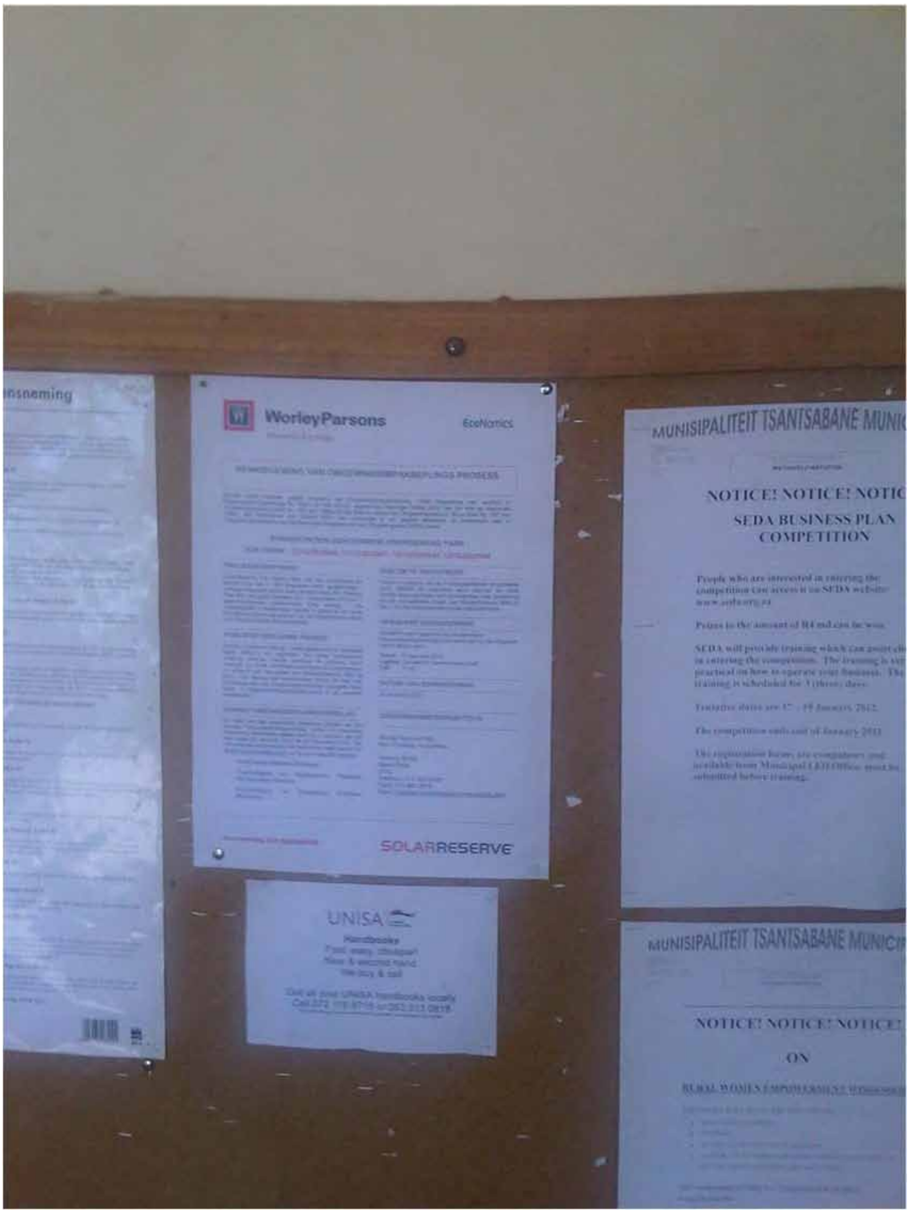
Notices at Lime Acres Shopping Area



Notices at Danielskuil Library



Notice at OK Store Danielskuil



Notice at Postmasburg Public Library

Appendix C Attendance Register and Minutes of the Meetings

WorleyParsons

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MEETING RECORD

Project No: 260380
Project: Meeting Record

Arriesfontein Public Meeting

PARTICIPANT NAME & ORGANISATION		**DATE**	08 February 2012
CLIENT:	SOLARRESERVE SA **(PTY) LTD**	**TIME START**	17:30
PRESENT:	WorleyParsons delegates	**TIME FINISH**	20:00
Messrs:		**LOCATION**	Danielskuil High School
		RECORDER	L. Rautenbach
		DOC NO	001
		FILE LOC	06
		PROJ REF	PWE
		COMMENCEMENT DATE	NA
		ORIGINAL COMPL DATE	NA
		CONTRACT VALUE	NA
APOLOGIES:	Johann Visser BertusWessels		
Messrs:			

SIGNATURE ORIGINATOR:	
WorleyParsonsRSA	**DATE SIGNED:**
SIGNATURE OTHER PARTY:	
	DATE SIGNED:
COPIES:	

RECORD OF DISCUSSIONS

ITEM	ITEM DETAILS	ACTION BY AND DATE
	Safety Moment	

ITEM	ITEM DETAILS	ACTION BY AND DATE
1.	**WELCOME AND INTRODUCTION**	
1.1	Francois Humphries (FH) started the meeting by welcoming everyone who attended and requested that all parties sign the attendance register.	
1.1.1	The Project Proponent for the proposed development is SolarReserve SA (Pty) Ltd. and the contact person Mr. Terence Govender (TG). The remainder of the project team consists of Environmental Assessment Practitioners, WorleyParsonsRSA both Mr. Francois Humphries &Miss Leanna Rautenbach (LR). Additionally the specialist team that will be undertaking all the various impact assessments on behalf of the project proponent consists of – – Air Quality – Airshed Planning Professionals (Pty) Ltd – Biodiversity – Bathusi Environmental Consulting – Geo-technical – MSJ – Geo-hydrological – SRK Engineers – Hydrological – KnightPieshold – Heritage – Professional Grave Solutions – Noise – JongensKeet Associates – Soils & Agriculture Potential – ARC – Socio-Economic – Urban-Econ: Development Economists – Tourism – Grant Thornton – Visual – MetroGIS – Waste – WPRSA – Avifauna – Endangered Wildlife Trust Wetland – Wetland Consulting Services	
1.1.2	Apologies were made on behalf of Mr Johann Visser and Mr Bertus Wessels.	
2.	**EMERGENCY PROCEDURE**	
2.1	FH discussed the procedure to be followed in the event of an emergency stating that all parties present needed to remain calm and proceed to the nearest exit in an orderly fashion and gather at the open car park area. A register will be taken upon gathering and matched with the original attendance register.	

ITEM	ITEM DETAILS	ACTION BY AND DATE
3.	**CODE OF CONDUCT**	
3.1	The focus/objective of the meeting was to discuss the Environmental Impact Assessment currently underway for the proposed Arriesfontein Solar Power Park. It is expected that the meeting will take place from 17:30 – 18:30, however it may extend these timeframes. General rules of the meeting defined included - – Ensure you sign the attendance register – Please hold questions until discussion period – Introduce yourself prior to asking questions – Please switch off all cell phones – Correction to Advertised PP communication error.	
4.	**PURPOSE OF THE MEETING**	
4.1	The meeting was centered around the following – Define the Environmental Impact Assessment Process; – Define the Public Participation Process; – Background information presented on the project; – Inform and update Interested and Affected Parties regarding the proposed project; – To record issues and concerns; and – Allow for community interaction with the Project.	
5.	**SCOPING ASSESSMENT & ENVIRONMENTAL IMPACT ASSESSMENT**	
5.1	What is a Scoping Assessment? What is an Environmental Impact Assessment (EIA) Why do we do an EIA? Who are the regulating authorities? What does the technical process entail? What are the deliverables? What is our progress to date	

ITEM	ITEM DETAILS	ACTION BY AND DATE
5.2	The purpose of EIA was defined as - – Process whereby activities are assessed prior to their being commenced to ensure the environmental impacts can be prevented, limited or, mitigated. – Ensure environmental issues are integrated into planning & decision making. – Anticipate & minimize environmental damage. – Public participation & well informed decision making & environmental conservation. – In terms of the National Environmental Management Act 107 of 1998 activities such as hospitality, tourism industrial and residential requires Environmental Authorisation. The functions of the Scoping and Full EIA was defined and as per the project requirements. FH stated that the scoping phase was the preliminary phase whereby possible impacted and affected parties were notified of the development as well as made aware of the scope of the development. Whereas the EIA phase entailed the detailed assessment of all possible impacts on the natural surrounding environment expected to be generated by the development.	
5.3	Legal Requirements – National Environmental Management Act, Act 107 of 1998 – National Environmental Management Amendment Act, Act 62 of 2008 – General Notice: GNR 543 - 546, promulgate in 2011 (Environmental Impact Assessment Regulations): published in terms of Section 24 and 24D of National Environmental Management Act, Act 107 of 1998. Other legislation – SA Constitution, Act 108 of 1996 – NEM:WA, Act 59 of 2008 – NWA, Act 36 of 1998 – NEM:AQA, Act 39 of 2004 – NHRA, Act 25 of 1999 – CARA, Act 43 of 1983 – NEM: BA, Act 10 of 2004 – NEM: Protected Areas Act, Act 57 of 2000 – Subdivision of Agricultural Land Act, Act 70 of 1970 International Conventions.	
5.4	Regulating Authorities – National Authorities: Department of Water and Environmental Affairs Integrated Permitting System(IPS) – Provincial Authorities: Northern Cape Department of Environmental Affairs and Nature Conservation – Local Authorities: Siyanda District Municipality, Tsantsabane Local Municipality, Kgatelopele Local Municipality	

ITEM	ITEM DETAILS	ACTION BY AND DATE
5.5	Commenting Authorities – National Authorities: South African Heritage Association, Department of Agriculture, Forestry and Fisheries; Department of Water Affairs – Provincial Authorities: Northern Cape Department of Environmental Affairs and Nature Conservation; Northern Cape Department of Roads and Public Transport, Northern Cape Dept. Agriculture, Land Reform and Rural Development	
6.	**PUBLIC PARTICIPATION PROCESS**	
6.1	What is Public Participation (PP)? Purpose of Public Participation? When is Public Participation required? The Public Participation Process defined?	
6.2	Project Announcements were done by means of - – Site notices were placed around the towns of Danielskuil, Lime Acres and Postmasburg on the 12th of January 2012, as well as at the site itself. – Advertisements were placed in the Kalahari Bulletin (Afrikaans & English) on the 26th January 2012 (initially the 12 January 2012, however an error occurred on this advert, and it needed to be replaced) and in the Sowetan (English) on the 12th January 2012. – Written notices were sent out on the 12th January 2012 & 25 January 2012 All relevant stakeholders were informed of project via e-mail, post and facsimile.	
6.3	Register of Interested & Affected Parties will be compiled for the project and it was highlighted by FH that this will be a continuous process. All communications regarding the project will be communicated to persons or parties registered as per this register.	
6.4	A Public Consultation was arranged for the scoping phase of the project on 8 February 2012 at Danielskuil High School. The purpose of this meeting will allow for a formal discussion of the project and to communicate the details of the Environmental Impact Assessment process & the main findings to date.	
6.5	As part of the PPP all project related documents have to be put out on public review. For the Scoping phase the report was put out for comment from 26 January 2012 to 26 February 2012. *Please note that dates changed according to discussion with DEA and approved by DEA.* A copy of the report can be obtained from WPRSA – Francois Humphries or at the Danielskuil Library, Postmasburg Library, and Groenwater Library.	
7.	**PROJECT OVERVIEW**	
7.1	The project is proposed for Farm 198 outside Danielskuil, in the Kgatelopele LM and Siyanda District, Northern Cape Province.	

ITEM	ITEM DETAILS	ACTION BY AND DATE
7.2	Project Summary of the proposed CSP Technology was provided and a diagrammatic depiction presented (refer to Presentation). The proposed development will entail a single phase CSP development comprise an installed capacity of 100MW on 600ha of the development property and will comprise of: – Solar Field - consists of all services and infrastructure related to the management and operation of the heliostats (reflective mirrors); – Molten Salt Circuit - includes the thermal storage tanks for storing liquid salt, a concentration receiver/tower, pipelines and heat exchangers; – The Power Block – housing the steam turbine. – Auxiliary facilities and infrastructure - includes a condenser-cooling system, electricity transmission lines to allow for grid connection, access routes, water treatment and supply amenities and a CSP plant start-up energy supply unit (gas or diesel generators).	
7.3	Project Summary of the proposed PV Technology was provided and a diagrammatic depiction presented (refer to Presentation). The proposed development will entail a 3 phased PV development will comprise an installed capacity of 225MW on 450ha of the development property and will comprise of: – PV solar Panels and arrays; – PV Panel mountings; – DC-AC current inverters and transformers; and – Underground cabling/ overhead power lines.	
7.4	Additional Project Related components may include but are not limited to: – Meteorological stations – Administration block including storage, security and associated facilities – Visitor centre – Car park – Temporary construction camp – Lay-down – Substation/Switching Station – Evaporation Ponds/Waste – 132kV Overhead Distribution Lines – Re- Alignment of the Rural Roads – Pipeline Access for Water etc.	

ITEM	ITEM DETAILS	ACTION BY AND DATE
7.5	The various project alternatives for both CSP& PV Technology developments were explained and depicted. Alternative options for the proposed project included the following – – Site Location Alternatives; – Site Layout Alternatives; – Technology Alternatives; and – No-Go Alternative. It was stated that the no-go alternative needed to be assessed in order to determine if the project in its entirety would have a net positive or net negative impact on the region as a whole.	
8.	**DISCUSSION**	
8.1	Gerrit Niewoudt enquired on the lighting impact of the proposed project – and wanted to find out what type of lighting would be used and how it would be managed and implemented. Leanna Rautenbach stated that according in order to undertake the type of project, as proposed; an application had to be lodged with the CAA for review and approval. This application has been approved, meaning that the CAA does not see the project as a civil aviation threat either the towers or heliostat field. The site coordinates have been provided to the CAA and the site in its entirety approved. Furthermore it was stated that the CAA has various regulations to which will have to be adhered when it comes to lighting of the tower. Gerrit Niewoudt stated that this is what he is afraid of as his clientele specifically chose his establishment due to the natural surroundings and that the lighting of the tower may be viewed as very negative and intrusive.	GN LR
8.2	Gerrit Niewoudt asked what types of noise will be generated by the proposed development as well as how loud the noise would be. Terence Govender explained that the CSP section of the development will by a quiet system. From the tower to the power block there will basically be no sounds emitted by the system, however when it comes to the power block, and the related power generation action the noise levels would be quite audible. Due to this the power block will be housed in a sound-proof room – as to not allow any noise to escape. It was furthermore stated that a Noise Impact Assessment report was undertaken to ensure that all noise levels are kept within the legislated levels (dB) and that proper mitigation measures have been identified if noise reduction is required.	GN TG
8.3	Gerrit Niewoudt enquired on what happens with excess salt and steam. Are these released in to the atmosphere – what happens to these? Leanna Rautenbach concluded that the steam and salt system is a closed loop system and that the release of steam would be counterproductive as the steam is used for power generation. If steam is to be released it will be condensed and released within the ambient parameter requirements.	

ITEM	ITEM DETAILS	ACTION BY AND DATE
8.4	With regards to the salt – Gerrit Niewoudt enquired on if the liquid salt mixture would be released into the atmosphere. He wanted to know where when and how this would be done. Leanna Rautenbach commented that in the occurrence of salt "blowdown" or release this will be done in the evaporation ponds. It was stated that the ponds were engineered to such a standard which could accommodate hazardous material storage, and would be lined, fenced and managed on a daily basis. The evaporation ponds will be a three pond system, with one as a fail-safe design option and that the evaporation ponds will take up approximately 6.7ha. It was also stated that these evaporation ponds may attract birdlife, but this will be monitored and mitigated.	
8.5	Gerrit Niewoudt wanted to know if the proposed tower project will impact on the environment i.e. alter the rain and temperature patterns etc. due to the increased temperatures as a result of the solar irradiation concentration actions. Leanna Rautenbach replied that no conclusive evidence is available to support that microclimates will occur and to date none of the specialists reports found a negative inclination in this regard. Terence Govender supported the statement by concluding that the plants in Spain have actually observed a decline in the number of birds visiting the site as the can sense the increase temperature. It was found that they altered their migratory routes as to just fly around the site.	
8.6	JdP enquired on the water volumes that will be used by the plant? Leanna Rautenbach informed the attendees that an allocation of 350 000m3 of water has been received from the Vaal-Gamagara pipeline. With regards to the CSP the water use requirements will be the highest due to the cooling activities. However SR will employ either dry or hybrid cooling methods which only requires 160 000m3 of water for the CSP technology (which is the water intensive technology).	
8.7	JdP wanted to know where SR will get the water if the Vaal-Gamagara is already overcapacity where will Sedibeng find the water to provide in the project needs. Leanna Rautenbach confirmed as per discussion with Sedibeng and various mines along the pipeline that the pipeline was overcapacity. WPRSA is in process of assessing the existing capacity of the line and determining the need and requirements of the secondary line. The mines have indicated (during several discussions) that if need be, they will assist with the capital inputs for the pipeline and Sedibeng has also commenced on the funding process. It was furthermore stated that the mines are in dire need of the new pipeline as their safety in operations could become threatened as they need to release water from dewatering activities. And they will then release their dewatering water into the new pipeline.	

ITEM	ITEM DETAILS	ACTION BY AND DATE
8.8	JdP asked how the water will be treated as the water in the pipeline is not clean? Leanna Rautenbach informed attendees that the water in the pipeline will not "dirty" per say as it needs to adhere to certain standards and requirements, which is contained in the mines water use licenses, so water will either be treated to a certain standard or raw groundwater will be separated and pushed into the pipeline.	
8.9	Gerrit Niewoudt stated that due to the development(s) proposed additional servitudes etc. will be required for the new pipeline on the various farmers' properties. Leanna Rautenbach stated that they don't have the knowledge to either confirm or deny if the pipeline will run across any farms or what the planning will be.	
8.10	A question was posed in terms of airplanes recorded flying around the site? Gerrit Niewoudt wanted to know if this had anything to do with the proposed project. Leanna Rautenbach informed attendees that a lidar survey was done last year in order to obtain the relevant topographical data required for modelling and design and relevant impact assessments. The airplanes observed of late, does not have anything to do with the solar development.	
8.11	It was stated that the current aerial activity could be DWA looking for water sources. Leanna Rautenbach explained to attendees that the mines may in the near future have a safety issue if they do not get access to a "water disposal point". According to legislation they can only release water as per their license agreements and it seems that they need to release to Sedibeng. Thus the need for a new pipeline. However the existing pipeline does not have the required capacity.	
8.12	Gerrit Niewoudt / PC / JdP confirmed that DWA/Sedibeng is currently looking for additional water to provide to developers and developments as the current pipeline cannot provide in the requirements. Leanna Rautenbach stated that if Sedibeng is looking in securing other sources of water in order to provide for new developments, we were not aware of this at all – as we submitted our application last year and received feedback and authorisation quite timely. Gerrit Niewoudt stated that if the pipeline is on capacity how is it possible for Sedibeng to give us water? And if they proceed with this "hunt" for water from farmers, as alternative supplementing source it will have a significant impact on farms.	

ITEM	ITEM DETAILS	ACTION BY AND DATE
8.13	Gerrit Niewoudt stated that if SR was to develop next to his business, he would prefer them buying him out. As the proposed development will have quite a significant impact on his business. He furthermore stated that he does not want to talk to Elena Broughton (Socio-Economist) as the project is already ongoing and the people are already moving about the farm. Leanna Rautenbach responded that the landowner Mr Gerrie Cloete has been informed of all project related intentions and actions to be performed – he is being made aware if and when specialists are to go out on site. It was furthermore explained to Gerrit Niewoudt that the EIA process should be seen as an environmental feasibility assessment that will determine if the project and proposed site is compatible. The specialists need to be on site in order to determine in their various capacities if the site is compatible. Gerrit Niewoudt reiterated that he will not give his business, or property related information to anyone, and would have preferred it if the specialist team were brought down prior to the start of investigations to meet him and be properly introduced. Leanna Rautenbach stated that this was not a cost effective measure, and that it would not be feasible to fly the specialists down for a meet and greet. It was explained that the NEMA defines the public participation process and its requirements. WPRSA has contacted all parties possibly affected or interested in the vicinity of the development site, all reports related to the proposed project will be made available to the public for comment and review and it was also made clear that all written comments received would be captured and recorded in the EIA process for authority perusal and consideration.	
8.14	Gerrit Niewoudt again raised the issue of DWA investigating the water resources of the neighbouring farmers in to obtain water for the development. Leanna Rautenbach and Terence Govender confirmed that the entire region along the Vaal-Gamagara is under pressure as developments need water – that it is not only this development that needs water.	
8.15	JdP stated that ground water levels are already receding and that borehole yields are not what they are supposed to be. Leanna Rautenbach stated that the farmers need to report these types of occurrences to the DWA – it is important to report of groundwater levels/borehole yields start to recede.	

ITEM	ITEM DETAILS	ACTION BY AND DATE
8.16	Gerrie Cloete the landowner wanted to know if the aerial photos that were taken last week had anything to do with the solar project. He said that the photos were seemingly to confirm geo-hydrological structures and groundwater sources. Leanna Rautenbach informed him that the projects' aerial photography has already been done and that to her knowledge you can't determine or define geo-hydrological structures with aerial photography. Gerrie Cloete stated that it was a yellow aeroplane taking photos in the area and marking their results with regards to water on a map. Terence Govender again reiterated that only a single flyover was undertaken for the project currently under discussion and that this was for topographical considerations PC commented that the DWA/Sedibeng wants to sell the farmers water to the developers (abstracting from their boreholes etc.) and he also indicated that the DWA/Sedibeng representative stated that the farmers had no say in the matter as they own the water resource. Leanna Rautenbach stated as a matter of courtesy WPRSA and SR would follow up with Sedibeng and DWA in order to determine what is going on.	
8.17	JDP enquired on if a visual rendering of the proposed development is available for them to see. Leanna Rautenbach replied that as the project is only in the Scoping Phase this rendering is not yet available and will only be done during the full scale EIA phase. Terence Govender indicated that the visual assessors take pictures/photos from all around the proposed site, where after these are modelled in 3D to depict the proposed development from all areas. It was stated that a view of the proposed development will be made from each sensitive receptor point of view. Terence Govender provided a verbal depiction of the tower stating that the microwave tower just outside of Kimberley is approximately 125meters high and that its visibility is dependent on where you enter the city. No matter the height the tower is not visible from every vantage point.	
8.18	JDP wanted to know why an air quality assessment was being done. Leanna Rautenbach stated that I was required by law. Due to the large scale of the project it is expected that during the construction phase large volumes of dust will be generated due to increased traffic volumes, and in order to know how and where to mitigate we need to draw a baseline and proceed from there.	
8.19	JDP enquired on the number of people who would be living on site. TG stated that during operations no one will be living on site and that only administrative and maintenance personnel would be on site – during work hours.	

ITEM	ITEM DETAILS	ACTION BY AND DATE
8.20	It was stated that the area is very prone to veld-fires and PC wanted to know what the implications of the proposed project (with all the heliostats) would have in terms of starting veld-fires. Leanna Rautenbach stated that fire breaks would be made to contain potential fires as the area is already prone to fires, however to date no fires have been recorded as being started by a heliostat.	
8.21	Gerrie Cloete stated that he had no problem with the study – and requested that all I&AP's be kept informed and that another meeting be held during the next phase of the project Leanna Rautenbach concurred that another meeting is to be held during the EIA phase and that all registered I&AP's will be kept informed as the process progresses. It was also stated that an Environmental Management Plan will be drafted on behalf of the project proponent for all phases of the project – construction, operation and decommissioning informing them on how all environmental components should be mitigated and managed.	
8.22	JDP enquired on who will be responsible for operating and managing the proposed plant. Terence Govender stated that SR would be there until project decommissioning, as they personally buy-into all of their projects. A bit of background with regards to the IPP bidding process was provided and it was highlighted that even if all the project authorisations are received in good order SR has no assurance that they will be awarded preferred bidder status. Terence Govender stated as SR intends to be in the area and present on site if preferred bidder status is obtained it is vital to get local buy into the project. As the proposed project is merely in the planning phase it is not yet know if both of the technologies will be deemed feasible of if only type of technology will be feasible, thus the assessment on the entire property. SR would like to bid this project as part of the August Round 2 Bidding phase thus the rush. If this deadline is made then construction will commence in August 2013.	
8.23	JDP wanted to know how the dust will affect the mirrors and the operations of the plant. Terence Govender indicated that the mirrors will be cleaned once a month during operations and that the project is expected to be up and running by June 2014. He also explained that besides solar projects that there are several wind energy projects under investigation.	
8.24	PC asked Terence if SR has any other solar related projects in the area. Terence Govender confirmed that SR has been awarded the Humansrus PV project and that the CSP component is still under investigation.	

ITEM	ITEM DETAILS	ACTION BY AND DATE
8.25	Gerrit Niewoudt enquired on what the neighbours response were in terms of the proposed Humansrus CSP development. Terence Govender assured him that no issues have been raised by surrounding farmers. Leanna Rautenbach explained that the authorities draft the environmental authroisation in such a manner that the developer needs to make sure all impacts identified are mitigated and reduced. Due to the depression characteristic of the site – the visual impacts have been quantified to a lesser degree – however measures are still implemented to reduce where possible. It was furthermore stated that the Humansrus public consultations have no environmental issues that were up for discussion only commercial issues.	
8.26	To conclude Gerrit Niewoudt stated that the proposed development would have a significant impact on him and the area. It was reiterated that tourism will decrease once the project takes place.	
8.27	Leanna Rautenbach urged all attendees to put all comments, enquiries, thoughts and concerns in writing in order for WPRSA to process and address	
9.	**WAY FORWARD**	
9.1	Sedibeng – follow up on water resource investigation currently underway. Schedule meeting with Sam Sithole to discuss.	
9.2	Request for EIA Phase Public Meeting granted – to schedule as such.	
10.	**CLOSURE**	
10.1	FH thanked all attendees and wished them a safe drive home.	

DISTRIBUTION LIST

DISTRIBUTION	COPY
1. See Attached Attendance Register	
2. **Circulate: WorleyParsonsRSA, *[office]*** **ATTENTION:** MR	

END OF RECORDS

WorleyParsons

resources & energy

ATTENDANCE REGISTER

Meeting Subject	Arriesfonteint Solar Power Plant, Scoping Phase, Public Meeting		
Location Of Meeting	Danielskuil High School, Danielskuuil	**Document No**	001
Chaired By	Francois Humphries	**Date of Meeting**	8 February 2012
Recorded By	Leanna Rautenbach	**Time Start**	17:30
		Time Finish	19:00

Attended by:

Representative	Name of Firm	Postal Address	Contact Details				Signature
1. T. Govender ~~G. Coetze~~	Solar Reserve		Tel No / Cell No	0834490433	E-mail / Fax No		
2. G. Coetze	Gr. Owner		TelNo / Cell No	0761787999	E-mail / Fax No		
3. L. Rautenbach	WPRSA		TelNo / Cell No	012 425 6300 / 079 5931323	E-mail / Fax No	leanna.rautenbach @worleyparsons .com	
4. F Humphries	WPRSA	=	TelNo / Cell No	0828767453	E-mail / Fax No	francois.humphies @WorleyParsons.com	

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Representative	Name of Firm	Postal Address	Contact Details				Signature
5. I. du Plessis	Idwala Lime	Bus 89, D/Kuil	TelNo	0533840055	E-mail	dps@idwala.co.za	
			Cell No	0832340468	Fax No	0533840659	
6. S. Botha	Idwala Lime P.O. Box 89 Danielskuil 8405	68 Lennox St	TelNo	0843472693	E-mail	bot@idwala.co.za	
			Cell No		Fax No		
7. G. Nieuwoudt	Constantia Safaris	Posbus 324 Danielskuil	TelNo	0824926796	E-mail	info@constantiasafaris.co.za	
			Cell No		Fax No		
8. PC [illegible]	[illegible]	Box 196 Danielskuil	TelNo	0826645258 0827808426	E-mail	[illegible]	
			Cell No		Fax No		
9.			TelNo		E-mail		
			Cell No		Fax No		
10.			TelNo		E-mail		
			Cell No		Fax No		
11.			TelNo		E-mail		
			Cell No		Fax No		

Appendix D Database of Potential and Registered I&AP's

WorleyParsons
resources & energy

WorleyParsons RSA
V3 Forum, 160 Garsfontein Road
Ashlea Gardens 0081
PO Box 36155, Menlo Park 0102, South Africa
Telephone:+27 (0)12 425 6300
Facsimile: +27 (0)12 460 1336
www.worleyparsons.com

24 January 2012

Enquiries: Francois Humphries

ARRIESFONTEIN SOLAR POWER PARK : (DEA REF : 12/12/20/2646; 12/12/20/2647; 12/12/20/2648; 12/12/20/2649)

This letter serves to confirm that the Draft Scoping Reports for the Arriesfontein Solar Power Park have been placed at the physical address bellow for public review from the 25th of January 2012 to the 25th of February 2012.

Date ____________________

LIBRARY NAME	RECEIVED:
Groenwater Public Library	DATE: 25/01/2012.
PHISICAL ADRESS:	NAME: Magdeline
	SIGNATURE:

Yours sincerely
WorleyParsons

FRANCOIS HUMPHRIES

WorleyParsons
resources & energy

WorleyParsons RSA
V3 Forum, 160 Garsfontein Road
Ashlea Gardens 0081
PO Box 36155, Menlo Park 0102, South Africa
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24 January 2012

Enquiries: François Humphries

ARRIESFONTEIN SOLAR POWER PARK : (DEA REF : 12/12/20/2646; 12/12/20/2647; 12/12/20/2648; 12/12/20/2649)

This letter serves to confirm that the Draft Scoping Reports for the Arriesfontein Solar Power Park have been placed at the physical address bellow for public review from the 25th of January 2012 to the 25th of February 2012.

Date ____________________

LIBRARY NAME	RECEIVED:
Postmasburg Public Library	DATE: 25/01/2012
PHISICAL ADRESS:	NAME: Natacia Moemedi
	SIGNATURE:

Municipal Manager
25/01/2012

Yours sincerely
WorleyParsons

FRANCOIS HUMPHRIES

WorleyParsons
resources & energy

WorleyParsons RSA
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www.worleyparsons.com

24 January 2012

Enquiries: Francois Humphries

ARRIESFONTEIN SOLAR POWER PARK : (DEA REF : 12/12/20/2646; 12/12/20/2647; 12/12/20/2648; 12/12/20/2649)

This letter serves to confirm that the Draft Scoping Reports for the Arriesfontein Solar Power Park have been placed at the physical address bellow for public review from the 25th of January 2012 to the 25th of February 2012.

Date ______________

LIBRARY NAME

Danielskuil Public Library

PHISICAL ADRESS:

RECEIVED:

DATE: 25 01 2012

NAME: Anastasia

SIGNATURE:

Yours sincerely
WorleyParsons

FRANCOIS HUMPHRIES

WorleyParsons
resources & energy

WorleyParsonsRSA
V3 Forum, 160 Garsfontein Road
Ashlea Gardens 0081
PO Box 36155, Menlo Park 0102, South Africa
Telephone: +27 (0)12 425 6300
Facsimile: +27 (0)12 460 1336
www.worleyparsons.com

24 January 2012

Enquiries: Francois Humphries

Ref: 260380 PWE

File: 05 -Public Participation

Constantia Safaris

PO Box 324

Danielskuil

8405

Attention Mr Gerrit Nieuwoudt

Dear Sir

DRAFT SCOPING REPORTS FOR THE ARRIESFONTEIN SOLAR POWER PLANT (DEA REF : 12/12/20/2646; 12/12/20/2647; 12/12/20/2648; 12/12/20/2649)

Please find attached the Draft Scoping Reports for the proposed Arriesfontein Solar Power Plant. There are 2 documents which relates to the Photovoltaic and Concentrated Solar Power projects separately. We would appreciate it if you could provide us with comments by the 25th of February 2012.

A Public Meeting is scheduled for the 8th of February 2012 at the Danielskuil Community Hall at 17:30. The aim of the meeting is to discuss the projects and to provide all Interested and Affected Parties the chance to provide us with their comments.

Yours faithfully

WorleyParsons

Francois Humphries

Environmental Scientist

RECEIVED:

DATE: 25.1.2012.

NAME: Hanlie Botha

SIGNATURE:

Vir Gerrit Nieuwoudt.

WorleyParsons
resources & energy

WorleyParsonsRSA
V3 Forum, 160 Garsfontein Road
Ashlea Gardens 0081
PO Box 36155, Menlo Park 0102, South Africa
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www.worleyparsons.com

24 January 2012

Enquiries: Francois Humphries

Ref: 260380 PWE

File: 05 -Public Participation

Kgatelopele Municipality

PO Box 43

Danielskuil

8405

Attention Mr Gustav von Mollendorf

Dear Sir

DRAFT SCOPING REPORTS FOR THE ARRIESFONTEIN SOLAR POWER PLANT (DEA REF : 12/12/20/2646; 12/12/20/2647; 12/12/20/2648; 12/12/20/2649)

Please find attached the Draft Scoping Reports for the proposed Arriesfontein Solar Power Plant. There are 2 documents which relates to the Photovoltaic and Concentrated Solar Power projects separately. We would appreciate it if you could provide us with comments by the 25th of February 2012.

A Public Meeting is scheduled for the 8th of February 2012 at the Danielskuil Community Hall at 17:30. The aim of the meeting is to discuss the projects and to provide all Interested and Affected Parties the chance to provide us with their comments.

Yours faithfully

WorleyParsons

Francois Humphries

Environmental Scientist

RECEIVED:

DATE: 25 January 2012

NAME: Clarissa de Koker

SIGNATURE: Clarke

Authorities							
Nnditsheni	Ramuhulu		☐ Email	☑ Mail	☐ Fax	☐ Telephone	Northern Cape Province
Anneliza	Collet		☐ Email	☑ Mail	☐ Fax	☐ Telephone	Department of Agriculture
Munsipalities							
Willem	Engelbrecht	Muncipal Manager	☐ Email	☐ Mail	☐ Fax	☐ Telephone	Kgatelopele Local Municipality
Moses	Moshia	Municipal Manager	☑ Email	☐ Mail	☐ Fax	☐ Telephone	Tsatsabane Local Municipality
			☑ Email	☑ Mail	☑ Fax	☑ Telephone	
Community							
Gerrit	Niewoudt	Neighbour	☑ Email	☐ Mail	☐ Fax	☐ Telephone	
Piet	Austin	Neighbour	☐ Email	☑ Mail	☐ Fax	☐ Telephone	
Keith	Williams	Neighbour	☐ Email	☑ Mail	☐ Fax	☐ Telephone	
Albertus	Viljoen	CEO	☑ Email	☐ Mail	☐ Fax	☐ Telephone	Tsiping Water Users Association
Johan	Visser	Community	☑ Email	☐ Mail	☐ Fax	☐ Telephone	
Christo	Steenkamp	Community	☐ Email	☐ Mail	☐ Fax	☑ Telephone	
Kobus	van Niekerk	Neighbour	☐ Email	☑ Mail	☐ Fax	☐ Telephone	
Arrie	Fouries	Community	☐ Email	☑ Mail	☐ Fax	☐ Telephone	
J	du Plessis	Idwala Mine	☑ Email	☐ Mail	☐ Fax	☐ Telephone	
S	Botha	Idwala Mine	☑ Email	☐ Mail	☐ Fax	☐ Telephone	
C	Groenewald		☑ Email	☐ Mail	☐ Fax	☐ Telephone	Council for Geosciences
N	Maas		☑ Email	☐ Mail	☐ Fax	☐ Telephone	Kalagadi SAJWV
Kevin Leask			☑ Email	☐ Mail	☐ Fax	☐ Telephone	ESKOM
			☑ Email	☐ Mail	☐ Fax	☑ Telephone	

Appendix E Proof of the Notice of the Availability of the Draft Scoping Report for Review

WorleyParsons
resources & energy

EcoNomics™

KENNISGEWING VAN OMGEWINGSIMPAKBEPLINGS PROSESS

Kennis word hiermee gegee kragtens die Omgewingsimpakbepaling (OIB) Regulasies wat verskyn in Regeringskennisgewings Nr. R543 tot 546 (2010), afgekondig ingevolge Artikel 24(5) van die Wet op Nasionale Omgewingsbestuur (Wet Nr. 107 van 1998) en die Wet op Nasionale Omgewingsbestuur: Afval (Wet Nr. 107 van 1998), dat SolarServe SA (Edms) BPK van voorneme is om gelyste aktiwiteite te onderneem wat 'n Omgewingsmagtiging van die Nasionale Departement van Omgewingsake (DOS) vereis.

ARRIESFONTEIN SONTERMIESE-ENERGIEKRAG PARK

DOS-VERW : 12/12/20/2649, 12/12/20/2647, 12/12/20/2648, 12/12/20/2646

PROJEKBESKRYWING

SolarReserve SA (Edms) Bpk stel die konstruksie en bedryf voor van n' 325 Megawatt (MW) sontermiese – energie krag park op die plaas Arriesfontein 267, Barkley Wes RD, wat gaan bestaan uit n' fotovoltaise (FV) en n' gekonsentreerde sontermiese krag aanleg. Die voorgestelde ontwikkelings ligging is geleë 32 km buite Danielskuil, binne die grense van die Kgatelopele Lokale and Siyanda Distrik Munisipaliteite.

PUBLIEKE DEELNAME PROSES

Partye of persone wat as 'n belangstellende en geraakte party (B&GP) wil registreer ten einde bykomende inligting rakende hierdie aansoek te ontvang, word versoek om hulle kontakbesonderhede en kommentaar in verband met die projek aan WorleyParsons RSA te stuur. Let daarop dat kommentaar binne 30 dae van publikasie aan die omgewingskonsultant voorgelê moet word. 'n Agtergrondinligtingsdokument is op versoek beskikbaar.

KONSEP OMVANGBEPLAINGSVERSLAG

As deel van die oppenbare deelname proses sal die konsep Omvangbepalingsverslag (OBV) vir openbare hersiening beskikbaar gestel word vir n' periode van 30 dae vanaf 25 Januarie 2012 tot 25 Februarie 2012. Die Omvangbepalingsverslag sal beskikbaar wees aanlyn by www.kv3engineers.com en by die volgende liggings:

- Groenwater Mobiele Biblioteek
- Tsantsabane en Kgatolopele Plaaslike Munisipaliteit Kantore
- Postmasburg en Daniëlskuil Publieke Biblioteke

HOE OM TE REGISTREER

Partye of persone wat as 'n belangstellende en geraakte party (B&GP) wil registreer word versoek om hulle kontak besonderhede and kommentaar met betrekking tot die voorgestelde projek aan WorleyParsons RSA te stuur, by die onderstaande kontak besonderhede.

OPENBARE VERGADERINGS

All B&GP word uitgenooi om die openbare / fokusgroepvergaderings by te woon wat op die volgende datum gehou word:

Datum: 8 Februarie 2012
Ligging: Danielskuil Gemeenskaps Saal
Tyd: 17:30

DATUM VAN KENNISGEWING

12 Januarie 2012

OMGEWINGSIMPAKPRAKTISYN

WorleyParsons RSA
Mnr. Francois Humphries

Posbus 36155
Menlo Park
0102
Telefoon: 012 425 6300
Faks: 012 460 9978
Epos: francois.humphries@worleyparsons.com

Incorporating KV3 ENGINEERS

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NOTICE OF ENVIRONMENTAL IMPACT ASSESSMENT: PUBLIC PARTICIPATION PROCESS

Notice is hereby given in terms of the Environmental Impact Assessment (EIA) Regulations, published in Government Notices No. R543 to 546 (2010), promulgated in terms of Section 24(5) of the National Environmental Management Act (Act No 107 of 1998) and the National Environmental Management: Waste Act (Act No 59 of 2008), of the availability of the Draft Scoping Report for public review and comment and the hosting of a public meeting for the proposed project:

ARRIESFONTEIN SOLAR ENERGY POWER PARK

DEA REF: 12/12/20/2649, 12/12/20/2647, 12/12/20/2648, 12/12/20/2646

PROJECT DESCRIPTION

SolarReserve SA (Pty) LTD is proposing to construct a 325 MegaWatt (MW) Solar Energy Power Park on the Farm Arriesfontein 267, Barkley Wes RD, Siyanda District Municipal Region, comprising of both Photovoltaic (PV) and Concentrated Solar Power (CSP) Technology. The proposed development site is situated an approximate 32 kms outside of the town Danielskuil. The development site is located within the institutional boundaries of the Kgatelopele Local and Siyanda District Municipalities.

PUBLIC PARTICIPATION PROCESS

All interested and affected parties (I&APs) wishing to participate in the Public Participation Process is invited to comment on the Draft Scoping Report and to attend a public meeting. All I&AP comment must be included and addressed in the final report prior to submission to the competent authority. This includes comments from the public meetings as well.

DRAFT SCOPING REPORT

The Draft Scoping Report (DRS) will be available for review and comment for a period of 30 days from 18 November 2011 to 28 January 2012. The DSR will be available online at www.kv3engineers.com and at the following venues:

- Groenwater Mobile Library
- Tsantsabane and Kgatolopele Local Municipal Offices
- Postmasburg and Daniëlskuil Public Libraries

Registered I&APs can submit comments/or concerns in relation to the project to the WorleyParsons RSA contact person below on or before 28 January 2012.

HOW TO REGISTER

Parties or persons wishing to register as an I&AP are requested to forward their contact details and comments/or concerns in relation to the project to the WorleyParsons RSA contact person provided below.

PUBLIC MEETING

All I&APs are invited to the public meetings to be hosted at the following:

Date: 8 February 2012
Venue: Danielskuil Community Hall
Time: 17:30

DATE OF NOTICE

12 January 2010

ENVIRONMENTAL ASSESSMENT PRACTITIONER

WorleyParsons RSA
Mr. Francois Humphries

P.O. BOX 36155
Menlo Park
0102
Telephone: 012 425 6300
Fax: 012 460 9978
Email: francois.humphries@worleyparsons.com

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Appendix F Written Comments and Concerns Recieved

Department:
Agriculture, forestry & fisheries
REPUBLIC OF SOUTH AFRICA

Directorate Land Use and Soil Management, Private Bag x120, Pretoria, 0001
Delpen Building, c/o Annie Botha & Union Streets, Riviera

From: Director: Land Use and Soil Management
Tel: (012) 319 7634 Fax: (012) 329 5938 e-mail: agriland@nda.agric.za

WORLEYPARSONS RESOURCES & ENERGY
P.O. Box 36155
MENLO PARK
SOUTH AFRICA
0102

2012/02/13

Dear Sir/Madam

This serves as a notice of receipt and confirms that your application has been captured in our electronic AgriLand tracking and management system. It is strongly recommended that you use the on-line AgriLand application facility in future.

Detail of your application as captured:

Type: **SCOPING REPORTS**
Your reference number: **12/12/20/2646**
Dated: **24 JANUARY 2012**

Please use the following reference number in all enquiries:

AgriLand reference number: 2012_02_0101

Enquiries can be made to the above postal, fax or e-mail address.

Yours sincerely,

L. Mongoato
pp DIRECTOR: LAND USE AND SOIL MANAGEMENT

Online application available at: http://www.agis.agric.za/agriland

Appendix G – Agricultural Potential and Soil Scoping Study

SCOPING REPORT

On contract research for

WORLEY PARSONS

SOIL INFORMATION FOR PROPOSED ARRIESFONTEIN SOLAR THERMAL ENERGY PLANT, NEAR DANIELSKUIL, NORTHERN CAPE

By

D.G. Paterson (Pr. Sci. Nat. 400463/04)

Report Number GW/A/2011/79

November 2011

ARC-Institute for Soil, Climate and Water,
Private Bag X79, Pretoria 0001, South Africa

Tel (012) 310 2500 Fax (012) 323 1157

DECLARATION

I hereby declare that I am qualified to compile this report as a registered Natural Scientist and that I am independent of any of the parties involved and that I have compiled an impartial report, based solely on all the information available.

D G Paterson
November 2011

CONTENTS **Page**

1. TERMS OF REFERENCE

The ARC-Institute for Soil, Climate and Water (ARC-ISCW) was contracted by Worley Parsons to undertake a soil investigation near Danielskuil, in the Northern Cape Province. The purpose of the investigation is to contribute to the scoping phase of the Environmental Impact assessment (EIA) process for the proposed Arriesfontein solar energy facility.

Scoping Report

The scoping report must include:

» a description of the environment that may be affected by the activity and the manner in which the environment may be affected by the proposed project

» a description and evaluation of environmental issues and potential impacts (including direct, indirect and cumulative impacts) that have been identified

» Direct, indirect and cumulative impacts of the identified issues must be evaluated within the Scoping Report in terms of the following criteria:

- the nature, which shall include a description of what causes the effect, what will be affected and how it will be affected;
- the extent, wherein it will be indicated whether the impact will be local (limited to the immediate area or site of development), regional, national or international

» a statement regarding the potential significance of the identified issues based on the evaluation of the issues/impacts

» a comparative evaluation of the identified feasible alternatives, and nomination of a preferred alternative for consideration in the EIA phase

» identification of potentially significant impacts to be assessed within the EIA phase and details of the methodology to be adopted in assessing these impacts.

The objectives of the study are;

- To obtain all existing soil information and to produce a soil map of the specified area as well as

- To assess broad agricultural potential.

2. SITE CHARACTERISTICS

2.1 Location

An area was investigated lying approximately 25 km to the east of the town of Danielskuil. The area comprises parts of the farm Arriesfontein 267. The area lies between 28° 14' and 28° 19' S and between 23° 45' and 23° 48' E. The position of the site is shown on the map in Figure 1.

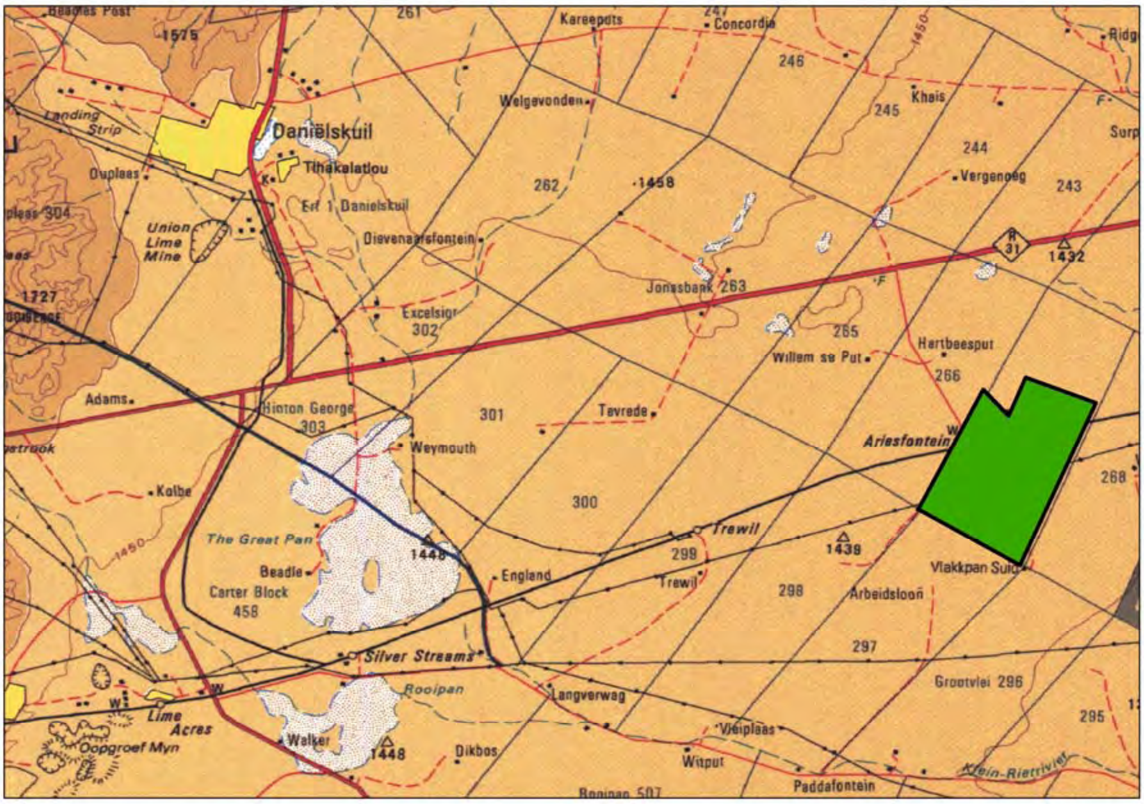


Figure 1 Locality map

2.2 Terrain

The site is almost flat and lies at a height of approximately 1 415 metres above sea level, sloping to the south-east. No permanent drainageways are present in the area and only a few small dry pans occur.

2.3 Climate

The climate of the study area (Koch & Kotze, 1986) can be regarded as warm to hot with rain in summer and dry winters. The long-term average annual rainfall in this region of the Northern Cape is only 329 mm, of which 142 mm, or 80%, falls from

November to April. Rainfall is erratic, both locally and seasonally and therefore cannot be relied on for agricultural practices. The average evaporation is 2 105 mm per year, peaking at 8.6 mm per day in December.

Temperatures vary from an average monthly maximum and minimum of 31.7ºC and 16.2ºC for January to 18.9ºC and 0.2ºC for July respectively. The extreme high temperature that has been recorded is 41.8ºC and the extreme low –10.0ºC. Frost occurs most years on 33 days on average between late May and early September.

2.4 Parent Material

The geology of the area comprises Tertiary and Quaternary deposits (Geological Survey, 1977). In the west, sandy deposits occur, while surface limestone occurs in the east

3. METHODOLOGY

Existing soil information was obtained from the map sheet 2822 Postmasburg (Eloff, Idema & Bennie, 1986 from the national Land Type Survey, published at 1:250 000 scale. A land type is defined as an area with a uniform terrain type, macroclimate and broad soil pattern. The soils are classified according to MacVicar *et al* (1977).

The area under investigation is covered by two land types, as shown on the map in the Appendix, namely:

- **Ae9** (Deep, red, freely-drained soils, high base status)
- **Fc4** (Shallow soils, usually calcareous)

It should be clearly noted that, since the information contained in the land type survey is of a reconnaissance nature, only the general dominance of the soils in the landscape can be given, and not the actual areas of occurrence within a specific land type. Also, other soils that were not identified due to the scale of the survey may also occur. **The site was not visited during the course of this study, and so the detailed composition of the specific land types has not been ground-truthed.**

A summary of the dominant soil characteristics of each land type is given in Table 2 below (the colours correspond to those used in the map in the Appendix).

The distribution of soils with high, medium and low agricultural potential within each land type is also given, with the dominant class shown in **bold type**.

4. SOILS

A summary of the dominant soil characteristics is given in **Table 2** below.

Table 2 Land types occurring (with soils in order of dominance)

Land Type	Depth (mm)	Dominant soils	Percent of land type	Characteristics	Agric. Potential (%)
Ae9	450-1200 200-450	Hutton 33 Hutton 33	37% 32%	Red, sandy soils, occasionally on hardpan calcrete Red-brown, sandy topsoils on hard rock and calcrete	High:0.0 Mod: 41.4 **Low: 58.6**
Fc4	100-250 100-250	Mispah 22 Mispah 20	71% 12%%	Grey-brown, sandy, calcareous topsoils on calcrete Grey-brown, sandy, calcareous topsoils on rock	High:0.0 Mod: 0.0 **Low: 100.0**

5. AGRICULTURAL POTENTIAL

The area comprises a mixture of red, sandy soils, sometimes deep, in the west, with shallow calcareous soils in the east, as can be seen from the information contained in Table 2. The very low rainfall in the area (Section 2.3) means that the only means of cultivation would be by irrigation and the Google Earth image of the area shows absolutely no signs of any agricultural infrastructure and certainly none of irrigation.

Figure 2 Google Earth image of study area

The climatic restrictions mean that this part of the Northern Cape is suited at best for grazing and here the grazing capacity is low, around 20 ha/large stock unit (ARC-ISCW, 2004).

6. IMPACTS

The major impact on the natural resources of the study area would be the loss of potentially arable land due to the construction of the various types of infrastructure. However, due to the dry and hot climate of the region (Section 2.3), this impact would in all probability be of limited significance and would be local in extent. At the end of the project life, it is anticipated that removal of the structures would enable the land to be returned to more or less a natural state following rehabilitation, with little impact, especially given the low prevailing agricultural potential.

The impact can be summarized as follows:

Table 3 Impact significance

Nature of impact	Loss of agricultural land	Land that is no longer able to be utilized due to construction of infrastructure
Scale of impact	Site only (1)	Confined to areas within the site where infrastructure will be located
Duration of impact	Long-term (4)	Will cease if operation of activity ceases
Probability of impact	Highly probable (4)	
Magnitude of impact	Low (4)	
Significance of impact	Moderate (4 + 4 + 1) x 4 = **36**	Mainly due to low potential of area, as well as nature of infrastructure

Mitigation factors

The main mitigation would be to ensure that as little pollution or other non-physical disturbance occurs. As far as the soils are concerned, the predominance of shallower, calcareous soils in the east (land type Fc4) means that this area is most recommended for placement of infrastructure if possible.

Conclusion

Due mainly to the prevailing unfavourable climatic conditions for arable agriculture, as well as the prevalence of soils with limited depth, it is not envisaged that any more detailed soil investigation will be required.

REFERENCES

ARC-ISCW, 2004. Overview of the status of the agricultural natural resources of South Africa (First Edition). ARC-Institute for Soil, Climate and Water, Pretoria

Eloff, J.F., Idema, S.W.J. & Bennie, A.T.P., 1986. Land types of the map 2822 Postmasburg. Field information. *Mem. Nat. Agric. Res. S. Afr.* No. 3. ARC-Institute for Soil, Climate and Water, Pretoria.

Geological Survey, 1977. 1:250 000 scale geological map 2822 Postmasburg. Department of Mineral and Energy Affairs, Pretoria.

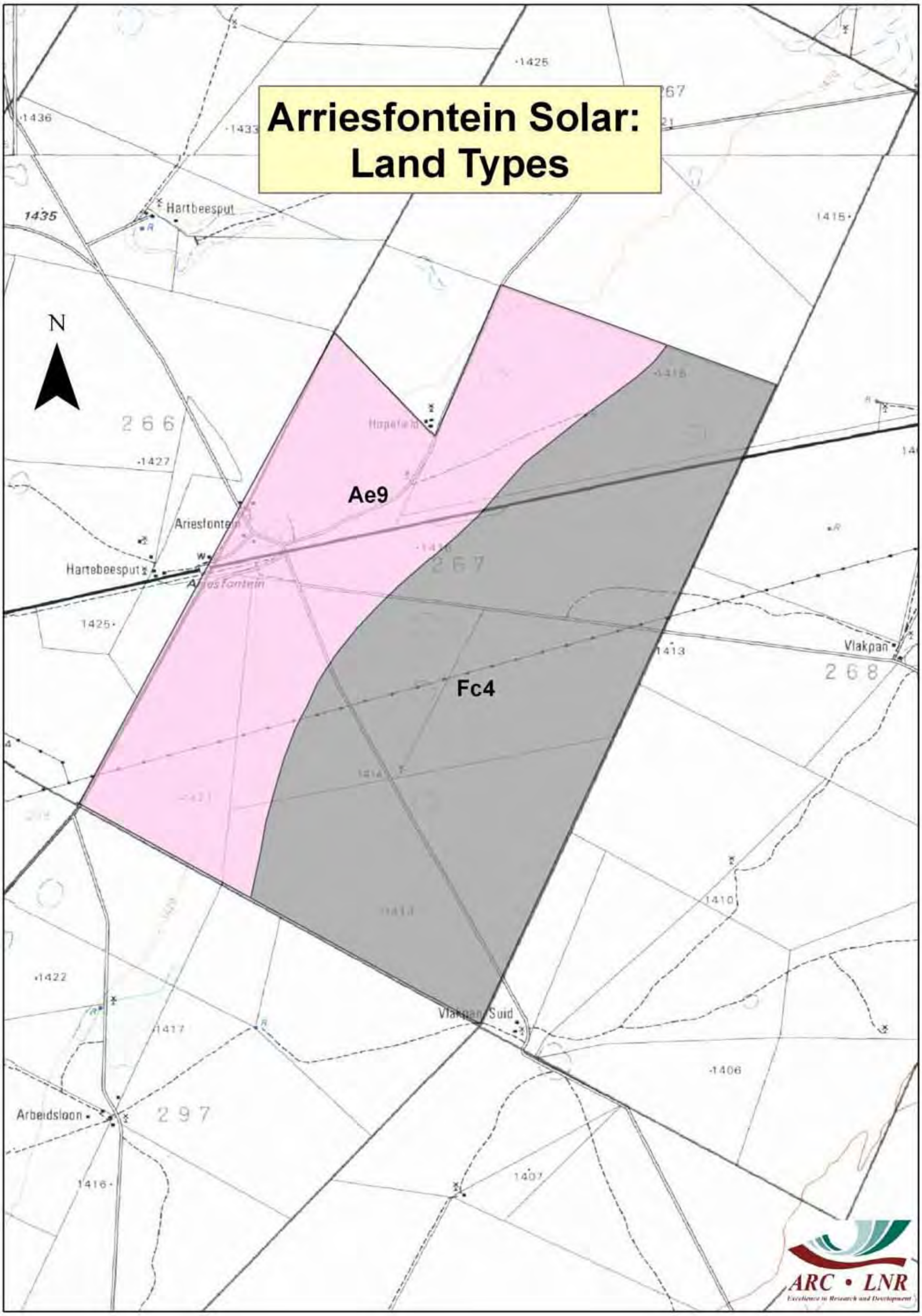
Koch, F.G.L. & Kotze, A.V., 1986. Climate data. In: Land types of the maps SE27/20 Witdraai, 2720 Noenieput, 2722 Kuruman, 2724 Christiana, 2820 Upington, 2822 Postmasburg. *Mem. Agric. nat. Res. S. Afr*. No. 3. Department of Agriculture and Water Supply, Pretoria.

MacVicar, C.N., de Villiers, J.M., Loxton, R.F, Verster, E., Lambrechts, J.J.N., Merryweather, F.R., le Roux, J., van Rooyen, T.H. & Harmse, H.J. von M., 1977. Soil classification. A binomial system for South Africa. ARC-Institute for Soil, Climate & Water, Pretoria.

Soil Classification Working Group, 1991. Soil classification. A taxonomic system for South Africa. ARC-Institute for Soil, Climate and Water, Pretoria.

APPENDIX

MAP OF LAND TYPES


Arriesfontein Solar:
Land Types
N
Ae9
Fc4
Hartbeesput
Hopefield
Ariesfontein
Hartebeesput
Vlakpan
Vlakpan Suid
Arbeidsloon
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ARC • LNR

Appendix H – Air Quality Scoping Study

Project done on behalf of
Worley Parsons RSA (Pty) Ltd

SCOPING REPORT: AIR QUALITY IMPACT ASSESSMENT FOR THE PROPOSED 325 MW SOLAR ENERGY POWER PARK ARRIESFONTEIN, NORTHERN CAPE

Report No.: APP/11/ WPL-03 Rev 0.0

DATE: January 2012

G Kornelius
R Bornman

Airshed Planning Professionals (Pty) Ltd

P O Box 5260
Halfway House
1685

Tel : +27 (0)11 805 1940
Fax : +27 (0)11 805 7010
e-mail : mail@airshed.co.za

REPORT DETAILS

Reference	APP/11/WPL-02
Status	Revision 0
Report Title	Scoping Report: Air Quality Impact Assessment for the Proposed 325 MW Solar Energy Power Park Installation at Arriesfontein, Northern Cape
Date	January 2012
Client	Worley Parsons RSA (Pty) Ltd
Prepared by	Gerrit Kornelius, Pr Eng PhD (Chem Eng) MBA (University of Pretoria) Rochelle Bornman MPhil. GIS and Remote Sensing (Cambridge)
Notice	Airshed Planning Professionals (Pty) Ltd is a consulting company located in Midrand, South Africa, specialising in all aspects of air quality, ranging from nearby neighbourhood concerns to regional air pollution impacts. The company originated in 1990 as Environmental Management Services, which amalgamated with its sister company, Matrix Environmental Consultants, in 2003.
Declaration	Airshed is an independent consulting firm with no interest in the project other than to fulfil the contract between the client and the consultant for delivery of specialised services as stipulated in the terms of reference.
Copyright Warning	Unless otherwise noted, the copyright in all text and other matter (including the manner of presentation) is the exclusive property of Airshed Planning Professionals (Pty) Ltd. It is a criminal offence to reproduce and/or use, without written consent, any matter, technical procedure and/or technique contained in this document.
History	Revision 0 – First Draft

1 INTRODUCTION

1.1 Background

SolarReserve SA (Pty) Ltd is proposing to construct a 325 MegaWatt (MW) Solar Energy Power Park on the farm Arriesfontein, approximately 32 km (by road) outside Daniëlskuil in the Northern Cape. The Power Park will comprise of both Photovoltaic (PV) and Concentrated Solar Power (CSP) technology. The CSP plant will utilize thousands of large tracking mirrors (also known as heliostats) to track the sun and reflect beam radiation to a common focal point. The plant will obtain a power output of approximately 100 MW and enable around 12-18 hours of energy storage. It needs to be constructed on a relatively flat terrain of approximately 6 km^2. The PV development will use a series of photovoltaic solar panels in rows, which are collectively known as a PV array. Three PV arrays occupying 150 ha each will produce 225 MW of power in total.

The purpose of the proposed facility is to add new capacity for the utilization of renewable energy so as to supplement the national electricity network. Airshed Planning Professionals (Pty) Ltd was appointed to provide an assessment of the potential air pollution associated with the construction, operation and decommissioning of the proposed development.

1.2 Site Overview

The general location of the proposed site is indicated in

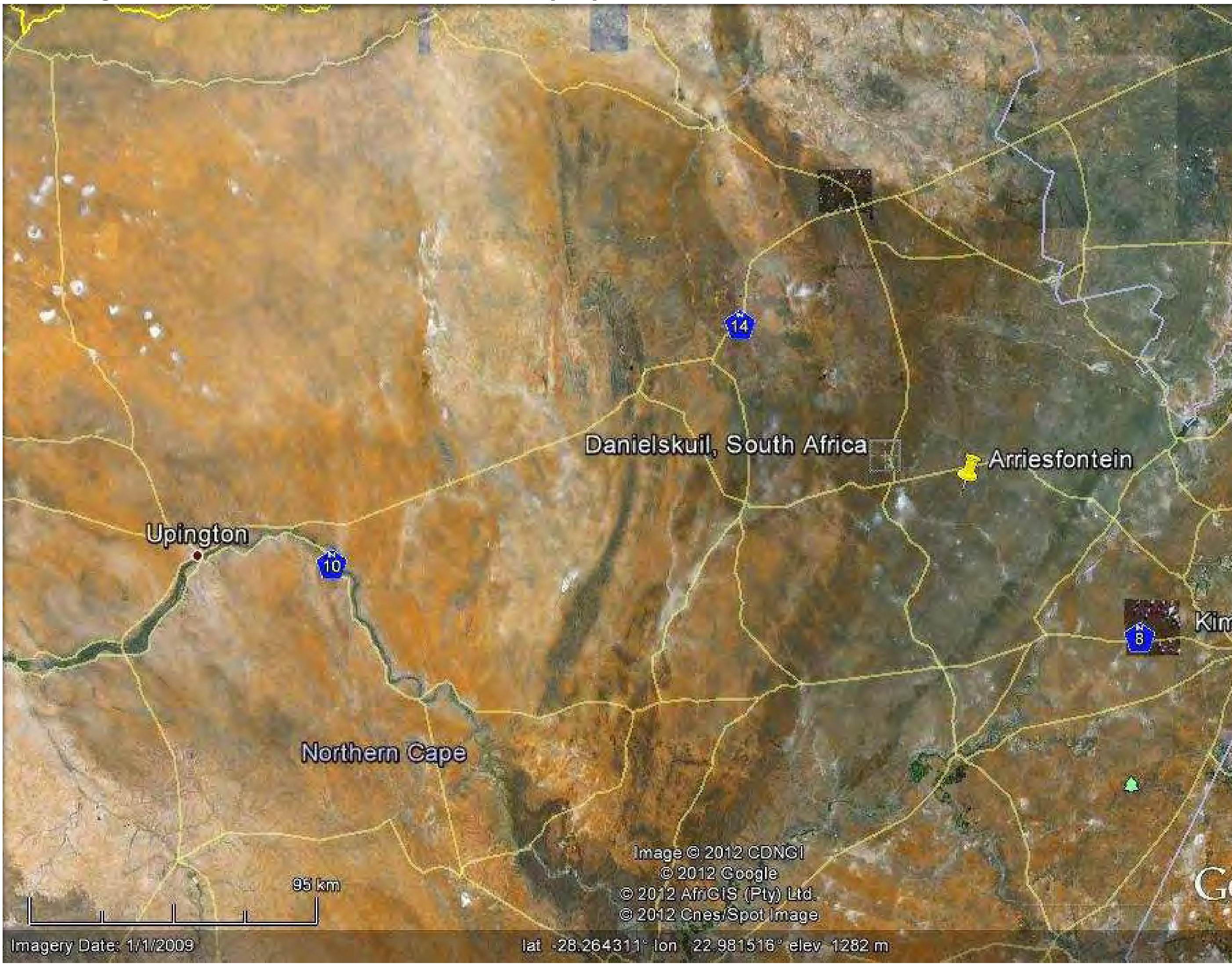

Figure 1-1. The site is located in Siyanda District Municipality on the road between Daniëlskuil and Barkley West (R31) and is approximately 41 km to the west of Afrisam's cement production facility at Ulco. The minor town of Delportshoop is situated another 15 km to the southeast of Ulco. The terrain is relatively flat, which makes it suitable for the construction of the CSP plant. The region is characterised by a mild to hot climate receiving most of it's rainfall during the summer months. Average daytime temperatures range from 19.8°C in July to 33°C in February. Average rainfall for the past five years has been recorded as 195 mm. Important topographical features include the Orange River to the south; industrial and road infrastructure includes Upington Airport and the N14 and N10 routes which serve as important national access routes for tourists.

1.3 Surrounding Receptors

The closest major sensitive receptor is Daniëlskuil. Other smaller sensitive receptors in the immediate vicinity of the proposed development will be determined by means of a site visit.

Figure 1-1: Location of proposed Solar Energy Power Park at Arriesfontein Farm, near Daniëlskuil

1.4 Meteorology

1.4.1 Surface wind field

The analysis of hourly average meteorological data is necessary to facilitate a comprehensive understanding of the ventilation potential of the site, and to provide the input requirements for the dispersion simulations. A comprehensive data set for at least one year of detailed hourly average wind speed, wind direction and temperature data are needed for the dispersion simulations. Meteorological data was obtained from the closest weather station, which is the Agricultural Research Council Weather Station in Ulco for the Period January 2008 to December 2010 and is summarised in figure 1-2 below.

Wind roses comprise 16 spokes, which represent the directions from which winds blew during the period. The colours reflected the different categories of wind speeds, the yellow area, for example, representing winds of 1 m/s to 2 m/s. The dotted circles provide information regarding the frequency of occurrence of wind speed and direction categories. For the current wind roses, each dotted circle represents a 6 % frequency of occurrence. The figure given in parenthesis described the frequency with which calms occurred, i.e. periods during which the wind speed was below 1 m/s.

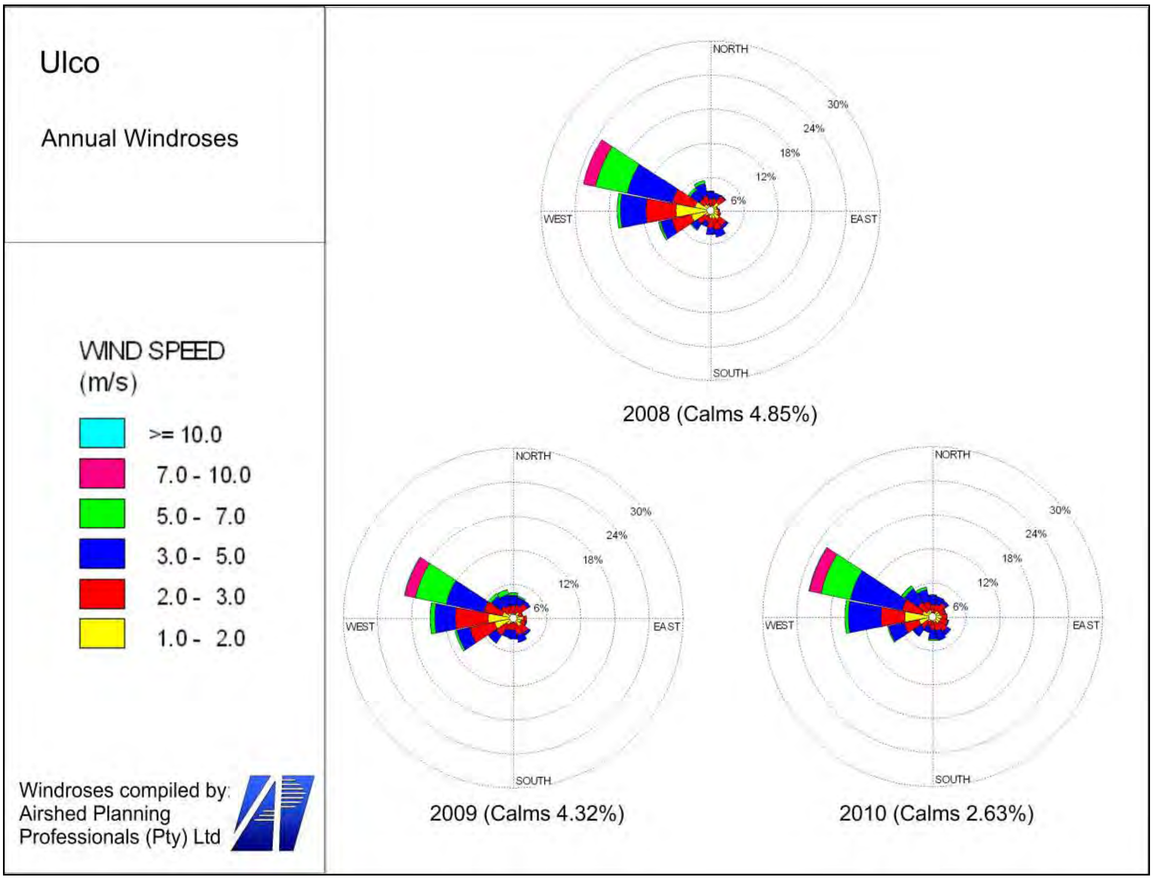

Figure 1-2: Annual wind roses for the ARC Ulco weather station

The wind dominates from the west-north-west with a 22% frequency of occurrence for the total period. Wind speeds of above 7 m/s are recorded from this dominant wind direction with few calm periods of 4%. Seasonal variations are illustrated in Figure 3; during winter and autumn months the wind is almost exclusively from the west and west north west, while in summer and spring months there is an increase in wind from the south west and south east sectors.

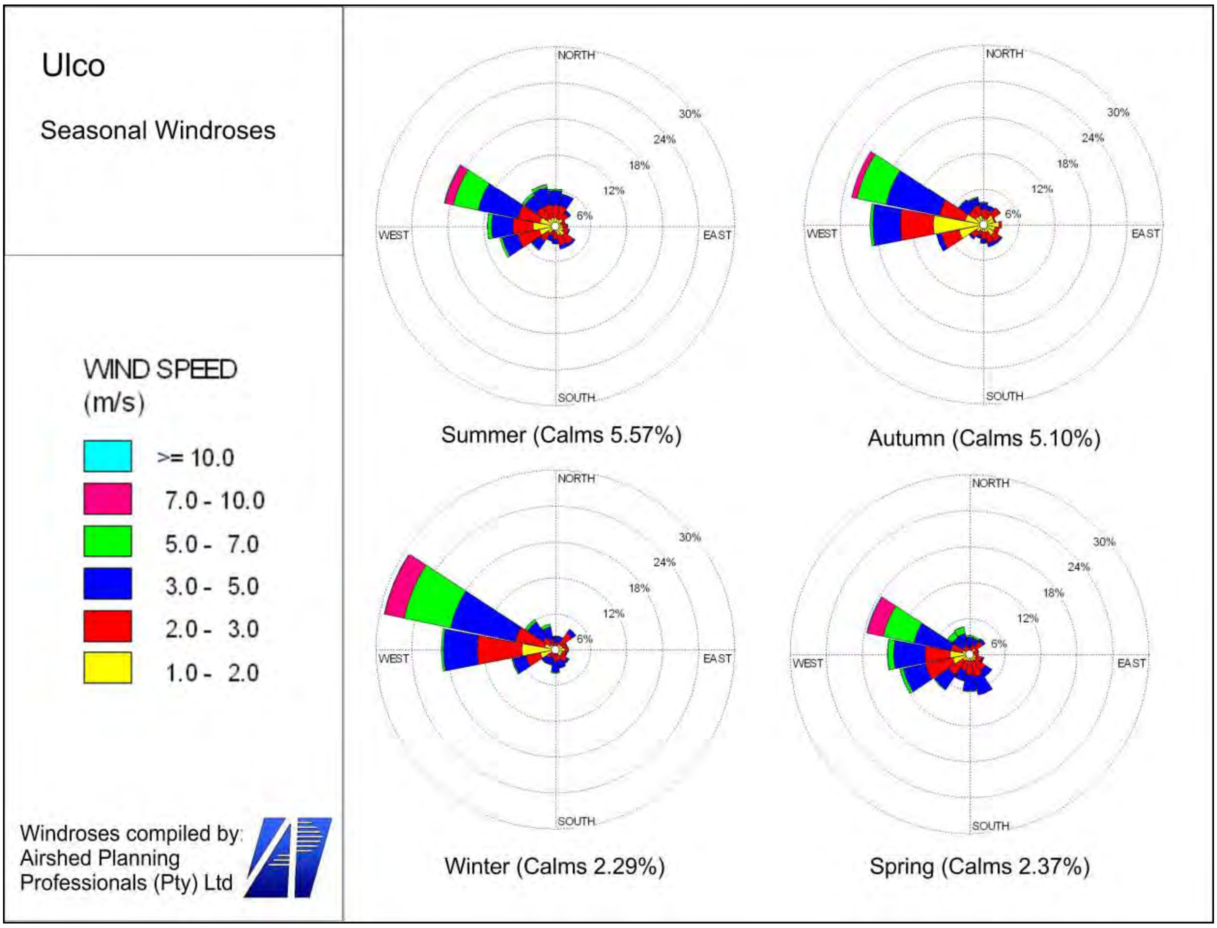

Figure 3-1-2 Seasonal wind roses for the period January 2008 to December 2010

Annual and seasonal wind roses effectively reflect the synoptic systems affecting a region. In order to investigate the impact of meso-scale circulation patterns it is also essential to consider the diurnal variations in the wind field at the site. The typical diurnal variations in the wind regime are evident in the day- and night-time wind roses illustrated in Figure1-4.

Increased wind frequencies from the southeast sector are noted for daytime hours with calm periods of 3.42% occurring. Nocturnal airflow is characterised by more frequent winds from the west with barely any wind from the east. Night-times have an increase in calm periods (4.54%) as is typical of the night-time flow regime in most regions.

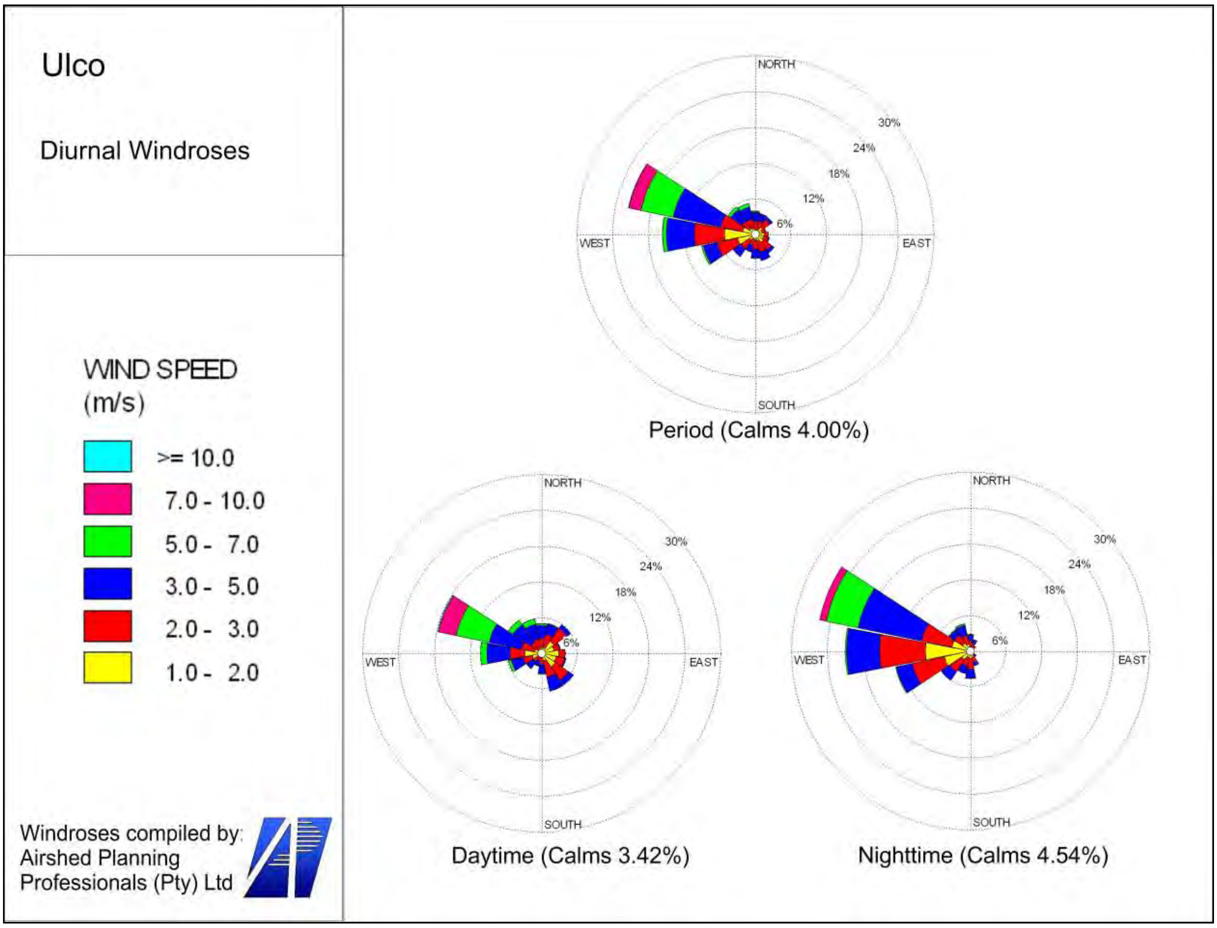

Figure1-4: Diurnal wind roses for the period January 2008 to December 2010.

1.4.2 Temperature

Air temperature is important, both for determining the effect of plume buoyancy (the larger the temperature difference between the plume and the ambient air, the higher the plume is able to rise), and determining the development of the mixing and inversion layers. Measured average maximum, mean and minimum temperatures for Ulco for the period January 2008 to December 2010 are given in Table 1-1.

The annual mean temperature for Ulco was measured as 19.6°C, based on the three year period. Average daily maximum temperatures range from 32.9°C in January to 23.5°C in June, with daily minima ranging from 13.8°C in January to -4.1°C in July.

Table 1-1: Minimum, maximum and mean temperature for Ulco for the period January 2008 to December 2010.

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
KIMBERLY	Maximum	35.9	35.8	33.9	30.7	28.3	23.7	25.3	29.5	33.4	36.3	37.5	37.9
	Mean	24.4	24.6	21.5	18.0	16.1	11.6	12.1	15.6	16.7	23.1	24.4	26.8
	Minimum	13.8	13.5	8.6	3.1	6.1	0.9	-4.1	1.5	-0.6	6.9	11.7	12.0

The average monthly temperature for each hour of the day is represented in Figure 1-5.

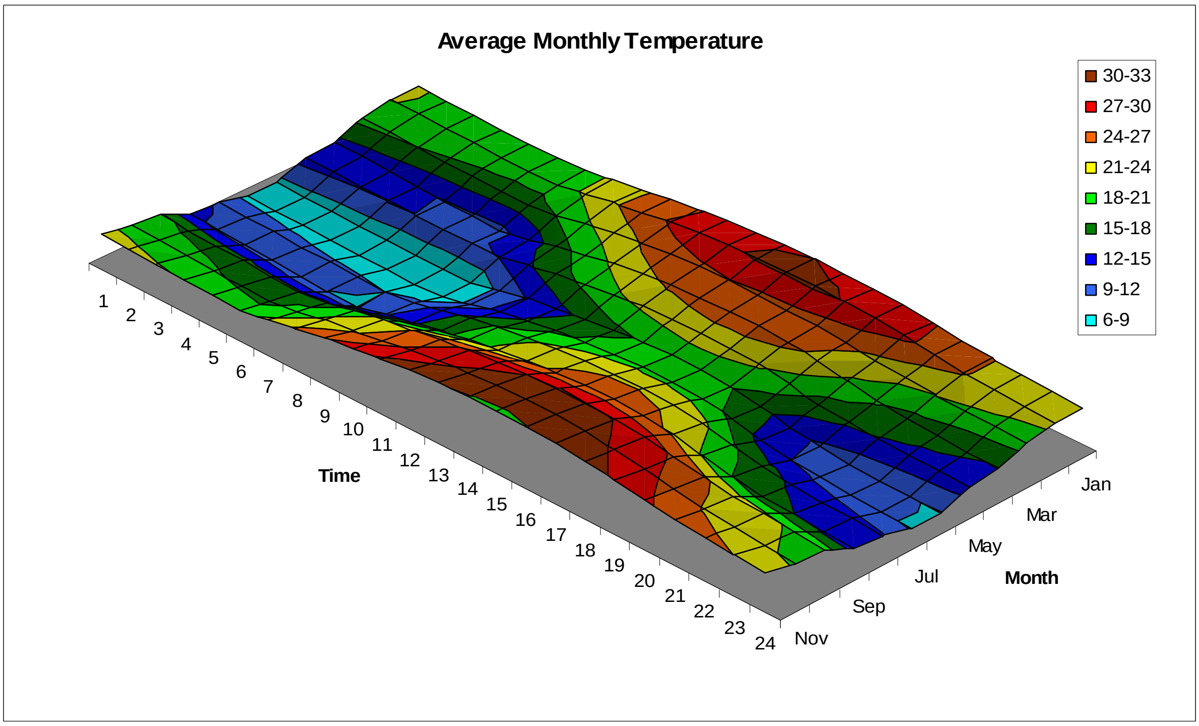

Figure 1-5 Average monthly temperature for each hour of the day

1.4.3 Precipitation

Precipitation represents an effective removal mechanism of atmospheric pollutants. Rainfall in the region falls mainly in summer, October to March (77%).

Table 1-2: Long-term average monthly rainfall for Kimberly (Schulze, 1986).

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Total
Average rainfall (mm)	61	65	73	42	19	7	7	9	13	28	43	52	419
Average no. Of rain days	9.1	9	9.8	6.9	4.3	2	1.7	1.8	2.4	5.2	7.1	7.4	66.7

The number of rainfall days (recorded when 0.1 mm or more is monitored) is 66.7 per annum. The long-term annual average rainfall for Kimberly for the period 1894-1984 is given in Table 1-3 (Schulze, 1986).

The average monthly rainfall and number of rainy days for the period January 2008 to December 2010 is summarised in Table 1-1-4 and Table1-5 respectively

Table 1-4 Recorded monthly rainfall in Ulco (mm).

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Total
2008	70	55	46	31	110	18	0	0	0	3	56	40	430
2009	81	143	13	10	0	0	6	0	0	61	19	15	348
2010	241	140	85	23	12	0	0	0	0	1	47	59	607

Table1-5 Number of days with more than 0.1 mm recorded rainfall in Ulco.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Total
2008	15	12	13	6	9	5	1	1	1	5	8	12	88
2009	15	19	8	5	1	3	2	2	1	11	7	7	81
2010	19	11	13	10	6	2	1	1	2	5	10	12	92

The recorded rainfall (in mm) of the measured weather data for the period 2008 to 2010 corresponds well to the long term data, while the number of rainfall days recorded in Ulco for this period is significantly higher that the long term data for Kimberly.

The recorded monthly rainfall for Ulco for the period 2008 to 2010 is presented in **Error! Reference source not found.**1-6.

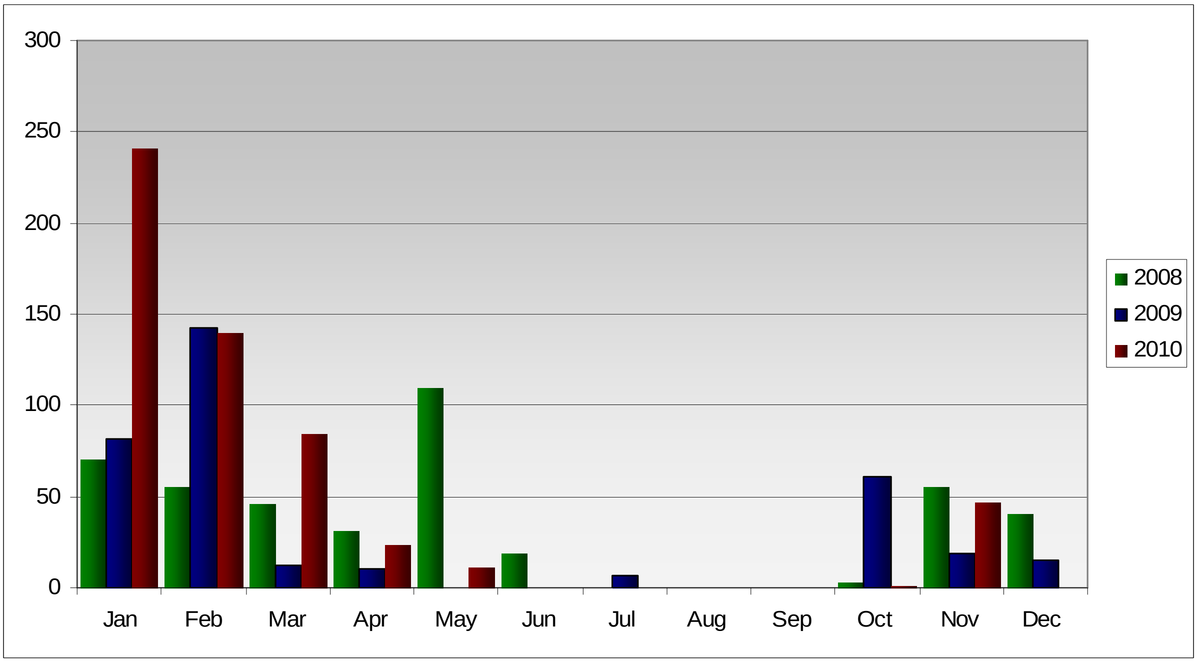

Figure 1-6: Ulco precipitation history (mm per month)

1.5 Current Air Quality

A comprehensive emissions inventory has not been completed for the region to date, and no ambient air quality monitoring around the proposed site has been carried out. However, due to the remoteness of the proposed project location it is expected that the concentrations of criteria pollutants[1] would be low. Existing sources of air pollution in the study area will be identified via a site visit.

1.6 Air Quality Impact Considerations

Impacts from a solar energy project can result from the construction, operation and maintenance and decommissioning phases. Of these, the construction phase is expected to contribute most to total air pollution from the project.

The air pollution due to construction would include (i) gaseous emissions from construction vehicle exhausts, including carbon monoxide (CO), nitrogen dioxide (NO_2), sulphur dioxide (SO_2) and inhalable particulate matter with diameter less than 10 µm (PM_{10}), (ii) diesel emissions from large construction equipment and generators, (iii) volatile organic compounds[2] releases from storage and transfer of vehicle/ equipment fuels and treatment of

[1] Criteria pollutants contained in the Department of Environmental Affairs National Ambient Air Quality Standards include sulphur dioxide, oxides of nitrogen, carbon monoxide, benzene, lead, ozone and inhalable particulates (i.e. airborne particles with aerodynamic diameters of 10 micrometres or less, or PM_{10})
[2] Volatile organic compounds (VOC) are carbon-containing gases and vapours such as gasoline fumes and solvents.

road surfaces with asphalt; (iv) particulates from blasting activities; and (v) fugitive dust from many sources such as disturbing and moving soils, mixing concrete, storage of unvegetated soil/ sand piles and drilling and pile driving. *The primary air pollutant is however expected to be fugitive dust*.

There are no direct air quality impacts arising from the operational phase; however, minor VOC emissions are possible during routine maintenance activities on the tracking mirrors, on-site and off-site maintenance of access roads may be required after rainfall events and vegetation maintenance would be required within the solar collector field. The accumulation of dirt on solar panels ("soiling") can have a significant impact on the performance of solar energy systems, particularly in arid regions where rainfall is limited for several months. Since the cleaning of PV arrays can cost a significant amount of money the effect of soiling should be monitored by measuring deposition. An attempt will be made to illustrate the link between measured dustfall and soiling using methods from available literature (see references).

Emissions from the decommissioning phase include vehicle tailpipe emissions, diesel emissions from large construction equipment and generators and fugitive dust. No large air quality impacts are expected from this phase of the project.

The criteria against which air quality impacts due to fugitive dust will be assessed are provided in the Appendix.

1.7 Gaps in Information

Given that construction activities are expected to produce the most significant impact, it is essential to have information regarding the length of the construction period, planned construction activities, the road layout (unpaved and paved), the amount of material to be moved, and the equipment to be used.

1.8 Recommendations

It is recommended that the gaps in information be addressed and supplied as soon as possible. It is also recommended that the monitoring of dust deposition on-site be included in the project budget from the start.

2 REFERENCES

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3 APPENDIX – ASSESSMENT CRITERIA

Since the only significant air pollutant expected from the project would occur during the construction phase, the focus is be on ambient air concentrations and fallout rates of particulate matter.

3.1 Health Implications of Inhaling Suspended Air Particulates

The impact of particles on human health is largely depended on (i) particle characteristics, particularly particle size and chemical composition, and (ii) the duration, frequency and magnitude of exposure. The potential of particles to be inhaled and deposited in the lung is a function of the aerodynamic characteristics of particles in flow streams. The aerodynamic properties of particles are related to their size, shape and density. The deposition of particles in different regions of the respiratory system depends on their size. The nasal openings permit very large dust particles to enter the nasal region, along with much finer airborne particulates. Larger particles are deposited in the nasal region by impaction on the hairs of the nose or at the bends of the nasal passages. Smaller particles (PM_{10}) pass through the nasal region and are deposited in the tracheobronchial and pulmonary regions. Particles are removed by impacting with the wall of the bronchi when they are unable to follow the gaseous streamline flow through subsequent bifurcations of the bronchial tree. As the airflow decreases near the terminal bronchi, the smallest particles are removed by Brownian motion, which pushes them to the alveolar membrane (CEPA/FPAC Working Group, 1998; Dockery and Pope, 1994).

Air quality health guidelines for particulates are given for various particle size fractions, including total suspended particulates (TSP), inhalable particulates or PM_{10}, and respirable particulates of $PM_{2.5}$ (i.e. particulates with an aerodynamic diameter of less than 2.5 µm). Although TSP is defined as all particulates with an aerodynamic diameter of less than 100 µm, an effective upper limit of 30 µm aerodynamic diameter is frequently assigned. PM_{10} and $PM_{2.5}$ are of concern due to their health impact potentials. As indicated previously, such fine particles are able to be deposited in, and damaging to, the lower airways and gas-exchanging portions of the lung.

During the 1990s the WHO stated that no safe thresholds could be determined for particulate exposures and responded by publishing linear dose-response relationships for PM10 and $PM_{2.5}$ concentrations (WHO, 2005). This approach was not well accepted by air quality managers and policy makers. As a result the WHO Working Group of Air Quality Guidelines recommended that the updated WHO air quality guideline document contain guidelines that define concentrations which, if achieved, would be expected to result in significantly reduced rates of adverse health effects. These guidelines would provide air quality managers and policy makers with an explicit objective when they were tasked with setting national air quality standards. Given that air pollution levels in developing countries frequently far exceed the recommended WHO air quality guidelines (AQGs), the Working Group also proposed interim targets (IT) levels, in excess of the WHO AQGs themselves, to promote steady progress towards meeting the WHO AQGs (WHO, 2005). The air quality guidelines and interim targets issued by the WHO in 2005 for particulate matter are given in Table 3-1 and Table 3-2.

Table 3-1: WHO air quality guideline and interim targets for particulate matter (annual mean) (WHO, 2005)

Annual Mean Level	PM10 (µg/m³)	PM2.5 (µg/m³)	Basis for the selected level
WHO interim target-1 (IT-1)	70	35	These levels were estimated to be associated with about 15% higher long-term mortality than at AQG
WHO interim target-2 (IT-2)	50	25	In addition to other health benefits, these levels lower risk of premature mortality by approximately 6% (2-11%) compared to WHO-IT1
WHO interim target-3 (IT-3)	30	15	In addition to other health benefits, these levels reduce mortality risks by another approximately 6% (2-11%) compared to WHO-IT2 levels.
WHO Air Quality Guideline (AQG)	20	10	These are the lowest levels at which total, cardiopulmonary and lung cancer mortality have been shown to increase with more than 95% confidence in response to PM2.5 in the American Cancer Society (ACS) study (Pope *et al.*, 2002 as cited in WHO 2005). The use of the PM2.5 guideline is preferred.

Table 3-2: WHO air quality guideline and interim targets for particulate matter (daily mean (WHO 2005)

Daily Mean Level	PM10 (µg/m³)	PM2.5 (µg/m³)	Basis for the selected level
WHO interim target-1 (IT-1)	150	75	Based on published risk coefficients from multi-centre studies and meta-analyses (about 5% increase of short-term mortality over AQG)
WHO interim target-2 (IT-2)*	100	50	Based on published risk coefficients from multi-centre studies and meta-analyses (about 2.5% increase of short-term mortality over AQG)
WHO interim target-3 (IT-3)**	75	37.5	Based on published risk coefficients from multi-centre studies and meta-analyses (about 1.2% increase of short-term mortality over AQG)
WHO Air Quality Guideline (AQG)	50	25	Based on relation between 24-hour and annual levels

* 99th percentile (3 days/year)

** for management purposes, based on annual average guideline values; precise number to be determined on basis of local frequency distribution of daily means

3.2 Air Pollution Legislative Context

The Atmospheric Pollution Prevention Act (APPA) of 1965 was repealed and the new National Environmental Management: Air Quality Act of 2005 was brought into full force on the 1st of April 2010. Previously under APPA, the focus was mainly on sourced based control with permits issued for Scheduled Processes. Scheduled processes, referred to in the Act, are processes which emit more than a defined quantity of pollutants per year, including combustion sources, smelting and inherently dusty industries. Although emission limits and ambient concentration guidelines were published, no provision was made under the APPA for ambient air quality standards or emission standards. NEMAQA shifted the approach of air quality management from source-based control to the control of the receiving environment. The Act has also placed the responsibility of air quality management on the shoulders of local authorities that will be tasked with baseline characterisation, management and operation of ambient monitoring networks, licensing of listed activities, and emissions reduction strategies.

The *National Framework* for achieving the Act was published in the Government Gazette on the 11th of September 2007. The National Framework is a medium- to long term plan on how to implement the Air Quality Act to ensure the objectives of the act are met. As part of the role out of the Act, the Framework included the development of the *Listed Activities and Minimum National Emission Standards* and the *National Ambient Air Quality Standards* (NAAQS).

3.2.1 Listed Activities and Minimum Emission Standards

The *Listed Activities and Minimum National Emission Standards* were published on 31 March 2010 (Government Gazette No. 33064). The project aimed to establish minimum emission limits for a number of activities identified through a consultative process at several forums. According to the process descriptions none of the proposed activities fall within n any of the Listed Activities.

3.2.2 National Ambient Air Quality Standards

Air quality guidelines and standards are fundamental to effective air quality management, providing the link between the source of atmospheric emissions and the user of that air at the downstream receptor site. The ambient air quality guideline values indicate safe daily exposure levels for the majority of the population, including the very young and the elderly, throughout an individual's lifetime.

The NAAQS as published in the Government Gazette on the 24th of December 2009 is summarised in Table 3-3. Air quality guidelines and standards are normally given for specific averaging periods. These averaging periods refer to the time-span over which the air concentration of the pollutant was monitored (predicted or measured) at a location. Generally, five averaging periods are applicable, namely an instantaneous peak, 1-hour average, 24-hour average, 1-month average, and annual average.

The application of these standards varies, with some pollutants allowed a certain number of exceedances of each of the *Limit Values* per year. Also, a *Level of Tolerance* has been set for some pollutants, e.g. the daily average PM_{10} limit. The daily average PM_{10} limit is currently at 120 µg/m³ and applies until 31 December 2014. From 1 January 2015, the limit reduces to 75 µg/m³. The number of allowable exceedances remains the same, i.e. 4 per annum.

Table 3-3: National Ambient Air Quality Standards (NAAQS)

Pollutant	Averaging Period	Limit Value (µg/m³)	Limit Value (ppb)	Frequency of Exceedance	Compliance Date
Carbon Monoxide (CO)	1 hour	30 000	26 000	88	Immediate
	8 hour [(a)]	10 000	8 700	11	Immediate
Nitrogen Dioxide (NO_2)	1 hour	200	106	88	Immediate
	1 year	40	21	0	Immediate
PM_{10}	24 hour	120	-	4	Immediate – 31 Dec 2014
		75	-	4	1 Jan 2015
	1 year	50	-	0	Immediate – 31 Dec 2014
		40	-	0	1 Jan 2015
Sulphur Dioxide (SO_2)	10 min	500	191	526	Immediate
	1 hour	350	134	88	Immediate
	24 hour	125	48	4	Immediate
	1 year	50	19	0	Immediate
Benzene	1 year	10	3.2	0	Immediate – 31 Dec 2014
		5	1.6	0	1 Jan 2015
Lead	1 year	0.5	-	0	Immediate
Ozone	8 hour [(b)]	120	61	11	Immediate

Notes:

(a) - calculated on hourly averages

(b) – running average

3.2.3 Draft Standards

3.2.3.1 $PM_{2.5}$ Air Quality Standard

The Department of Environmental Affairs (DEA) published the proposed national ambient air quality standard for particulate matter of aerodynamic diameter less than 2.5 micron metres (Government Gazette No. 34493 of 5 August 2011).

The limit values and compliance dates are summarised in Table 3-4. Unlike the standard for PM_{10}, the DEA proposes no frequency of exceedances for the 24 hourly average limits.

Table 3-4: Proposed national ambient air quality standard for particulate matter of aerodynamic diameter less than 2.5 micron metres ($PM_{2.5}$)

Averaging Period	Band Concentration Limit	Frequency of Exceedance	Compliance Date
24 hours	65 µg/m³	0	Immediate - 31 December 2015
	40 µg/m³	0	1 January 2016~ 31 December 2029
	25 µg/m³	0	1 January 2030
1year	25 µg/m³	0	Immediate- 31 December 2015
	20 µg/m³	0	1 January 201~ 31 December 2029
	15 µg/m³	0	1 January 2030

3.2.3.2 Dust Fallout

Dustfall is associated with nuisance rather than human health impacts. Given that the air quality impact study is concerned with assessing the potential for impacts on both human health and on the well-being of people it is necessary to determine the likely limits of acceptability for dustfall rates. Dust deposition may be gauged according to the criteria published by SABS (SANS, 2009) and recently proposed by the DEA (Government Gazette No. 34307 of 27 May 2011). This includes a system of dust-fall rate assessment were dust deposition rates are evaluated against a four-band scale, as presented in

Table 3-5.

According to the SANS dust-fall limits an enterprise may submit a request to the authorities to operate within the Band 3 ACTION band for a limited period, providing that this is essential in terms of the practical operation of the enterprise (for example the final removal of a tailings deposit) and provided that the best available control technology is applied for the duration. No margin of tolerance will be granted for operations that result in dust-fall rates in the Band 4 ALERT.

Target, action and alert thresholds for ambient dust deposition, as published by Standards SA, are given in Table 3-6.

Table 3-5: Bands of dustfall rates proposed for adoption

Band Number	Band Description Label	Dust-Fall Rate (D) (mg m^{-2} day^{-1}, 30-Day Average)	Comment
1	RESIDENTIAL	D < 600	Permissible for residential and light commercial
2	INDUSTRIAL	600 < D < 1 200	Permissible for heavy commercial and industrial
3	ACTION	1 200 < D < 2 400	Requires investigation and remediation if two sequential months lie in this band, or more than three occur in a year.
4	ALERT	2400 < D	Immediate action and remediation required following the first exceedance. Incident report to be submitted to relevant authority.

Table 3-6: Target, action and alert thresholds for ambient dustfall

Level	Dust-Fall Rate (D) (mg m^{-2} day^{-1}, 30-Day Average)	Averaging Period	Permitted Frequency Of Exceedances
TARGET	300	Annual	
ACTION RESIDENTIAL	600	30 days	Three within any year, no two sequential months.
ACTION INDUSTRIAL	1 200	30 days	Three within any year, not sequential months.
ALERT THRESHOLD	2 400	30 days	None. First exceedance requires remediation and compulsory report to authorities.