ORLIGHT SA (PTY) LTD

DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT

FOR THE

PROPOSED DEVELOPMENT OF THE LOERIESFONTEIN SOLAR PHOTOVOLTAIC POWER PLANT IN THE NORTHERN CAPE PROVINCE

APPLICANT:

ORLIGHT SA (PTY) LTD

MAY 2012

DEA REFERENCE NO: 12/12/20/2632

NEAS REFERENCE NO: DEA/EIA/0000825/2011

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This document has been prepared by **Digby Wells Environmental**.

Report title: Orlight SA (Pty) Ltd – Draft EIA Report for the proposed development of the Loeriesfontein Solar PV Plant in the Northern Cape Province

Project number: BSG1384

NAME	RESPONSIBILITY	SIGNATURE	DATE
Marike de Klerk	Project administrator and report compiler		10 April 2012
Mia Ackermann	Project manager and report compiler		07 May 2012
Grant Beringer	Project sponsor and report review		12 May 2012

INFORMATION REQUIREMENTS OF THE DEPARTMENT OF ENVIRONMENTAL AFFAIRS

CONTENT/SPECIFICATIONS	REFERENCE
1. GENERAL SITE INFORMATION	
Descriptions of all affected farm portions.	Refer to Section 1.1 – Portion 5 of the farm Kleine Rooiberg 227 RD Section 5 – Status of baseline environment
21 digit Surveyor General codes of all affected farm portions	Refer to Section 1.1 – SG Code C015-000-000-000-227-00005
Copies of deeds of all affected farm portions	Refer to Appendix B – Title deeds
Photos of areas that give a visual perspective of all parts of the site	Refer to Figure 1-1: General site characteristics of the proposed Loeriesfontein Solar PV Power Plant
Photos from sensitive visual receptors (tourism routes, tourism facilities, etc.)	Refer to Figure 1-1: General site characteristics of the proposed Loeriesfontein Solar PV Power Plant Refer to Figure 5-8: View of project site from main tourist route
Solar Plant design specifications including: • Type of technology • Structure height • Surface area to be covered (including associate infrastructure such as roads) • Structure orientation • Laydown area dimensions	Refer to Section 1.1 – Project overview Refer to Section 4.1 – Description of the proposed project
Generation capacity of the facility as a whole at delivery points.	Refer to Section 1.1 – Project overview Refer to Section 4.1 – Description of the proposed project
2. SITE MAPS AND GIS INFORMATION	
All maps/information layers must also be provided in ESRI Shapefile format	Refer to Compact Disc submitted as part of this report.
All affected farm portions must be indicated	Refer to Plan 1c – Land tenure
The exact site of the application must be indicated (the areas that will be occupied by the application)	Refer to Plan 2c – Site layout
A status quo map/layer must be provided that includes the following: • Current use of land on the site including:	Refer to Plan 3c – Land use Refer to Plan 7c – Vegetation types

CONTENT/SPECIFICATIONS	REFERENCE
○ Buildings and other structure ○ Agricultural fields ○ Grazing areas ○ Natural vegetation areas with an indication of the vegetation quality as well as fine scale mapping in respect of Critical Biodiversity Areas and Ecological Support Areas ○ Critically endangered and endangered vegetation areas that occur on the site ○ Bare areas which may be susceptible to soil erosion ○ Cultural historical sites and elements • Rivers, streams and water courses • Ridgelines and 20 m continuous contours with height reference in the GIS database • Fountains, boreholes, dams (in-stream as well as off-stream) and reservoirs • High potential agricultural areas as defined by the Department of Agriculture, Forestry and Fisheries • Buffer zones (also where it is dictated by elements outside the site); ○ 500 m from any irrigated agricultural land ○ 1 km from residential areas • Indicate isolated residential, tourism facilities on or within 1 km of the site	Refer to Plan 8c – Ecological sensitivity Refer to Plan 12c – Heritage aspects
A slope analysis map/layer that include the following slope ranges: • Less than 8% slope • Between 8% and 12% slope • Between 12% and 14% slope • Steeper than 18% slope	Refer to Plan 5c – Slope analysis **The slopes are generally less than 8% and therefore, further categories have been mapped.*
A map/layer that indicate locations of birds and bats including, roosting and foraging areas.	Not applicable to the study area.
A site development proposal map(s)/layers(s) that indicate: • Positions of solar facilities • Foundation footprint • Permanent laydown area footprint • Construction period laydown footprint • Internal roads indicating width and with numbered sections between the other site elements which the serve • River, stream and water crossing of roads and cables indicating the type of bridging structures that will be used • Substation(s) and/or transformer(s) sites including their entire footprint. • Cable routes and trench dimensions (where they are not along internal	Refer to Plan 2c – Site layout

CONTENT/SPECIFICATIONS	REFERENCE
roads) • Connection routes to the distribution/transmission network • Cut and fill areas along roads and at substation/transformer sites indicating the expected volume of each cut and fill • Borrow pits • Spoil heaps • Buildings including accommodation.	
3. REGIONAL MAP AND GIS INFORMATION	
All maps/information layers must also be provided in ESRI Shapefile format	Refer to Compact Disc.
Indicate the following: • Roads including their types (tarred or gravel) and category (national, provincial, local or private) • Railway lines and stations • Industrial area • Harbours and airports • Electricity transmission and distribution lines and substations • Pipelines • Water sources to be utilised during the construction and operational phases • A visibility assessment of the areas from where the facility will be visible • Critical Biodiversity Areas and Ecological Support Areas • Critically Endangered and Endangered vegetation areas • Agricultural fields • Irrigated areas • An indication of new road or changes and upgrades that must be done to existing roads in order to get equipment onto the site including cut and fill areas and crossings of rivers and streams.	Refer to Plan 3c – Land use Refer to Plan 7c – Vegetation types Refer to Plan 8c – Ecological sensitivity Refer to Plan 10c – Viewshed Refer to Plan 12c – Heritage aspects

INFORMATION REQUIREMENTS IN TERMS OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 (ACT 107 OF 1998)

CONTENT/SPECIFICATIONS	REFERENCE
(2) AN EIA REPORT MUST CONTAIN ALL INFORMATION THAT IS NECESSARY FOR THE COMPETENT AUTHORITY TO CONSIDER THE APPLICATION AND TO REACH A DECISION CONTEMPLATED IN REGULATION 35, AND MUST INCLUDE	
(a) Details of: (i) the EAP who compiled the report; and (ii) the expertise of the EAP to carry out an environmental impact assessment;	Refer to Section 1.3 – Details of the EAP
(b) A detailed description of the proposed activity;	Refer to Section 4 – Project description
(c) A description of the property on which the activity is to be undertaken and the location of the activity on the property, or if it is (i) a linear activity, a description of the route of the activity; or (ii) an ocean-based activity, the coordinates where the activity is to be undertaken;	Refer to Section 1.1 – Portion 5 of the farm Kleine Rooiberg 227 RD Refer to Plan 1c – Land tenure
(d) A description of the environment that may be affected by the activity and the manner in which the physical, biological, social, economic and cultural aspects of the environment may be affected by the proposed activity;	Refer to Section 5 – Status of baseline environment
(e) Details of the public participation process conducted in terms of sub-regulation (1), including— (i) steps undertaken in accordance with the plan of study; (ii) a list of persons, organisations and organs of state that were registered as interested and affected parties; (iii) a summary of comments received from, and a summary of issues raised by registered interested and affected parties, the date of receipt of these comments and the response of the EAP to those comments; and (iv) copies of any representations and comments received from registered interested and affected parties;	Refer to Section 2.2 – Public participation process Refer to Section 2.3 – Public review of reports Refer to Section 6.1 – Findings of the Public Participation Process Refer to Appendix D – Public Participation Process Report
(f) A description of the need and desirability of the proposed activity;	Refer to Section 4.2 – Need and desirability
(g) A description of identified potential alternatives to the proposed activity, including advantages and disadvantages that the proposed activity or alternatives may have on the environment and the community that may be affected by the activity;	Refer to Section 4.3 – Project alternatives and the project design process
(h) An indication of the methodology used in determining the significance of potential environmental impacts;	Refer to Section 6 – Environmental Impact Assessment Refer to Appendix K – Impact assessment methodology
(i) A description and comparative assessment of all alternatives identified during the environmental impact assessment process;	Refer to Section 4.3 – Project alternatives and the

CONTENT/SPECIFICATIONS	REFERENCE
	project design process
(j) A summary of the findings and recommendations of any specialist report or report on a specialised process;	Refer to Executive summary Refer to Section 7 – Environmental Impact Statement
(k) A description of all environmental issues that were identified during the environmental impact assessment process, an assessment of the significance of each issue and an indication of the extent to which the issue could be addressed by the adoption of mitigation measures;	Refer to Section 6 – Environmental Impact Assessment
(l) An assessment of each identified potentially significant impact, including: (i) cumulative impacts; (ii) the nature of the impact; (iii) the extent and duration of the impact; (iv) the probability of the impact occurring; (v) the degree to which the impact can be reversed; (vi) the degree to which the impact may cause irreplaceable loss of resources; (vii) the degree to which the impact can be mitigated;	Refer to Section 6 – Environmental Impact Assessment
(m) A description of any assumptions, uncertainties and gaps in knowledge;	Refer to Section 2.5 – Assumptions and limitations
(n) A reasoned opinion as to whether the activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation;	Refer to Executive summary Refer to Section 7 – Environmental Impact Statement
(o) An environmental impact statement which contains— (i) a summary of the key findings of the environmental impact assessment; (ii) a comparative assessment of the positive and negative implications of the proposed activity and identified alternatives;	Refer to Executive summary Refer to Section 7 – Environmental Impact Statement
(p) A draft environmental management programme containing the aspects contemplated in regulation 33;	Refer to Appendix J
(q) Copies of any specialist reports and reports on specialised processes complying with regulation 32;	Refer to Appendix D to Appendix K
(3) The EAP managing the application must provide the competent authority with detailed, written proof of an investigation as required by section 24(4)(b)(i) of the Act and motivation if no reasonable or feasible alternatives, as contemplated in sub-regulation 31(2)(g), exist.	Refer to Section 2.5.1 – Assumptions Refer to Section 4.3 – Project alternatives

EXECUTIVE SUMMARY

Orlight SA (Pty) Ltd (Orlight SA) is proposing to develop a Solar Photovoltaic (PV) Power Plant on a site approximately 40 km north of the town of Loeriesfontein in the Namakwa District Municipality of the Northern Cape Province. The proposed site for development is located on Portion 5 of the farm Klein Rooiberg 227 RD.

It was previously thought that the affected property was Portion 1 of the farm Kleine Rooiberg 227 RD. However, a land surveyor has since confirmed that the correct property description is Portion 5 of the farm Kleine Rooiberg 227 RD.

Digby Wells Environmental (Digby Wells) was appointed as independent Environmental Assessment Practitioner (EAP) to conduct the Environmental Impact Assessment (EIA) process for the proposed Loeriesfontein Solar PV Power Plant and associated activities in accordance with the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA).

A study area of 1 040.04 ha was considered throughout the EIA process and an available surface area of 334.5 ha in extent was delineated for the development of the proposed project, based on the avoidance of the following environmentally sensitive and other no-go areas:

- *Drainage line* – The main drainage line and associated system should be avoided, owing to the sensitivity of the benefiting ephemeral river systems and the largely natural state of these systems. A buffer zone of 50 m is prescribed around the main drainage system, with 30 m buffer zones around its tributaries. The establishment of internal roads and trenches for underground cabling could be allowed, pending approval of a Water Use License Application (WULA) for associated water uses.
- *Ecologically sensitive areas* – Consists of the drainage line running through the project area and the northern part of the site where *Aloe falcata* (Vanrhynsdorp Aloe) and *Hoodia gordonii* was encountered.
- *Areas with heritage value* – It is recommended that Late Stone Age (LSA) sites that have been rated as significant in terms of local and provincial archaeological context that are found on the outskirts of the study area and within other delineated no-go areas should be avoided to ensure they are conserved (Site LO57, Site 122, Site 143 and Site 086).
- *Eskom transmission line servitudes* – The existing 66 kV transmission lines that runs through the project site has a servitude width of 22 m. No construction will take place within these servitudes.

Based on an estimated requirement of 4 ha surface area per MW generation capacity, the optimal generation capacity of the power plant that can be accommodated in the available area was determined to be 84 MW.

The proposed power plant will make used of Solar PV technology and will be comprised of the following infrastructure:

- Solar PV panels;
- Support structures;
- Foundations;
- Electrical cabling;
- On-site substation;
- Transmission lines;
- Access roads;
- Temporary construction lay-down yard; and
- Access control and fencing of the site.

Development of the project components require environmental authorisation in terms of NEMA and an EIA application for the proposed project was submitted to the Department of Environmental Affairs (DEA) on 24 November 2011.

Reference numbers 12/12/20/2632 (DEA) and DEA/EIA/0000825/2011 (NEAS) were assigned to the application on 8 December 2011.

The objectives of the EIA process for the proposed Loeriesfontein Solar PV Power Plant were to:

- Undertake a Public Participation Process (PPP) to ensure that Interested and Affected Parties (I&APs) can participate in the EIA process;
- Prepare integrated sensitivity maps for the study area based on the findings of environmental, socio-economic and cultural assessments as input into the project design process;
- Identify and assess the significance of potential impacts associated with the projects; and
- Recommend mitigation and enhancement measures to ensure that the development is undertaken in such a way as to promote the positive impacts and to minimise the negative impacts.

The following potentially significant positive impacts were identified during the EIA process:

- *Employment opportunities* – An estimated 280 employment opportunities will be created during construction of which some will be for unskilled labourers sourced from the local area. The majority of youth in this area have low educational and skills levels, thus many are unemployed and well suited to unskilled labour.
- *Procurement of goods and services* – The project will necessitate procurement of goods and services, many of which could be sourced from local companies, Small, Medium and Micro Enterprises (SMMEs) or entrepreneurs, thereby enhancing the socio-economic benefits associated with the project's construction phase.
- *Skills training and capacity building* – Both local employees and entrepreneurs, SMMEs and businesses will likely gain significantly from appropriate skills training and capacity building.

The following potentially significant negative impacts were identified during the EIA process:

- *Surface water impacts* – The removal of natural vegetation, levelling of undulating areas and creation of hard and compacted surfaces will alter the drainage patterns of the project site. A significant impact would be the construction of road crossings over drainage lines and similarly, the laying of underground electric cables. During rainfall events, disturbed surfaces would be susceptible to erosion and altered surface flow dynamics will accelerate the very slow, natural erosion process and sediment transport off-site. Owing to the sensitivity of the benefiting ephemeral river systems and the largely natural state of these systems, these impacts could be significant if not mitigated.

Mitigation: All road crossings and underground trenches for electric cables that cross drainage lines must be designed by a qualified road engineer in consultation with a surface water specialist. A WULA must be obtained prior to the construction phase and all mitigation measures specified in the WULA must be implemented. The storm water management plan should be implemented (Appendix J).

- *Ecological impacts* – Ecologically sensitive areas were delineated as no-go areas during the site layout design process and will not be directly impacted by development. However, due to the complex drainage pattern present on site, a boundary effect could occur that might impact on these areas. The project footprint still consist mostly of indigenous natural vegetation and during site preparation activities, 99% of this vegetation will be removed. There is also a possibility that Red Data or protected plant species that have not been identified in these areas during dry-season surveys could be destroyed. It is also likely that alien invasive and weed species will propagate on disturbed areas.

Mitigation: The no-go and high ecologically sensitive areas should be demarcated and avoided at all costs. A flora survey should be undertaken during the wet-season to try and identify Red Data and protected plant species that might not have been identified during dry-season surveys. The opportunity to maintain or increase the ecological

functioning of the study area exists, thereby indirectly supporting the population of animal species possibly reliant on this area for services. By increasing the natural habitat types in the no-go areas and removing the threats (i.e. grazing by livestock and alien species invasion), the ecological functioning of the area will be positively affected, thereby increasing the suite of ecological services offered to animals, making the area an attractive option for animals to re-colonise.

Therefore, it is recommended that a management plan be implemented which will firstly monitor ecological status of the project site and secondly, that the destruction of the sensitive species and landscapes areas such as drainage lines, ridges and plains should be avoided. An alien invasive and weed control programme will be an integral part of the success of efforts to increase the ecological functioning of the study area.

- *Influx of job-seekers* – News of the proposed project and employment opportunities may result in an influx of job-seekers into the area which could results in negative social impacts such as informal settlements, social conflict between the incumbent and migrant populations, an increase in social pathologies, petty crimes and stock theft.

Mitigation: An influx of job-seekers should be proactively discouraged by being transparent about the local employment policy and by requiring employees to verify their local residence status. The establishments of informal housing/ or settlements should be actively prevented by implementing an effective system through which the erection of such structures can be reported and dismantled as soon as possible. Adequate accommodation and ablution facilities for employees should be made available in town. A code of conduct should be developed and the construction workforce should be contractually bound to it.

- *Cumulative impacts on water availability* – There are at least three other solar PV project proposed in the vicinity of Loeriesfontein. These projects will place increasing demand on water resources in a water scarce area.

Mitigation: The project area is water scarce and very few water supply alternatives are available. The projects should therefore consider recycling water, or using treated effluent from the municipality for washing the solar PV panels.

- *Heritage impacts* – The site has a moderate potential of finding fossils and damage to the palaeontological environment could occur during the construction phase. In addition, LSA artefact scatters recorded in the project development footprint will be destroyed during site establishment. The LSA sites have the potential to inform us on a regional pattern of LSA settlement and the sites are therefore considered to be of medium to high significance.

Mitigation: In the event of a fossil find, the procedure detailed in the EMP should be implemented. A Phase 2 mitigation should be undertaken for all significant LSA sites that are located within the project development footprint prior to the commencement of the construction phase. The systematic excavation and/or collection of material will enhance the understanding of the regional LSA settlements and is, therefore, considered to be a positive impact in terms of archaeological research. Necessary permits must be obtained from the South African Heritage Resources Agency (SAHRA) before excavation or destruction of sites.

The main issues and concerns that were raised by I&APs and the effect of that addressing of these concerns has had on the project design and environmental management objectives of the project are:

- *Water utilisation and storm water management* – Orlight SA has applied to the Hantam Local Municipality for water provision. Water provision has not yet been approved. Objectives for storm water management and design measures have been included in the EMP.

- *Heritage impacts* – Impacts to heritage resources include the destruction of LSA sites of significance and the potential destruction of fossils found during site preparation. Phase 2 mitigation is required for archaeological sites and a fossil find procedure will be implemented, should any fossils be found.
- *Soil erosion and land capability impacts* - Anticipated vulnerabilities of the identified soils to erosion induced by water when the soils are exposed, is considered to be moderate. A storm water management plan will be implemented.
- *Socio-economic benefits of the project* – Social management plans and programmes are included in the EMP (Appendix J) to ensure that socio-economic benefits of the project are enhanced.
- *Impacts on existing Eskom transmission line servitudes* – The transmission line servitudes have been delineated as no-go areas. Eskom will retain access to these servitudes during the project life.
- *Requirement for a rezoning application for affected land* – The rezoning process for the project site is in process. Consultation with the municipality has been completed.
- *Safety and security* – Theft of stock grazing on farms in the area is of concern, should there be an influx of job seekers during the construction phase of the project. A code of conduct should be developed and the construction workforce should be contractually bound to it. No trespassing on neighbouring farms will be allowed or tolerated.
- *Competitive bidding process* – There are several other planned renewable energy projects in the vicinity of the project and the necessary lease agreements with the land owner has been reached.
- *Visual impacts* – No significant visual impacts have been identified.
- *Tourism impact* – No significant tourism impacts have been identified.

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To summarise, I&APs generally had no objections regarding the proposed project and feel that the proposed project will benefit them in terms of the supply of renewable energy to an area where it is much needed and through local socio-economic development.

Based on the nature and extent of the proposed project and the understanding of the significance of anticipated impacts that will be experienced, the EAP is of the opinion that the predicted impacts can be mitigated to an acceptable level. The EAP and specialist team supports the decision for an environmental authorisation.

The following conditions would be required in the environmental authorisation for the proposed project:

- All mitigation measures described in this report and in the EMP (Appendix J) should be implemented to ensure that the negative impacts of the project are mitigated and that positive impacts are enhanced.
- All no-go areas, sensitive areas and prescribed buffer zones that were defined unsuitable for development purposes should be avoided.
- Establishment of internal roads and trenches for underground cabling should be allowed, pending approval of a WULA for identified water uses.
- A flora survey of the project development footprint should be undertaken during the wet-season to try and identify Red Data and protected plant species that might not have been identified during dry-season surveys. If found, the necessary permits should be obtained prior to the removal or destruction of these species.
- A Phase 2 Archaeological Impact Assessment (AIA) should be implemented for all significant Late Stone Age (LSA) sites that are located within the project development footprint prior to the commencement of the construction phase. The necessary permits should be obtained from SAHRA.

- The implementation of the EMP (Appendix J) is considered a key factor to the achievement of the environmental standards and long-term sustainability of the project. For this purposed, the EMP should form part of the contractual agreement with the contractors that are appointed for development and operation of the proposed project.
- The EMP (Appendix J) should be considered a living document and should be updated during the project phases as more information on the significance of impacts and effectiveness of mitigation measures becomes known.

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ABBREVIATIONS

AIA	Archaeological Impact Assessment
BA	Basic Assessment
BID	Background Information Document
BSGR	BSG Resources Limited
CAA	Civil Aviation Authority
CARA	Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983)
CBA	Critical Biodiversity Area
CBO	Community Based Organisation
CCS	Crypto-crystalline silica
CEPF	Critical Ecosystem Partnership Fund
CITES	Convention on International Trade in Endangered Species
CV	Curriculum Vita
CPV	Concentrated solar photovoltaic
DAFF	National Department of Agriculture, Forestry and Fisheries
DEA	National Department of Environmental Affairs
DEANC	Northern Cape Department of Environmental Affairs and Nature Conservation
Digby Wells	Digby Wells Environmental
DoE	Department of Energy
DWA	Department of Water Affairs
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EIA Regulations	GN Regulations 543 to 546 (18 June 2010)
EHS	Environmental, Health and Safety
EIS	Environmental Impact Statement
ELC	European Landscape Convention
EMP	Environmental Management Programme
EMS	Environmental Management System
ESA	Early Stone Age
FEPA	Freshwater Ecological Priority Area
GHG	Greenhouse Gas

GIS	Geographic Information System
I&AP	Interested and Affected Party
IDP	Integrated Development Plan
IFC	International Finance Corporation
IPP	Independent Power Producer
IRP	Integrated Resources Plan
IUCN	International Union for Conservation of Nature and Natural Resources
LED	Local Economic Development
LUPO	Land Use Planning Ordinance, Ordinance 15 of 1985
LSA	Late Stone Age
mamsl	metres above mean sea level
MSA	Middle Stone Age
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998)
NEMBA	National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)
NGO	Non-Governmental Organisation
NHRA	National Heritage Resources Act, 1999 (Act No. 25 of 1999)
NID	Notice of Intent to Develop
NWA	National Water Act, 1998 (Act No. 36 of 1998)
OES	Ostrich eggshell
Orlight SA	Orlight SA (Pty) Ltd
PPP	Public Participation Process
PV	Photovoltaic
RE	Remaining Extent
SAHRA	South African Heritage Resources Agency
SANBI	South African National Biodiversity Institute
SANRAL	South African National Roads Agency Limited
SKA	Square Kilometre Array
SKEP	Succulent Karoo Ecosystem Programme
SMME	Small, Medium and Micro Enterprise
TIA	Traffic Impact Statement
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change

VIA	Visual Impact Assessment
WMA	Water Management Area
WULA	Water Use License Application
WWF	World Wildlife Foundation

1 INTRODUCTION

In line with the growing need for electricity supply and cleaner energy production in South Africa, the Orlight SA (Pty) Ltd (Orlight SA) Solar Photovoltaic (PV) Project was initiated by its holding company, BSG Resources Limited (BSGR). BSGR is an international natural resources company that operates in the fields of mining and energy. BSGR established a new company, Orlight SA, for the construction and operation of five new Solar PV Power Plants in the Western Cape and Northern Cape Provinces (Plan 14 – Appendix A).

Digby Wells Environmental (Digby Wells) was appointed as independent Environmental Assessment Practitioner (EAP) to conduct the Environmental Impact Assessment (EIA) process for the proposed Loeriesfontein Solar PV Power Plant and associated activities in accordance with the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA).

1.1 Project Overview

The proposed site for development of the Loeriesfontein Solar PV Power Plant is located on Portion 5 of the farm Klein Rooiberg 227 RD [SG Code C015-000-000-000-227-00005], approximately 40 km north of the town of Loeriesfontein in the Namakwa District Municipality of the Northern Cape Province (Plan 1c – Appendix A). During the application and scoping phase of the project, an error was made in the property description of the proposed study area. It was previously thought that the affected property was Portion 1 of the farm Kleine Rooiberg 227 RD. However, a land surveyor has since confirmed that the correct property description is Portion 5 of the farm Kleine Rooiberg 227 RD. The DEA and all stakeholders have been notified of the amendment to the property description. Copies of the title deeds of the affected property are attached as Appendix B.

The site is located in an area characterised by low population density, high solar irradiation and in close proximity to the existing Eskom Helios substation and existing transmission lines, which allows for easy integration into the national electricity grid. The general site characteristics are illustrated in Figure 1-1.

A study area of 1 040.04 ha was considered throughout the EIA process, although the actual development footprint of the proposed project will be smaller in extent. The objective was to determine the optimal generation capacity that could be accommodated in the study area, by configuring the placement of infrastructure in such a way as to avoid environmentally sensitive and other problematic areas.

The available surface area that was delineated for the development of the proposed project is approximately 334.5 ha in extent and, therefore, the optimal generation capacity of the power plant based on an estimated requirement of 4 ha surface area per MW generation capacity was determined to be 84 MW. The site layout is illustrated in Plan 2c.

Figure 1-1: General site characteristics of the proposed Loeriesfontein Solar PV Power Plant *(Clockwise from top left: Looking southeast; looking southwest; looking down a dry drainage channel; and look towards the Rooiberge to the west)*

The proposed Solar PV Power Plant will be comprised of the following infrastructure:

- *Solar PV panels* – An array of solar PV panels with a generating capacity of up to 84 MW will be installed over an area of 323.5 ha;
- *Support structures* – The solar PV panels will be mounted on steel support structures. The solar PV panels will be mounted to a maximum height of 7 m and tilted approximately 25° from the horizontal plane, facing to the north and may be on tracking systems to adjust the angle of the panels to the summer or winter solar radiation characteristics;
- *Foundations* – The panel foundations will be either hammered into the ground or have concrete foundations excavated to a depth of approximately 1.5 m, depending on the terrain characteristics determined through geotechnical studies;
- *Electric cabling* – The solar PV arrays will be connected via electric cabling which will be laid underground in trenches of approximately 1 m deep and 0.6 m wide. These cable will cross drainage lines at five points;
- *On-site substation* – The substation will occupy a surface area of approximately 0.78 ha and will include invertors to convert the electricity generated by the solar PV arrays from direct current to alternating current;
- *Transmission line* – The proposed power plant will be connected to the Eskom Helios substation which is located approximately 11 km to the north with 22 kV overhead transmission lines;
- *Access roads* – Access to the proposed project site will be from the Granaatboskolk/Zout Dwaggas gravel road which runs through the site. An internal network of roads will be required to access the different components of the proposed project. These roads will cross drainage lines at four points;

- *Temporary construction lay-down yard* – The construction lay-down yard will occupy a surface area of 8.1 ha and will include a site office, mobile toilets and bathroom facilities, a car parking yard and the hydrocarbon management facility; and
- *Access control and fencing of the site* – The site must be secured against theft from outside and for this purpose, fencing will be installed.

1.2 Objectives of the EIA process

The objectives of the EIA process for the proposed Loeriesfontein Solar PV Power Plant were to:

- Undertake a comprehensive and fully transparent Public Participation Process (PPP) to ensure that Interested and Affected Parties (I&APs) were afforded the opportunity to participate in the EIA process;
- Prepare integrated sensitivity maps for the study area based on the findings of environmental, socio-economic and cultural assessments undertaken for the project as input into the project design process;
- Identify and assess the significance of potential impacts associated with the projects; and
- Recommend mitigation and enhancement measures that should be implemented to ensure that the development is undertaken in such a way as to promote the positive impacts and to minimise the negative impacts.

1.3 Details of the EAP

Digby Wells is a South African company with international expertise in delivering comprehensive environmental and social solutions for clients in diverse sectors including the energy, minerals and mining industries. The names and expertise of the project team members are provided in Table 1-1. A company profile and the Curricula Vitae (CVs) of the project team have been attached to this report as Appendix C.

Table 1-1: Names and expertise of the project team

ASPECT	SPECIALIST	QUALIFICATIONS AND COMPETENCY
Project sponsor	Grant Beringer	2004 – 2006: MSc Environmental Management –UJ 2002 – 2003: BSc (Honours) Geography and Environmental Management (*Cum Laude*) – RAU 2000 – 2002: BSc Earth Sciences – RAU
EAP and project manager	Mia Ackermann	2008: MSc Geography – UJ 2006: BSc (Honours) Geography and Environmental Management (*Cum Laude*) – UJ 2003 – 2005: BSc Geography and Environmental Management – UJ
EAP and project administrator	Marike de Klerk	2005 – 2006: MA Sustainable Development – UJ 2000 – 2002: BhcS (*Cum Laude*) – UP 2003 – 2004: BhcS (Honours) (*Cum Laude*) – UP
Public Participation	Sibongile Bambisa	2010: BA (Honours) Anthropology – UJ 2009: BA Health Psychology – UJ

1.4 Overview of the EIA process

This section provides an overview of the EIA process that was undertaken for the proposed project. The approach to undertaking the EIA process and details of the activities undertaken during each phase of the process is described in Chapter 2 of this report.

1.4.1 Screening phase

An environmental screening assessment was undertaken in December 2011 by a team of environmental and cultural specialists from Digby Wells Environmental with the aim of determining the suitability of the proposed study area for development, taking into consideration the general environmental characteristics and the anticipated impacts of project activities on natural or cultural resources.

The findings of the screening assessment concluded that the proposed project has no fatal flaws, pending further assessment of identified environmental features within the study area.

1.4.2 Application phase

An EIA application for the proposed project was submitted to the relevant competent authority, namely the Department of Environmental Affairs (DEA) on 24 November 2011. The applicable listed activities of the proposed project in terms of the EIA Regulations are detailed in Table 1-2 below.

Table 1-2: Listed activities applicable to the proposed project

GN. R	ACTIVITY	DESCRIPTION
544	10	The construction of overhead transmission lines to connect the proposed Solar PV Power Plant to the Eskom Helios Substation[1]
545	1	The construction of a Solar PV Power Plant. The power plant infrastructure will consist of a ground mounting system, solar PV panels, inverters, switchboards and transformer.
545	15	The physical alteration of more than 20 ha of agricultural land for the purposes of constructing a Solar PV Power Plant.
546	14	The clearance of more than 5 ha of land consisting of 75% or more of indigenous vegetation.

Copies of the EIA application form were sent to the relevant provincial authority, namely the Northern Cape Department of Environmental Affairs and Nature Conservation (DEANC). In view of the urgency of developing renewable energy projects in South Africa and to aid in fulfilling the country's demand for electricity, as well as the stringent timeframes imposed on parties intending to bid as Independent Power Producers (IPPs), the EAP lodged a request with the provincial department that the responsibility for processing and evaluating the application is succeeded to the national DEA.

[1] New transmission lines will be required to connect the Solar PV Power Plant to the Eskom Helios Substation. This Basic Assessment (BA) process is being undertaken as a separate application, but concurrent to the main EIA process.

The request was granted and during the EIA Phase, the provincial department was involved as a stakeholder and they were given the opportunity to comment on all environmental documentation.

Reference numbers 12/12/20/2632 (DEA) and DEA/EIA/0000825/2011 (NEAS) were assigned to the application on 8 December 2011.

1.4.3 Scoping Phase

The objectives of the Scoping Phase for the proposed project were to:

- Consult with stakeholders during the first phases of the project to ensure that they are given an opportunity to comment on the proposed projects;
- Define the scope of the EIA process, based on the main issues identified during stakeholder engagement and a screening of potential impacts;
- Define the methodology for the EIA Phase; and
- Describe a Plan of Study for the EIA Phase.

The Scoping Phase was initiated with the distribution of information sharing documents, including a Background Information Document (BID) and I&AP registration form, newspaper advertisements and site notices to the identified stakeholders. An information sharing meeting was held on 12 January 2012 in the town of Loeriesfontein with the objective of presenting stakeholders with information regarding the proposed project and the EIA process to undertaken and to provide I&APs with a platform to raise their issues and comments regarding the proposed project.

A draft Scoping Report was subsequently compiled to present the findings of the public consultation and other environmental, social and cultural assessments that were undertaken during this phase and the report was made available to all I&APs for review over a period of 40 days from 26 January 2012 to 06 March 2012.

The draft Scoping Report was updated to address the comments that were received from the public and authorities and on the basis of all assessments undertaken. The final Scoping Report was submitted to the DEA on 04 April 2012.

The main findings of the Scoping Phase and recommended scope for the EIA phase of the proposed project are summarised below:

- *Drainage lines within the site* – It is recommended these systems be avoided, owing to the ecological importance of the benefiting ephemeral river system. Suitable buffer zones must be established around these drainage lines, within which no construction activities will be allowed. A storm water management plan must be implemented to minimise impacts of the project on drainage lines and water quality in the catchment;
- *Soil erosion and impacts on land capability* – The land types present in the study area have restrictive soil properties and inherent low agricultural potential. A soil and land capability assessment must be undertaken to identify measures to prevent or mitigate soil erosion for different soil types;
- *Water availability* – The project is located in a water scarce area and alternative options for supply of water during construction and operation must be investigated;
- *Visual impacts* – There will be a change in the aesthetic characteristics of the site during both the construction and operational phase. A Visual Impact Assessment (VIA) must be conducted to determine the full range of visual impacts that the project will have on the surrounding visual environment and to inform the site layout design process;

- *Tourism* – The tourism industry in the project area is mainly dependent on natural and cultural resources such as seasonal flowers, vast open areas and outdoor activities such as hiking and 4x4 routes. A Tourism Screening Assessment should be undertaken to assess the potential impacts the project may have on tourist attractions;
- *Socio-economic benefits of the project* – These benefits should be optimised and the negative impacts must be prevented or mitigated through the implementation of effective social management plans and programmes;
- *Safety and security* – Theft of stock grazing on farms in the area is of concern, should there be an influx of job seekers during the construction phase of the project. Negative impacts should be prevented through the implementation of a construction management plan;
- *Heritage resources* – No significant heritage resources were identified during this phase, but it was recommended that a Phase 1 Archaeological Impact Assessment (AIA) and a Palaeontological Impact Statement be undertaken to assess potential impacts on heritage resources;
- *Transmission line servitudes* – There are existing Eskom transmission lines that run across the property. No project infrastructure may be located within the servitudes and Eskom must be assured that access to these transmission lines will be maintained;
- *Rezoning and land use* – The project will require the appropriate rezoning of land in accordance with provincial legislation; and
- *Competitive bidding process* – There are several other planned renewable energy projects in the vicinity of the project and the necessary lease agreements need to be in place with the respective land owners.

The Final Scoping Report for the Loeriesfontein Solar PV Power Plant was approved on 17 May 2012. All requirements stipulated by the DEA will be addressed in the Final EIA report to be submitted for the proposed project.

1.4.4 EIA Phase

The objectives of the EIA phase of the proposed project were to:

- Undertake specialist environmental assessments in order to determine the significance (i.e. duration, spatial extent, severity and probability) of potential impacts associated with the construction, operational and decommissioning phases of the proposed project;
- Provide input into the project design process by delineating no-go areas within which no development should be undertaken;
- Address the environmental impacts associated with proposed project as part of an Environmental Management Programme (EMP) that specifies the measures to mitigate negative and enhance positive environmental impacts; and
- Provide stakeholders with an opportunity to verify whether all issues and concerns have been captured and adequately addressed in the EIA report.

The findings of the EIA phase for the proposed project are integrated into the relevant chapters of this EIA report. Please refer to the executive summary for a concise description of the main findings of this EIA process.

2 APPROACH TO UNDERTAKING THE EIA PROCESS

This section describes the approach that was followed in undertaking the EIA process for the proposed project and details of the activities undertaken throughout the process, including activities undertaken in support of the PPP.

2.1 Requirements for the EIA process

The proposed development of the proposed project is subject to the requirements of GN Regulations 543 to 546 (18 June 2010) ("EIA Regulations") published in terms of the NEMA.

To achieve the objective of cooperative environmental governance and integration of all social, economic and environmental factors into planning, implementation and decision-making, NEMA makes provision for the use of the EIA process as its main planning and decision-making tool.

The PPP is one of the most important aspects of the EIA process. It involves communication and disclosure of relevant project information and provides those interested in, or affected by, a proposed development an opportunity to provide input into the decision making process. It is a legislative requirement to undertake PPP for any development that requires environmental authorisation.

Failure to undertake public participation may create significant risks to the project as members of the public could mobilise against the project if they have not been given the opportunity to participate The PPP for the proposed project was undertaken in an effort to ensure that all I&APs were given a platform to raise their issues and comments regarding the proposed project.

Through compliance with the requirements of the EIA Regulations, the decision-maker is given the opportunity to consider the potential environmental impacts associated with a project early in its development process and evaluate whether these impacts can be avoided, mitigated or enhanced to an acceptable level.

The approach that was followed in undertaking the EIA process for the proposed project was in accordance with the EIA Regulations.

2.2 Public Participation Process

A comprehensive PPP Report was compiled to document the activities undertaken as part of the PPP for the proposed project. Please refer to Appendix D for the PPP Report.

2.2.1 Pre-consultation meeting

A pre-consultation meeting was held with DEA on 18 November 2011 at the DEA offices in Pretoria. The purpose of this meeting was to discuss the requirements for the Scoping and EIA process for the proposed projects. The main points raised at the pre-consultation meeting are highlighted in Table 2-1. A copy of the minutes is included in Appendix D.

Table 2-1: Main points raised at the pre-consultation meeting

ASPECT	NAME AND ORGANISATION	ISSUES/COMMENT	RESPONDER	RESPONSE
Scoping and EIA Reports	Mia Ackermann Digby Wells	Will the DEA require separate Scoping reports and EIA reports for each specific site?	Coenrad Agenbach Deputy director: Special projects (DEA)	All sites can be combined into one comprehensive report, but there must be separate chapters dedicated to each site. Common chapters can be combined, but maps, descriptions of the site and property, applicable listed activities, impacts and mitigation measures must be in separate chapters. The cumulative impacts of the project and other projects in the vicinity must be assessed. There are a significant number of applications for renewable energy projects in the project area.
PPP report	Mia Ackermann Digby Wells	Enquired if the Issues and Response report can be combined for all sites.	Coenraad Agenbach Deputy director: Special projects (DEA)	There might be site specific issues and therefore, it is best to have a separate Issues and Responses reports and tables for each site.
Submission of reports	Mia Ackermann Digby Wells	Enquired on the process to follow when to submitting draft and final reports.	Coenraad Agenbach Deputy director: Special projects (DEA)	Draft reports must be sent to commenting authorities and I&APs on the same day. Final reports should be sent to DEA after the 40 day commenting period. Prior to the lapsing of the DEA's commenting period, the DEA will follow up with the commenting authorities to find out if they have any comments regarding the proposed project. In order to avoid delays in the project, the consultant must ensure that the commenting authorities respond to the draft reports. Suggests that the following organisations should be added as key stakeholders and commenting authorities for the proposed project: • Department of Agriculture, Forestry and Fisheries (DAFF); • Weather South Africa; • Square Kilometre Array (SKA) project;

ASPECT	NAME AND ORGANISATION	ISSUES/COMMENT	RESPONDER	RESPONSE
				• Eskom; • Department of Energy; • South African Biodiversity Institute; • Civil Aviation Authority (CAA);
Screening phase	Mia Ackermann Digby Wells	During the screening phase three alternatives sites will be considered for each Orlight SA Solar PV Power Plant. Heritage, Visual and Ecological studies will be undertaken during this phase to assess potential impacts.	Coenraad Agenbach Deputy director: Special projects (DEA)	Indicated that he fully supports the undertaking of a screening phase. The proposed project area is characterised by Succulents, Camel Thorns and Kokerbome, so it important that a Flora and Fauna study is undertaken. Information collected during the screening phase and the determination of preferred site options should be included in the Scoping and EIA reports. Suggested that an environmental sensitivity map indicating no-go areas, alternative sites and buffer areas should be developed. The project infrastructure and project information should be overlaid on the sensitivity map in order to determine the impacts the proposed development will have on the environment.

2.2.2 *Identification of Interested and Affected Parties*

During the initial phase of the project, I&APs were identified by means of land surveyor data and Windeed searches. Two main stakeholder groups were identified, namely public parties and authorities.

Public

The general public includes the following groups of stakeholders:

- Directly affected land owners;
- Surrounding land owners;
- Environmental groups;
- Non-Governmental Organisations (NGOs); and
- Community Based Organisations (CBOs).

The land owner of the Portion 5 of the farm Klein Rooiberg 227 RD is Mr Herman van Heerden and he was involved during the preliminary identification of sites for the development of the proposed solar PV power plants and on a continuous basis throughout the EIA process.

Authorities

Authorities responsible for governing all aspects of the proposed project and forming part of the decision-making process were identified. The authorities were identified through liaison with different government officials and through considering existing I&AP databases for similar projects and published government databases. Authorities have been divided into the categories listed in Table 2-2.

2.2.3 *Notification of the EIA process*

This phase of the EIA process commenced in December 2011 with the distribution of information sharing documents to identified stakeholders. A copy of all documentation that was developed for the PPP is included in Appendix D.

The objectives of this phase of the process were to:

- Inform I&APs of the proposed project and the PPP to be followed;
- Ensure that stakeholders receive accurate and sufficient project information;
- Invite I&APs to raise issues of concern and suggest project alternatives; and
- Identify and register additional I&APs for the project in response to newspaper advertisements and site notices.

Table 2-2: Authorities included in the EIA process

GROUP	AUTHORITY
National	• Department of Environmental Affairs; • Department of Water Affairs; • South African National Roads Agency Limited; • Department of Agriculture, Forestry and Fisheries; • Civil Aviation Authority; • Department of Science and Technology; and • South African Heritage Resources Agency.
Provincial	• Department of Agriculture; • Northern Cape Department of Economic Development and Tourism; • Department of Transport and Public Works; • Department of Water Affairs; • Department of Environmental and Spatial Planning; • Economic Development Agency; • Cape Nature; and • Northern Cape Economic Development Agency.
Municipalities	• Namakwa District Municipality; • Hantam Local Municipality; and • Ward councillors.
Parastatals	• Eskom; and • Transnet

Background Information Document

A BID and I&AP registration form were developed as part of the PPP. BIDs were distributed to various stakeholders and I&APs from 07 December 2011. Additional BIDs were made available at the local municipal offices and libraries. The BIDs included information regarding the following:

- Description of the project;
- Legal framework to be adhered to;
- Locality and extent of the proposed project;
- Specialist studies to be undertaken;
- Approach to the EIA;
- PPP that will be followed;
- Invitation to an information sharing meeting; and
- I&AP registration form.

Newspaper adverts

In compliance with the local environmental regulations, newspaper advertisements were published in English and Afrikaans. **Error! Reference source not found.** indicates the publication dates and the newspapers used to dvertise the proposed project. Proof of placement of the newspaper advertisements are provided in (Appendix D).

Table 2-3: Newspaper adverts

NEWSPAPER	DATE OF PUBLICATION
Cape Argus	09 December 2011
Diamond Field Advertiser	09 December 2011
Ons Kontrei	15 December 2011
Gemsbok	15 December 2011

Site notices

Site notices were compiled in English and Afrikaans and placed in the vicinity of the study areas and within local towns. The site notices provided I&APs with similar information as contained in the BIDs. Please refer to Appendix D for photographs of site notice placements.

2.2.4 Information sharing meeting

An information sharing meeting was held on 12 January 2012 in the town of Loeriesfontein. The meeting was conducted in Afrikaans and attendees were encouraged to ask questions in the language of their choice. Details of the information sharing meeting are listed in Table 6-3 below.

Table 2-4: Details of the Information Sharing Meeting

LOCATION	VENUE	DATE	TIME
Loeriesfontein	Loeriesfontein Community Hall	12 January 2012	14h00

The purpose of the meeting was to present I&APs with information regarding the proposed project, the process to undertaken and to provide I&APs with a platform to raise their issues and comments regarding the proposed project. Minutes from the information sharing meeting are included in Appendix D.

2.3 Public review of reports

2.3.1 Review of draft Scoping Report

The draft Scoping Report was made available to all I&APs for review over a period of 40 days from 26 January 2012 to 08 March 2012 at the Hantam Library Local Municipal offices in Loeriesfontein.

The report was also made available for download at www.digbywells.com. Information letters were sent to I&APs to inform them about the availability of the draft Scoping Report. This letter was sent by e-mail, fax and registered post from 26 January 2012.

In accordance with Section 56(7) of GN Regulation 543 of NEMA, the draft Scoping Report was also sent to all identified regulating authorities for comment. Proof of notification of the availability of the draft Scoping Report for review by authorities is included in Appendix D.

2.3.2 Review of final Scoping Report

All I&APs were notified of the submission of the final Scoping Report to the DEA on 04 April 2012 and the availability of this report for review for a further period of 21 days. I&APs were invited to submit their comments to the responsible officer at the DEA.

2.3.3 Review of draft EIA Report

In accordance with Section 56(7) of GN Regulation 543 of NEMA, this draft EIA Report will be sent to all identified regulating authorities for comment. Proof of notification of the availability of the draft EIA Report for review by authorities will be forwarded to the DEA upon submission of the final reports.

The report will also be available for download at www.digbywells.com. Hard copies of the report will be made available on request.

2.4 Specialist environmental assessments

Upon completion of the scoping phase, it was determined that further specialist investigations would be required during the EIA Phase to assess the environmental impacts associated with the construction, operational and decommissioning phases of the proposed project.

The specialist investigations, as well as the name and expertise of the various specialists involved in undertaking these assessments are provided in Table 2-5. Copies of their CVs have been attached to this report as Appendix C.

Table 2-5: Specialist studies and project team

ASPECT	SPECIALIST	QUALIFICATIONS AND COMPETENCY
Aquatic and wetland ecology	Andrew Husted	2006 – 2007: MSc Aquatic Health – UJ 2005 – 2006: BSc (Honours) Zoology and Aquatic Health –RAU 2005 – 2003: BSc Zoology and Botany – RAU Competent Wetland Delineator, Department of Water Affairs
Visual Impact Assessment	Bradly Thornton	2008: Advanced Analysis with ArcGIS (GIMS) 2008: Flood Hydrology (University of Stellenbosch) 2007: Introduction to ArcGIS (GIMS) 2003: BSc (Honours) Geography and Environmental Management – RAU 2000 – 2002: BSc Geology, Geography & Environmental Management - RAU
	Alice McClure	2009 – 2010: MSc Environmental Sciences 2008: BSc (Honours) Environmental Sciences – Rhodes University 2005 – 2007: BSc Environmental Sciences and Ethnology – Rhodes University
Ecological assessment	Rudi Greffrath	2005: B-tech Nature Conservation – UPE Saasveld Campus 2001 – 2004: Diploma in Nature Conservation – UPE Saasveld Campus

ASPECT	SPECIALIST	QUALIFICATIONS AND COMPETENCY
Soils and agricultural potential assessment	Louw Potgieter	2004 – current: SA Council for Natural Scientific Professions – Certificated Natural Scientist (Soil Science) 1989 – 1991: National Diploma in Resource Utilisation – Pretoria Technikon
Tourism and land use assessment	Marike de Klerk	2005 – 2006: MA Sustainable Development – UJ 2003 – 2004: BhcS (Honours) (*Cum Laude*) – UP 2000 – 2002: BhcS (*Cum Laude*) – UP
Socio-economic impact assessment	Karien Lotter	2007: MA Research Psychology – UP 2006: BSocSci (Honours) – UP 2005: BSocSci Psychology (*Cum Laude)* – UP
Rehabilitation plan	Thomas Wilson	2008 – 2009: BSc (Honours) Geography and Environmental Management – UJ 2005 – 2007: BSc Geography and Environmental Management – UJ
Traffic impact statement	Gerhard de Wet	2011 – 2012: BKS (PTY) LTD, Associate Engineer 2006 – 2011: BKS (PTY) LTD, Chief Engineer 2002 – 2006: BKS (PTY) LTD, Senior Engineer 2001 – 2002: BKS (PTY) LTD, Engineer
Cultural resources pre-assessment	Johan Nel	2002: BA (Honours) Archaeology – UP 2001: BA Anthropology and Archaeology – UP
Archaeological Impact Assessment	Jayson Orton	1998: MA Archaeology – UCT 1997: BA (Honours) Archaeology – UCT
Palaeontological Impact Statement	John Pether	1994: M.Sc. degree awarded with distinction (UCT). 1983: B.Sc. Honours (UCT) SACNASP: Pr.Nat.Sci (Earth Science)

2.5 Knowledge gaps

This section describes the knowledge gaps that were identified during the specialist investigations undertaken for the proposed project.

2.5.1 Assumptions

This report is based on the following assumptions:

- The main factors that were taken into consideration during the selection of a suitable site for development of the proposed Loeriesfontein Solar PV Power Plant were the identification of available land where long-term lease agreements for the development of renewable energy projects by Orlight SA could be put in place with the land owners and the willingness of the land owner of the identified site to agree to a long-term lease of the property; and

- The objective of the EIA process was to determine the optimal generation capacity that could be accommodated in the identified study area, by configuring the placement of infrastructure in such a way as to avoid environmentally sensitive and other problematic areas. The optimal generation capacity specified in this report is thus based on the maximum amount of solar PV panels and associated infrastructure that could technically be accommodated within the areas that have been delineated as suitable for development. A surface area requirement of 4 ha per MW generation capacity was assumed.

2.5.2 Limitations

2.5.2.1 *Fauna and flora assessment*

The flora and fauna field survey was conducted during the dry season (December) due to constraints imposed by the project timeline. The implication of this was that many of the plant species were dormant during this period and the species that were present were not easily identifiable. Theoretically, sampling of plants should be completed over a full annual cycle. The most appropriate season for surveying flora in the study area is August to September.

In spite of this, regional data from the Succulent Karoo Ecosystem Programme (SKEP) and Critical Biodiversity Area (CBA) plans data that were collected for the study area have a high confidence level and these data sets were used in addition to the findings of the field surveys to delineate sensitive areas. The species composition of the study areas, according to the study, could change if the seasonality of plant species is taken into account.

2.5.2.2 *Visual Impact Assessment*

The site visit that was undertaken for the VIA was not carried out during the flowering season. The study area is situated in Namakwaland, a tourist region known for its daisies and other flowers after the rainy season. Documentation of the landscape character, scenic value and sense of place could change dramatically after a visit to the sites during the flowering season since the dry, barren landscapes become vibrant and colourful in some cases.

2.5.2.3 *Alternatives*

No alternative sites in proximity to Loeriesfontein was assessed as part of this EIA process for development of the proposed Orlight SA solar PV power plant as the objective of the EIA process was to determine the optimal generation capacity that could be accommodated in the areas identified by Orlight SA as proposed development sites.

3 LEGISLATIVE REQUIREMENTS AND PLANNING CONTEXT

3.1 Background and context

The main energy challenges faced by the world today include addressing climate change considerations, limited water resources and increased demand for electricity. A number of people are demanding sustainable methods of electricity generation. With regards to energy supply in South Africa, Eskom reported that there may be a shortfall in electricity supply in the near future, despite a significantly lower-than-expected recovery in electricity demand. South Africa's energy demand will continue to increase and the shortfall in supply is a major concern.

Simultaneously, South Africa is attempting to move away from the utilisation of carbon intensive, non-renewable fossil fuels for energy production. On international level, the legally binding Kyoto Protocol agreement was established in 1997 soon after the inception of the United Nations Framework Convention on Climate Change (UNFCCC). According to the Kyoto Protocol, developed countries are committed to reducing their greenhouse gas (GHG) emissions by 5.2% from 1990 levels by the year 2012. Classified as a developing country under the Kyoto Protocol, South Africa is not legally bound to reduce its GHG emissions and, therefore, the country's contribution to climate change mitigation has not been framed as an absolute emission reduction target.

The likelihood of GHG emission constraints playing a role in the medium and long-term future of South Africa's economy, whether invoked through the UNFCCC, trade barriers, or other measures not yet contemplated cannot, however, be dismissed. International pressure on industrialised developing countries to formalise their GHG emission reduction target and climate change mitigation strategy is increasing and it is within this context that the Government of South Africa pledged to reduce domestic GHG emissions by 34% by 2020 and 42% by 2025, when compared to business as usual. This pledge was made in agreement with the Copenhagen Accord, a non-binding agreement reached by parties at the 15th Conference of Parties (COP 15) of the UNFCCC held in December 2009 in Copenhagen. The South African economy is, however, still highly dependent on fossil fuels and is considered one of the top 15 countries in terms of absolute GHG emissions. Achievement of the GHG emission reduction target pledge by the South African Government will require a well-planned and co-ordinated response over the long-term.

As outlined by the National Climate Change Response Green Paper (2010), South Africa is subsequently aiming to increase the use of renewable energy and energy efficiency to ensure a sustainable energy future that is in line with the principles of sustainability. This includes the development of future opportunities for the use of renewable energy such as solar power in South Africa that is affordable, environmentally sound and socially acceptable. The Department of Energy (DoE) confirmed the procurement (Request for Proposals) of allocated capacity across various renewables technologies, with 1 850 MW set aside for onshore wind, 200 MW for concentrated solar thermal and a further 1 450 MW for Solar PV solutions.

In response to the macro-economic needs described in this legislative overview, Orlight SA is proposing to construct and operate five new Solar PV Power Plants in the Northern Cape and Western Cape Provinces. The aim is for these projects to participate in the third bidding window of the DoE bidding process, which ends on 20 August 2012.

3.2 Legislative framework

The following legislation and guidelines were considered during the EIA process for the proposed Loeriesfontein Solar PV Power Plant.

3.2.1 Constitution of the Republic of South Africa, 1996 (Act No. 108 of 1996)

Section 24 of the Constitutional Act states that everyone has the right to an environment that is not harmful to their health or well-being and to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures, that -

i. Prevents pollution and ecological degradation;
ii. Promotes conservation; and
iii. Secures ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.

In support of the above rights, the environmental management objectives of proposed project are to protect ecologically sensitive areas and support sustainable development and the use of natural resources, whilst promoting justifiable socio-economic development in the towns nearest to the project sites.

3.2.2 National Environmental Management Act, 1998 (Act No. 107 of 1998)

The National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) provides for cooperative environmental governance by establishing principles for decision making on matters affecting the environment, institutions that will promote cooperative governance and procedures for coordinating environmental functions exercised by organs of state.

NEMA also provides for matters related to sustainable development, which means the integration of social, economic and environmental factors into planning, implementation and decision-making so as to ensure that development serves present and future generations. To achieve the above objectives, the Act makes provision for the use of the EIA process as a tool for environmentally sound decision-making. The EIA process is regulated in terms of the GN Regulations 543 to 546 (18 June 2010) ("EIA Regulations"). This EIA Report is an integrated part of the EIA process.

3.2.3 The National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)

The National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA) controls Indigenous Biological Resources. NEMBA provides for the consolidation of biodiversity legislation through establishing national norms and standards for the management of biodiversity across all sectors and by different management authorities.

Within the regional conservation context there are two conservation programmes which are underlain by NEMBA, namely the SKEP and the CBA. The aim of these programmes are to identify and conserve areas of high biodiversity and areas that are in support of these areas through defining conservation outcomes and working towards these. For this report, these programmes were referred to as the basis for conservation planning for the project.

3.2.3.1 *Succulent Karoo Ecosystem Programme*

The SKEP is a long-term, multi-stakeholder bioregional conservation and development programme, with four strategic areas:

- Increasing local and international awareness of the unique biodiversity of the Succulent Karoo;
- Expanding protected areas and improving conservation management;
- Supporting a matrix of harmonious land uses; and

- Improving institutional co-ordination.

The SKEP is a partnership programme with government and non-government partners. The first five years of implementation was funded by the Critical Ecosystem Partnership Fund (CEPF) and focused on catalysing and programme start-up. The next five years will focus on programme consolidation. This will entail integrating the SKEP objectives into national and regional government programmes, and thereby ensuring programme sustainability. The Succulent Karoo biodiversity hotspot extends from the southwest through the north-west areas of South Africa and into southern Namibia.

The data collected and collated by the SKEP for the Loeriesfontein study area shows that the site is not a geographic priority area in terms of SKEP, although it has an irreplaceability value of 0.28.

More information on the importance of the site in terms of biodiversity is provided in Chapter 5 of this report.

3.2.3.2 *Critical Biodiversity Areas*

CBAs are terrestrial and aquatic features in the landscape that are critical for retaining biodiversity and supporting continued ecosystem functioning and services. These form the key output of a systematic conservation assessment and are the biodiversity sectors inputs into multi-sectorial planning and decision making tools. The proposed Loeriesfontein study area does not fall within a CBA.

3.2.3.3 *Freshwater Ecological Priority Area Programme*

For the aquatic and hydrological assessment of the proposed project, the Freshwater Ecological Priority Area (FEPA) Programme will be considered. This programme provides FEPA maps and supporting information which forms part of a comprehensive approach to sustainable and equitable development of South Africa's scarce water resources (WRC, 2011).

FEPA is a single, nationally consistent information source for incorporating freshwater ecosystem and biodiversity goals into planning and decision-making processes to support the water resource protection goals of the National Water Act, 1998 (Act No. 36 of 1998) (NWA) (WRC, 2011). This programme is directly applicable to the NWA, informing Catchment Management Strategies, classification of water resources, reserve determination, and the setting and monitoring of resource quality objectives. FEPA maps are also directly relevant to the NEMBA, informing both the listing of threatened freshwater ecosystems and the process of bioregional planning provided for by this Act.

FEPA maps support the implementation of the National Environmental Management: Protected Areas Act, 2003 (Act No. 57 of 2003) by informing the expansion of the protected area network.

3.2.4 National Water Act, 1998 (Act No. 36 of 1998)

According to the NWA, a water resource is not only considered to be the water that can be extracted from a system and utilised but the entire water cycle. This includes evaporation, precipitation and entire aquatic ecosystem including the physical or structural aquatic habitats, the water, the aquatic biota and the physical, chemical and ecological processes that link water, habitats and biota. The entire ecosystem is acknowledged as a life support system by the NWA.

According to van Wyk et al. (2006) the "…*resource is defined to include a water course, surface water, estuary and aquifer, on the understanding that a water course includes rivers and springs, the channels in which the*

water flows regularly or intermittently, wetlands, lakes and dams into or from which water flows, and where relevant, the banks and bed or the system."

In terms of the NWA, water courses that are identified in the project area will necessitate the establishment of suitable buffer zones around these drainage lines within which no construction of solar PV panels or substations will be allowed. The Department of Water Affairs (DWA) was consulted in an attempt to determine the suitable widths for these buffer zones, depending on the nature of drainage lines identified.

However, the pattern of the drainage lines that were identified on the project site poses a number of restrictions to the project site layout design in terms of totally avoiding the drainage lines and delineated buffer zones. Although the construction laydown yards, substation or solar PV panels would not be located within the drainage lines and buffer zones, the internal roads and underground transmission cables required to connect the different solar arrays with other areas could not be located away from the drainage lines. Four road crossings and five cables crossings of the drainage lines would therefore be required.

A Water Use License Application (WULA) will be prepared and submitted to the DWA in terms of Section 21 of the Act, prior to any of these crossings being constructed. Suitable crossings will have to be designed in consultation with a road engineer and surface water specialist to ensure that impacts on these drainage lines are minimised.

3.2.5 Environment Conservation Act, 1989 (Act No. 73 of 1989)

The aim of the Environment Conservation Act, 1989 (Act No. 73 of 1989) is to provide for cooperative environmental governance by establishing principles for decision-making on matters affecting the environment, institutions that will promote cooperative governance and procedures for coordinating environmental functions exercised by organs of state; and to provide for matters connected therewith. The Act also includes aspects related to the protection of freshwater systems stating that appropriate environmental investigations are mandatory before approval for the "…*construction or upgrading of dams, levees or weirs affecting the flow of a river*…" will be given by the relevant authority.

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

The Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) (CARA) provides for control and conservation of the utilisation of the natural agricultural resources of South Africa in order to promote the conservation of the soil, water sources and vegetation and the combating of weeds and invader plants; and for matters connected therewith. Land owners are obliged, by law, to eradicate alien vegetation on their properties.

For the purpose of the proposed Solar PV Power Plant, the relevant soil and agricultural assessments were undertaken in order to minimise potential impacts on the agricultural potential or productivity of the proposed project site. This report also provides a motivation for the use of agricultural land for energy generation in Section 5.6, based on the findings of the assessment undertaken. The motivation will be communicated to DAFF and will be managed as part of the rezoning application for the proposed project.

3.2.7 National Heritage Resources Act, 1999 (Act No. 25 of 1999)

The National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA) devolves responsibility for the identification of local heritage resources and the inclusion of heritage areas to all municipalities in South Africa.

Developers need to incorporate the NHRA and gain approval from the relevant heritage authorities or municipalities before construction may commence.

For the purpose of this project, a cultural resource pre-assessment was undertaken for the study area, which incorporated the submission of a Notice of Intent to Develop (NID) to the South African Heritage Resources Agency (SAHRA) in terms of Section 38 of the NHRA and the undertaking of a Phase 1 AIA and a Palaeontological Impact Statement, as stipulated in the feedback received from SAHRA.

3.2.8 Land Use Planning Ordinance, Ordinance 15 of 1985

The purpose of the Land Use Planning Ordinance (LUPO), Ordinance 15 of 1985, is "*to regulate land use and to provide for matters incidental thereto*". The consultation and rezoning process for the proposed project site will be undertaken concurrently with the EIA process.

3.3 Local economic planning context

The municipality in which the study area is located is the Hantam Local Municipality of the Namakwa District Municipality in the Northern Cape Province.

The local socio-economic planning factors of the province and municipalities that were taken into consideration during the EIA process for the proposed project are discussed below.

3.3.1 Namakwa District Municipality Integrated Development Plan, 2006 – 2011

The Integrated Development Plan (IDP), 2006 – 2011 for the Namakwa District Municipality was assessed as part of the EIA process for the proposed Loeriesfontein Solar PV Power Plant. The objective of the IDP is to promote the establishment of a sustainable development-orientated and economically viable district.

In terms of local economic development (LED), the municipality has identified a number of LED projects which will have important implications for the proposed Loeriesfontein Solar PV Power Plant. A description of these LED projects and their relevance to the proposed project is provided in Table 3-1.

3.3.2 Hantam Local Municipality Integrated Development Plan, 2011 – 2012

The IDP, 2011 -2012 for the Hantam Local Municipality presents a situational analysis of the key development needs in the municipal area and identifies the key development outputs that are required in an attempt to meet these needs.

One of the key development outputs of the municipality is to increase the percentage of households with access to electricity and renewable energy projects in the areas surrounding Calvinia, Brandvlei, Nieuwoudtville, Middelpos and Loeriesfontein have been identified as a priority for the next 3 years. The proposed Loeriesfontein Solar PV Power Plant is therefore in alignment with the municipality's key development outputs.

3.3.3 Local Economic Development Strategy

During the EIA process, the LED Strategy for the Namakwa District Municipality was taken into consideration in an attempt to identify socio-economic opportunities and constraints for the proposed project. These opportunities and constraints would have to be integrated into the project planning and design process to ensure that the socio-economic benefits of the project are enhanced.

The LED Strategy contains a scan and analysis of potential opportunities for private sector development in the municipality and identifies public sector projects required to create the economic environment in which private sector projects could be implemented. These projects have already been scanned according to their potential for job creation; strategic importance and alignment with national government priorities; feasibility; economic impacts; and development support of small- and medium enterprises. The private sector projects and public sector interventions identified in the LED Strategy that are considered relevant to the proposed Solar PV Power Plant is described in Table 3-2.

Table 3-1: LED projects for the Namakwa District Municipality and project implications

PROJECT	OBJECTIVE	RELEVANCE
Project LE02 – Renewable Energy Cluster	To ensure the participation of the municipality in creating synergy between different renewable energy sectors to allow the municipality to enhance their competitive and comparative advantage for renewable energy projects.	The proposed project will directly contribute to the realisation of the municipality's goal to enhance their competitive advantage for renewable energy project, by illustrating that renewable energy projects can be successfully implemented in the district. Orlight SA must endeavour to consult with the municipality to understand how the project can further contribute to the realisation of this goal.
Project LE05 – Small, Medium and Micro Enterprise (SMME) development cluster	To develop a management support system for SMMEs.	The proposed project will necessitate the procurement of goods and services, many of which could be sources from new SMMEs in the district.
Project LE11 – Working for Water (Tourism and Environmental Cluster)	To eradicate Prosopis sp. to protect the underground water resources and eradicate poverty in communities.	Prosopis species were identified in the study area and will have to be eradicated in terms of CARA. The project will implement an alien invasive eradication programme to ensure that impacts on biodiversity and water resources are minimised.
Project LE12 – Tourism and Environment Cluster (Development of Biodiversity in Namakwa)	To promote initiatives such as the Greening Namakwa, Skeppies Fund and Tourism Hub projects, including development of heritage sites.	The project site itself is not located next to a main tourist route and is therefore not considered an integral part of these tourism initiatives. However, the opportunity exists for Orlight SA to promote a new form of tourism in the area, namely "renewable energy tourism".

Table 3-2: Private and public sector projects and interventions relevant to the proposed project

OPPORTUNITY AREA	PRIVATE SECTOR OPPORTUNITY	PUBLIC SECTOR INTERVENTIONS	RELEVANCE
Manufacturing	Supply of machinery and parts for energy sector.	An equipment needs analysis is required with the private sector to identify their supply chain requirements.	If and when available, Orlight SA should promote procurement of locally produced machinery and equipment.
	Recycling depots	A feasibility study is required to identify potential sites for recycling depots.	The solar PV panels are recyclable and therefore the establishment of recycling depots that could accommodate materials from the project would be favourable for both Orlight SA and the municipality. Orlight SA should use local recycling depots if available.
Energy	Solar energy projects	Develop a legal framework for public-private partnerships guiding the establishment of such partnerships.	A legal framework for the establishment of these partnerships has not yet been formulated, but Orlight SA will engage with the public sector to ensure that its operations are aligned with the legal framework once implemented.
		Infrastructure required for the development of projects should be communicated to the relevant provincial departments so that they can take it into consideration during their budget and planning process.	The South African National Roads Agency Limited (SANRAL) was identified as an important stakeholder during the EIA process, as access to the project site will be via the main national highways. Orlight SA will continue to consult SANRAL throughout the development process.
		Skills development programmes will be required for installation, operation and maintenance of renewable energy projects.	Orlight SA will implement their own training and skills development programme to ensure that necessary skills transfer is achieved for local workers that are employed during the construction and operational phases of the project.
Tourism	Techno tours (local space and energy projects) Eco-tourism and flower mapping tours	The Namakwa Tourism information office should package these opportunities and present them at relevant expos and Indabas.	The proposed project will have a negative impact on eco-tourism due to the removal of natural vegetation. Orlight SA should therefore consider the establishment of a visitors centre at the proposed project, or alternatively, contribute to the establishment of a visitors centre in the town with educational opportunities on solar energy for tourists that visit the area.

3.4 Policies, guidelines and conventions

In addition to the regulations and guidelines discussed in this chapter, the guidelines and policies of the following organisations were also considered during the EIA Phase:

- Guidelines implemented by the South African National Biodiversity Institute (SANBI), responsible for exploring, revealing, celebrating and championing biodiversity;
- Guidelines of the World Wildlife Foundation (WWF) South Africa, which aims to conserve the biodiversity assets (endangered wildlife, species, habitats and ecosystems) of South Africa and ensure natural ecosystems and their services are appropriately valued and integrated into sustainable development;
- The International Union for Conservation of Nature and Natural Resources (IUCN) Red List, which is based on information from a network of conservation organisations to rate which species are most endangered;
- Convention Concerning the Protection of the World Cultural and Natural Heritage initiated by the United Nations Educational, Scientific and Cultural Organization (UNESCO). The Convention aims to protect and conserve the world's natural and cultural heritage. As custodian of unique cultural and natural heritage, South Africa has the responsibility to ensure the identification, protection, conservation, presentation and transmission of cultural and natural heritage sites for future generations;
- The Convention on Biological Diversity that is dedicated to promoting sustainable development. Conceived as a practical tool for translating the principles of Agenda 21 into reality, the Convention recognises that biological diversity is no only centred around plants, animals and ecosystems, but includes people and their need for food security, medical care, fresh air and water, shelter and a clean and healthy environment in which to live;
- The Convention on International Trade in Endangered Species (CITES) which governs international trade in wild animals and plants; and
- The European Landscape Convention (ELC) of the Council of Europe which focuses exclusively on landscapes with the purpose of promoting effective management and planning of landscapes.

3.5 Equator Principles

The Equator Principles are a voluntary set of standards for determining, assessing and managing social and environmental risk in project financing. Once a bank or financial institution adopt the Equator Principles, they commit to refrain from financing projects that fail to follow the processes defined by the principles. The Equator Principles are modelled on the environmental guidelines of the World Bank Group and social policies of the International Finance Corporation (IFC).

Financing of the proposed Solar PV Power Plant will most likely require that the project applicant demonstrates that all potential environmental and social impacts associated with the project have been considered and that these will be managed and monitored in accordance with the Equator Principles. As listed in Table 3-3 and Table 3-4, the Equator Principles and the IFC performance standards were considered throughout the EIA process for the project.

Table 3-3: The Equator Principles applicable to the proposed Solar PV Power Plants

EQUATOR PRINCIPLES
EP 1: Review and Categorisation A project should be categorised according to the magnitude of its potential impacts and risks in accordance with the environmental and social screening criteria of the IFC. **The proposed Orlight SA Solar Power Plants project does not have the potential to bring about significant adverse social and environmental impacts and has thus been classified as a* ***Category C project.***
EP 2: Social and Environmental Assessment An environmental and social assessment process should be conducted to assess the relevant impacts and risks of the proposed project. Mitigation and management measures relevant and appropriate to the nature and scale of the proposed project should be proposed.
EP 3: Applicable Social and Environmental Standards The assessment should refer to the applicable IFC Performance Standards and the Industry Specific Environmental, Health and Safety (EHS) Guidelines and establish the project's overall compliance with, or justified deviation from, these standards and guidelines. **The IFC Performance Standards applicable to the proposed project are listed* in Table 3-4.
EP 4: Action Plan and Management System Action plans should be prepared that details the actions needed to implement mitigation measures, corrective actions and monitoring measures necessary to manage the impacts and risks of the project. **The EMP for the proposed project should hereby be converted into action plans and implemented as part of an Environmental Management System (EMS) for the project.*
EP 5: Consultation and Disclosure Consultation with project affected communities should be undertaken in a structured and culturally appropriate manner. **The PPP for the proposed project will be undertaken in accordance with Government Notice R. No. 543 of NEMA and the IFC Performance Standard 1.*
EP 6: Grievance Mechanism A grievance mechanism should be implemented to ensure that consultation, disclosure and community engagement continues throughout construction and operation of the proposed project.
EP 7: Independent Review An independent social or environmental expert not directly associated with the borrower should review the assessment, action plan and consultation process documentation.

EQUATOR PRINCIPLES
EP 8: Covenants Covenants to comply with all relevant host country social and environmental laws, regulations and permits and project action plans should be made.
EP 9: Independent Monitoring and Reporting An independent environmental and/or social expert should be requested to verify all monitoring information.
EP 10: Equator Principles financial Institution Reporting An annual report on the implementation processes and experience of the project should be supplied to the lender.

Table 3-4: IFC performance standards applicable to the proposed Solar PV Power Projects

APPLICABLE IFC PERFORMANCE STANDARDS
PS 1: Social and Environmental Sustainability Underscores the importance of managing social and environmental performance throughout the life of a project. The objectives of this standard are to: • Identify and assess social and environment impacts, both adverse and beneficial, in the project's area of influence; • To avoid, or where avoidance is not possible, minimise, mitigate, or compensate for adverse impacts on workers, affected communities and the environment; • To ensure that affected communities are appropriately engaged on issues that could potentially affect them; and • To promote improved social and environment performance of companies through the effective use of management systems.
PS 2: Labour and Working Conditions Recognises that the pursuit of economic growth through employment creation and income generation should be balanced with protection for basic rights of workers. The objectives of this standard are to: • Establish, maintain and improve the worker-management relationship; • Promote the fair treatment, non-discrimination and equal opportunity of workers and compliance with national labour and employment laws; • Protect the workforce by addressing child labour and forced labour; and • Promote safe and healthy working conditions, and to protect and promote the health of workers.

APPLICABLE IFC PERFORMANCE STANDARDS
PS 3: Pollution Prevention and Abatement Outlines a project approach to pollution prevention and abatement in line with these internationally disseminated technologies and practices. The objectives of this standard are to: • Avoid or minimise adverse impacts on human health and the environment by avoiding or minimising pollution from project activities; and • Promote the reduction of emissions that contribute to climate change.
PS 4: Community Health, Safety and Security Addresses the client's responsibility to avoid or minimise the risks and impacts to community health, safety and security that may arise from project activities. The objectives of this standard are to: • Avoid or minimise risks to and impacts on the health and safety of the local community during the project life cycle from both routine and non-routine circumstances; and • Ensure that the safeguarding of personnel and property is carried out in a legitimate manner that avoids or minimises risks to the community's safety and security.
PS 5: Land Acquisition & Involuntary Resettlement Seeks to protect sellers from a variety of risks of negotiated transactions that occur as a result of expropriation. The objective of this standard for the proposed Orlight SA Solar PV Power Plants is ensure land owners are satisfied with the lease agreements that are negotiated for use of the land to establish the proposed Orlight SA Solar PV Power Plants.
PS 6: Biodiversity Conservation & Sustainable Natural Resource Management Recognises that protecting and conserving biodiversity and its ability to change and evolve is fundamental to sustainable development. The objectives of this standard are to: • Protect and conserve biodiversity; and • Promote the sustainable management and use of natural resources through the adoption of practices that integrate conservation needs and development priorities.
PS 8: Cultural Heritage Aims to protect irreplaceable cultural heritage and to guide clients on protecting cultural heritage in the course of their business operations. The objectives of this standard are to: • Protect cultural heritage from the adverse impacts of project activities and support its preservation; and • Promote the equitable sharing of benefits from the use of cultural heritage in business activities.

4 PROJECT DESCRIPTION

This chapter provides an overview of the proposed Loeriesfontein Solar PV Power Plant, as well as the findings of assessments undertaken in support of the project design process. A description of the need and desirability of the proposed project in comparison to the no-go project alternative is also provided.

4.1 Description of the proposed project

The proposed project entails the development of a solar PV power plant on Portion 1 of the farm Klein Rooiberg 227 RD, approximately 40 km north of the town of Loeriesfontein in the Northern Cape Province. The land tenure of the project site and directly adjacent properties is illustrated in Plan 2c (Appendix A).

The available surface area that was delineated for the development of the proposed project, based on the avoidance of environmentally sensitive and no-go areas, is approximately 334.5 ha in extent and, therefore, the optimal generation capacity of the power plant based on an estimated requirement of 4 ha surface area per MW generation capacity was determined to be 84 MW. This area includes the surface area requirements for the development of access roads, the construction lay-down yard, site offices and all other project components. The details of the project design process are provided in Section 4.3 and Section 6.2 of this report.

The proposed Solar PV Power Plant will be comprised of the following infrastructure:

- *Solar PV panels* – An array of solar PV panels with a generating capacity of up to 84 MW will be installed over an area of 323.5 ha;
- *Support structures* – The solar PV panels will be mounted on steel support structures. The solar PV panels will be mounted to a maximum height of 7 m and tilted approximately 25° from the horizontal plane, facing to the north and may be on tracking systems to adjust the angle of the panels to the summer or winter solar radiation characteristics;
- *Foundations* – The panel foundations will be either hammered into the ground or have concrete foundations excavated to a depth of approximately 1.5 m, depending on the terrain characteristics determined through geotechnical studies;
- *Electric cabling* – The solar PV arrays will be connected via electric cabling which will be laid underground in trenches of approximately 1 m deep and 0.6 m wide. These cable will cross drainage lines at five points;
- *On-site substation* – The substation will occupy a surface area of approximately 0.78 ha and will include invertors to convert the electricity generated by the solar PV arrays from direct current to alternating current;
- *Transmission line* – The proposed power plant will be connected to the Eskom Helios substation which is located approximately 11 km to the north with 22 kV overhead transmission lines;
- *Access roads* – Access to the proposed project site will be from the Granaatboskolk/Zout Dwaggas gravel road which runs through the site. An internal network of roads will be required to access the different components of the proposed project. These roads will cross drainage lines at four points;
- *Temporary construction lay-down yard* – The construction lay-down yard will occupy a surface area of 8.1 ha and will include a site office, mobile toilets and bathroom facilities, a car parking yard and the hydrocarbon management facility; and
- *Access control and fencing of the site* – The site must be secured against theft from outside and for this purpose, fencing will be installed.

The layout of these components within the development footprint is illustrated in Plan 2c (Appendix A).

4.2 Need and desirability

The proposed Loeriesfontein Solar PV Power Plant is one of five proposed solar PV developments that are being proposed by Orlight SA. The other projects are situated near the towns of Aggeneys and Kenhardt in the Northern Cape Province and Vanrhynsdorp and Graafwater in the Western Cape Province (Plan 14).

The proposed solar PV developments are being planned in response to the urgent need for increase electricity supply and cleaner energy production in South Africa. As discussed in Section 3.1 of this report, the development of the proposed solar PV power plants will ensure adherence to the Final Integrated Resources Plan (IRP), 2010 – 2030 which allows for the development of solar PV and other renewable energy technologies in the country. The proposed project is also in alignment with the IDPs of the Namakwa District Municipality and Hantam Local Municipality, as discussed in Section 3.3.

4.2.1 Project benefits

The project benefits, including a description of the need and desirability of the proposed project, are described in **Error! Reference source not found.** below.

Table 4-1: Project benefits

MOTIVATION	DETAILS
Energy demand	The proposed solar PV power plant will assist in addressing the growing need for increased electricity supply and cleaner energy production in South Africa.
Adherence to the Final Integrated Resources Plan (IRP) 2010 – 2030	The development of the proposed solar PV power plant will ensure adherence to the Final IRP 2010 – 2030. The IRP is a living document promulgated by the Department of Energy (DoE) on 6 May 2011 (in consultation with Eskom) to guide decisions on the future energy mix in SA. This document allows for a certain MW capacity for Solar PV in SA.
Solar radiation	The proposed project site is located in an area of high solar irradiation and is considered ideal for solar PV power generation.
Grid accessibility	The proposed project site is located in geographical proximity to the existing Eskom Helios substation which allows for easy integration into the national electricity grid.
Accessibility	The site is located adjacent to the Granaatboskolk/Zout Dwagga gravel road and can therefore be easily accessed during the construction and operational phases.
Optimisation of use of available land	The proposed project site is located in a region characterised by vast tracts of available land. The current grazing capacity of the site is very low and there are no other significant competitive land uses. Use of the land for renewable energy projects is considered a suitable use.
Affordability	PV installations require little maintenance or intervention after their initial set-up (after the initial capital cost of building any solar power plant, operating costs are extremely low compared to existing power technologies).
Future growth	Demand for energy will increase. Although renewable energy is currently still a capital intensive development, technologies will become more cost effective over time, while fossil fuels may become more expensive.
Socio-economic development	The proposed solar PV power plant will stimulate job creation, local content and local manufacturing, rural development and community involvement, education and development of skills, enterprise development and socio-economic development of the Western and Northern Cape Provinces.

MOTIVATION	DETAILS
Emission reduction targets	The development of renewable energy projects and solar plants leads to a reduction in additional carbon intensive electricity demand, which may in turn reduce the overall GHG emission rates of South Africa and promote energy efficiency.

4.2.2 Assessment of the no-go alternative

The no-go alternative is the option of not proceeding with the development of the proposed Loeriesfontein Solar PV Power Plant. The status quo will be maintained and none of the expected negative environmental impacts will occur. In addition, none of the anticipated benefits of the project, as described in **Error! Reference source not ound.** will be realised.

Based on the above motivations, it would be beneficial to pursue projects such as the Loeriesfontein Solar PV Power Plant that may assist in electricity supply and contribute towards more sustainable and renewable energy. This project also has the potential to provide much needed training and employment opportunities for local communities in the Northern Cape Province. The aspiration and desires to proceed with this sustainable project became apparent during public consultations and site visits to the study area.

4.3 Project alternatives and the project design process

The following alternatives were considered during the EIA process for the proposed development of the solar PV power plant:

- Site alternatives;
- Design and layout alternatives;
- Technology alternatives;
- Operating alternatives; and
- No-go alternative.

4.3.1 Assessment of alternative project sites

The identification of suitable sites for development of proposed solar PV power plants was undertaken prior to the commencement of the EIA process. Sites suitable for the development of solar PV power plants were considered according to the following parameters:

- Areas of high solar irradiation;
- Availability of large tracts of open land for development;
- Easy access to existing roads;
- Diversity in terms of geographical location of the projects proposed by the applicant to ensure that socio-economic benefits of renewable energy projects are not restricted to certain localities;
- Proximity to existing Eskom substations to allow for easy integration of the solar plants with the nearest grid connection points;
- Proximity of sites to load centres where electricity is required;
- Willingness of land owners to agree to long-term leases of their properties; and
- Local need for employment creation and economic development.

Based on an assessment of different areas according to these parameters, the applicant identified the following properties as potential sites for the proposed development of solar PV power plants:

- Portion 1 of the farm Aroams 57 RD near Aggeneys in the Namakwa District Municipality, Northern Cape Province;
- The Remaining Extent (RE) of the farm Klein Zwart Bast 188 RD near Kenhardt in the Siyanda District Municipality. Northern Cape Province;
- Portion 5 of the farm Klein Rooiberg 227 RD near Loeriesfontein in the Namakwa District Municipality, Northern Cape Province;
- The RE of the farm Paddock 257 RD near Vanrhynsdorp in the West Coast District Municipality, Western Cape Province; and
- Portion 1 of the farm Graafwater 97 RD and the RE of the farm Bueroskraal 220 RD near Graafwater in the West Coast District Municipality, Western Cape Province.

All of the above properties were considered suitable for the development of solar PV power plants and, therefore, it was decided to submit EIA applications for the development of solar PV power plants on each of the above mentioned properties.

Although the EIA processes for the five proposed Solar PV Power Plants are being undertaken concurrently, this draft EIA Report specifically addresses the impacts associated with the development of the Loeriesfontein Solar PV Power Plant.

4.3.2 Assessment and delineation of study areas

An environmental screening assessment was undertaken in December 2011 with the aim of determining the suitability of the proposed project site for development, taking into consideration the site's environmental sensitivities and the anticipated impacts of project activities on natural or cultural resources.

The study area that would be considered during the EIA process was subsequently delineated. From the onset of the project, the objective was to design the infrastructure layout in such a way to avoid problematic areas. The study area would thus have to be larger than the required footprint areas for the proposed Solar PV Power Plant, to provide adequate space for optimising site layout to avoid ecological and cultural sensitive areas; transmission line, road servitudes; and difficult topographical areas

The delineation of the study area was based on the following factors:

- Preliminary exclusion of areas that would be present challenges to development in terms of topography;
- Preliminary exclusion of areas that are not easily accessible from main roads;
- Optimisation of the extent of study areas to provide sufficient space for site layout alternatives, while minimising the costs and time involved in surveying large areas of land; and
- Willingness of land owners to agree to long-term leases of land included in the delineated study areas.

4.3.3 Assessment of alternative site layouts

Upon completion of the environmental and cultural assessments undertaken in the study area, including important feedback received from stakeholders during the PPP, a number of sensitivity maps were created using a Geographic Information System (GIS). Details of the approach and process used to delineate environmentally sensitive and no-go areas are provided in Chapter 7 of this report.

The proposed site layout for the proposed Loeriesfontein Solar PV Power Plant, based on the environmental sensitivity analysis is illustrated in Plan 2c (Appendix A).

4.3.4 Assessment of alternative project generation capacities

The optimal generation capacity that can be accommodated in the study area, based on the preliminary assessment of ecological, cultural and socio-economic characteristics and other technical factors are summarised in **Error! Reference source not found.**.

Table 4-2: Optimal generation capacity of the proposed Loeriesfontein Solar PV Power Plant

SITE	AVAILABLE AREA (LOW SENSITIVITY)	AVAILABLE AREA (TECHNICAL)	OPTIMAL GENERATION CAPACITY[2]
Loeriesfontein	521.5 ha	334.5 ha	83.62 MW

4.3.5 Assessment of alternative solar technologies

Two main solar PV technologies were considered for the project, namely solar PV and concentrated solar PV (CPV). At this stage, the use of specific technology alternatives is still under investigation by the Orlight SA, but it is foreseen that the two technologies will have similar environmental impacts. It is anticipated that the final decision on preferred technology will depend on both generation efficiency and economic conditions.

4.4 Proposed project activities

4.4.1 Construction phase

The duration of the construction phase of the proposed 84 MW solar PV power plant is approximately 16 months.

Employment opportunities and accommodation

In the event that an 84 MW power plant is developed, approximately 336 direct job opportunities will be created during the construction phase.

Construction workers will be sourced from local areas and therefore, minimal additional housing will be required. Accommodation of workers from outside the local area will be provided in the town of Loeriesfontein.

Establishment of access and internal roads

The site will be accessed from the existing Granaatboskolk/Zout Dwagga gravel road. Sight distances along the road are adequate to allow safe use of the access to the site. Conflicting traffic flows on the road at the access are low, and there are no noteworthy safety concerns.

Two-track gravel roads of approximately 6 m in width will be established to access the construction lay-down yard and development footprint.

[2] This was based on an approximated requirement of 4 ha per MW peak generation capacity. Includes all power plant infrastructure, construction lay-down areas and internal and access roads.

The pattern of the drainage lines that were identified on the project site poses a number of restrictions to the project site layout design in terms of totally avoiding the drainage lines and delineated buffer zones. The internal roads required to connect the different areas with each other could not be located away from the drainage lines. Four road crossings of the drainage lines would therefore be required.

A WULA will be prepared and submitted to the DWA in terms of Section 21 of the Act, prior to any of these crossings being constructed. Suitable crossings will have to be designed in consultation with a road engineer and surface water specialist to ensure that impacts on these drainage lines are minimised.

Site preparation

Site preparation will consist of the clearance of vegetation at the footprint of the construction lay-down yard, substation and each solar PV mounting structure. Topsoil will be stripped from the footprint of the substation and car parking yard and the topsoil stockpiled for use during site remediation. Where the terrain is undulating, the terrain may be levelled. Large boulders and rocks will be removed. No protected tree species will be removed.

Construction lay-down yard

The construction lay-down yard will provide a storage area for construction material and will be used for assembly purposes.

Vehicle hard park and hydrocarbon storage

A vehicle hard park will be established where all construction vehicles and equipment will be parked overnight, serviced and refuelled. The hydrocarbon management area will be bunded for the safe storage of fuel, lubricants and waste oils.

Access control and fencing of site

Adequate systems and procedures will be in place to minimise the risk of unauthorised access to the site. Carefully consideration will also be given to the plant layout to ensure access for day-to-day operations, emergency escape routes and maintenance of the plant and equipment.

Anchoring and installation of solar PV panels

The foundation types used for the solar PV mounting structures will depend on the terrain characteristics defined by the geotechnical studies. The mounting structure will either be hammered into the earth surface, or a shallow concrete foundation will be cast.

Installation of underground cables

Trenches will be excavated wherein underground electrical transmission cables will be laid. The pattern of the drainage lines that were identified on the project site poses a number of restrictions to the project site layout design in terms of totally avoiding the drainage lines and delineated buffer zones. Five underground cable crossings of the drainage lines would therefore be required.

A WULA will be prepared and submitted to the DWA in terms of Section 21 of the Act, prior to any of these crossings being constructed. Suitable crossings will have to be designed in consultation with an electrical engineer and surface water specialist to ensure that impacts on these drainage lines are minimised.

Construction of facility substation

An on-site facility substation will be constructed which will include the casting of foundations, installation of the transformer and inverters and connecting of the conductors.

Construction of transmission lines

In the event that a 40 MW power plant is constructed, 2 x 22 kV transmission lines will be constructed from the facility substation along existing Eskom transmission lines to the Helios Substation. For an 84 MW power plant, 4 x 22 kV transmission lines will be required.

The properties on which these transmission lines are to be located were not included in the original EIA application. The EAP recommended that a separate Basic Assessment (BA) process be undertaken for the proposed transmission lines. Although considered an "associated activity" to the Solar PV Power Plants, this approach would allow the current EIA process to continue without affecting its planned timeframes.

The proposed approach to the environmental authorisation process for the proposed Solar PV Power Plant and the required transmission lines were discussed with the DEA and it was decided that the potential impacts and required management measures for transmission lines would be addressed during the BA process. Please refer to Appendix D for the correspondence with the DEA.

Water use

Water will be used for domestic use and possibly for dust suppression during the construction phase. The total water requirements for the construction phase are estimated at 173 m^3 per month. Orlight SA has applied for water service provision with the local municipality.

Construction waste management

All construction phase waste will be collected and stored in a temporary waste storage area, where it will be collected by a waste removal contractor for disposal at a licensed waste disposal facility. No on-site burying or burning of wastes will be allowed.

The only chemical toxins on site will be the gas used in welding, the concrete, sulphur hexafluoride housed inside the switchgears and the diesel for the power generators used during the construction. These will be handled with care according to regulatory requirements. Wherever possible, waste materials shall be recycled.

Sewage management

Temporary ablution facilities will be provided and a contractor employed to safely remove sewage from the site to a licensed disposal facility.

Site remediation

Upon completion of the construction phase, the site will be remediated by removing all temporary construction infrastructure, construction waste and construction materials. Vegetation will be re-established in areas where sufficient and suitable substrate remains.

4.4.2 Operational phase

The typical lifecycle of a PV power plant is generally 20 years, where after it can be considered for upgrade and renewal or decommissioning, depending on the prevalent socio-economic conditions.

Employment opportunities and accommodation

In the event that an 84 MW power plant is developed, approximately 84 direct job opportunities will be created during the operational phase.

Generation and transmission of electricity

The electricity generated by the solar PV panels will be stepped up through the inverters and transformers in the facility substation. The electricity will be evacuated from the facility substation via the overhead transmission lines described above.

Access control and fencing of the facility

The perimeter fence established during the construction phase will be maintained and access to the facility will be through a controlled access point.

Facility maintenance

Facility maintenance will include the replacement of damaged solar PV panels and cleaning of the panels using small amounts of water. Approximately 371 m^3 water will be required per month for cleaning purposes of an 84 MW power plant. Orlight SA has applied for water service provision with the local municipality.

4.4.3 Decommissioning phase

Removal of infrastructure

Depending on the economic situation at the end-of-life of the solar PV panels, the facility will either be decommissioned or its operational phase extended.

Site rehabilitation

Where disturbed during operation and decommissioning, sites will be rehabilitated by re-establishment of vegetation compatible with the surrounding land. Rehabilitation is the process of returning the land in a given area to some degree of its former state, after some construction or operation activities may have resulted in its damage. The implementation of the EMP will be essential through the construction operational and closure phase.

5 STATUS OF BASELINE ENVIRONMENT

This chapter provides a description of the current status of the biophysical, socio-economic and cultural characteristics of the study area for the development of the proposed Loeriesfontein Solar PV Power Plant.

The specialist environmental investigations that were undertaken to in support of the baseline characterisation are attached as Appendix E to Appendix J to this report.

5.1 Climate

Loeriesfontein normally receives about 147 mm of rain per year. It receives the lowest rainfall (1 mm) in February and the highest (27 mm) in June. The monthly distribution of average daily maximum temperatures shows that the average midday temperatures for Loeriesfontein range from 17°C in June and July to 29 °C in January and February. The region is the coldest during July when the temperature drops to 2.4°C on average during the night. Brandvlei normally receives about 130 mm of rain per year (five year average), with most rainfall occurring mainly during late summer and autumn. It receives the lowest rainfall in July and the highest in March. The monthly distribution of average daily maximum temperatures shows that the average midday temperatures for Brandvlei range from 18°C in June and July to 35°C in January. The region is the coldest during July when the mercury drops to 1°C on average during the night. Winds generally predominate from the southwest, west-southwest and south southwest direction.

5.2 Land use of the site and surrounding area

The land use of the study area is illustrated in Plan 3c. The main land use is grazing, as illustrated in Figure 5-1. There are two existing transmission lines near the site, including a 66 kV transmission line that runs along the gravel road towards the Helios substation (Figure 5-2) and a 400 kV transmission line that runs towards the north of site from Klein Rooiberg to the substation. There is also a small concrete farm dam located on the property next to a windmill. This functional unit may be used to pump and store good quality groundwater. Farm fences have been erected on the property.

Figure 5-1: Main land use of the Loeriesfontein project site is grazing

Figure 5-2: Existing transmission line that runs along the gravel road at the Loeriesfontein site

5.3 Topography

The Loeriesfontein study area is elevated at 815 metres above mean sea level (mamsl) to 840 mamsl (Plan 4c). The landscape is flat for the most part and there is a mild slope rise of between 0% and 2% (Plan 5c). There are small isolated areas within the study area where the slope rise does increase to a maximum of 6.5%.

The farm on which the proposed project will be positioned is named “Kleine Rooiberg” after the small mountains that are reddish in colour located towards western border of the study area. These mountains or “Rooiberg” regions are elevated above the rest of the landscape. As illustrated in Figure 5-3, the landscape is slightly east facing. The study area is covered by low lying vegetation and rocky areas.

Figure 5-3: Loeriesfontein study area landscape

Drainage starts with narrow rills in the west of the study area transporting water in a general easterly direction. The rills transform to larger drainage channels (Figure 5-4) towards the east and became wider. The Rooiberg River finally drains the runoff out of the study area towards the south. A few loose standing rocky koppies of approximately 5 m to 10 m in height are scattered across the site.

Figure 5-4: Drainage line at Loeriesfontein site

The geology of the project site depicts shale rock type of the Ecca Group of the Karoo Sequence. Remnants of shale littered the surface across most of the terrain, covering the surface in a variety of fragment sizes, also shown in Figure 5-4.

5.4 Catchment characteristics

The project area is situated in the Olifants/Doring Water Management Area (WMA 17). The major rivers associated with this WMA are the Olifants, Doring, Krom, Sand and Sout Rivers.

The project site is situated in the quaternary catchments E31B and E31C. A few ephemeral river systems and associated drainage lines were identified for the project area. These systems are associated with the Volstruisnesholte River catchment which is recognised by the FEPA as an upper management area in support of the downstream FEPAs (sub-catchment 5338). The catchment area is considered to be largely natural and as a result, any impacts to the systems may be severe.

5.5 Soils

A soil and agricultural potential assessment was undertaken and a comprehensive report was compiled at this site. This report was attached to the EIA as Appendix E.

Three transects constituted a cross-cut for the Loeriesfontein study area and enabled observation of the soil with hand-held augers at 30 locations. The results of importance are as follows:

- The vast presence of the shale rock type gave rise to fragment infested shallow soils (<30 cm) for the majority of the site, with the exception of the watercourses/drainage lines where alluvial deposits were dominating;

- The colour of the soils when dry, was found to be yellow-brown when compared to colour coding, however, when compared after moistening matched a red qualification;
- The yellow-red soil particles between the many rock fragments were found to be structureless (apedal), had low clay content and overlaid consolidated rock in the majority of the observation points; and
- The transported soil deposits found in the watercourses was of similar characteristics. However, fine-graded yellow sandy deposits were also observed at river bends and/or where watercourses were wider. Lime was also detected in places.

Table 5-1 describes the main characteristics of the dominant soil types. A map illustrating the dominant land type of the site is provided in Plan 6c.

Table 5-1: Properties of the soil at the Loeriesfontein site

SOIL TYPE	DEPTH RANGE (CM)	CLAY CONTENT* %	TEXTURE	EROSION SUSCEPTIBILITY	UNDERLYING MATERIAL
Red-yellow apedal	<5 – 30	15 – 25	Sandy loam to sandy clay loam	Low	Consolidated rock
Alluvial deposits	30 – 50	12 – 30	Loamy sand to loam	Low	Consolidated bedrock
*Take note that clay content was based on an in-field estimation and texture was derived from the clay content estimation.					

No erosion features of significance were found on this site, although minor sheet erosion seems to occur on the footslopes, but is a very slow going natural process of this region. It is to some extent, counteracted and limited by the rock fragment cover. Anticipated vulnerabilities of the identified soils to anticipated impacts such as erosion induced by water when the soils are exposed, is considered to be moderate. This will be partly due to the little cohesion between particles on the one hand, while the mass of the coarser fragments will reduce the susceptibility, depending on the force subjected to.

5.6 Land Capability

The land capability of the Loeriesfontein site is described in Table 5-2. The classification of land capability was conducted in terms of the Guidelines for Rehabilitation of Mined Land (Chamber of Mines & Coaltech, 2007).

Table 5-2: Land capability of the Loeriesfontein study area

TERRAIN	SOIL TYPE	LAND CAPABILITY
Crests	Very shallow topsoil with abundant rock outcrop	Wilderness/grazing*
Scarps	Rock faces	Wilderness/grazing*
Midslopes	Red fragment-infested topsoil on rock including scattered rock outcrop	Grazing
Footslopes	Red-yellow, fragment-infested topsoil on rock	Grazing
Valley bottoms and flood plains	Yellow and red-yellow, fine alluvial deposits on bedrock. Often bedrock is exposed	Riparian area
**A combination of the two is assigned, as the terrain unit 1 may proof to be too small to warrant delineation on its own for grazing purposes.*		

The majority of the study area can be classified as either wilderness or grazing potential, with exclusion of the riparian areas. No areas with arable potential were identified.

The grazing capacity of the land is considered too low for large-scale, intensive stock farming and, therefore, the use of the land for generation of renewable energy is considered a suitable alternative land use.

5.7 Flora

The Loeriesfontein study area is situated approximately 40 km north of the town of Loeriesfontein, within the Succulent Karoo biome. The study area is located in the Trans-Escarpment Succulent Karoo. According to Mucina and Rutherford (2006), the vegetation type is called Hantam Karoo (SKt2). Dominant vegetation and landscape features include Dwarf Karoo Shrubland with nearly equal proportions of succulent elements and low microphyllous karroid shrubs, particularly of the family Asteracea. The vegetation type has rich displays of spring annuals and Geophytes (Mucina & Rutherford, 2006).

This Loeriesfontein study area falls outside of the CBA and SKEP, but due to the ecological sensitivity of the dominant vegetation type, further baseline characterisation of the flora present in the study area was undertaken as part of a comprehensive Flora and Fauna Assessment that was undertaken for the project. A total of 41 plant species were identified in the study area. Please refer to Appendix F for a copy of the Flora and Fauna Report.

5.7.1 Red Data and Protected Plant Species

During the dry season field work, one protected plant species was encountered namely *Hoodia gordonii*. Red Data plant lists were also obtained from SANBI (Raimondo et al., 2009), which indicated that the following Red Data and protected plant species could occur in the area:

- *Amphiglossa corrudifolia* – Data deficient, Vulnerable, Loeriesfontein and Prince Albert;
- *Babiana cinnamomea* (J.C. Manning & Goldblatt) – Rare, Langeberg north-west of Loeriesfontein;
- *Conophytum caroli* (Lavis Rare) – Northern Cape Kliprand near Loeriesfontein;
- *Cylindrophyllum hallii* (L. Bolus) – Vulnerable, African endemic, Loeriesfontein;
- *Dregeochloa calviniensis* (Conert) – Rare, African endemic, Loeriesfontein and Van Wyksvley;
- *Gladiolus lapeirousioides* (Goldblatt) – Vulnerable, African endemic, Loeriesfontein;
- *Haemanthus dasyphyllus* (Snijman) – Rare, Kamiesberg to Loeriesfontein;
- *Lachenalia barkeriana* (U.Müll.-Doblies, B.Nord. & U.Müll.-Doblies) – Rare, Vanrhynsdorp to Kliprand to Loeriesfontein;
- *Lithops divergens* (L. Bolus) – Near Threatened, African endemic, Loeriesfontein and Vanrhynsdorp;
- *Lithops otzeniana* (Nel) – Vulnerable, African endemic, Loeriesfontein to Gamoep;
- *Lithops viridis* (H.A. Lückh) – Vulnerable, African endemic, Loeriesfontein;
- *Strumaria aestivalis* (Snijman) – Vulnerable, African endemic, Loeriesfontein;
- *Strumaria massoniella* (D.&U.Müll.-Doblies, Snijman) – Vulnerable, Kamiesberg to Loeriesfontein; and
- *Zaluzianskya inflata* (Diels) – Rare, Bokkeveld to Klein Toren near Loeriesfontein.

5.7.2 Medicinal Plant Species

The results from the field survey further indicate that the Loeriesfontein study area contains a wide diversity of medicinal species (Table 5-3), implying that this area is sensitive as far as medicinal plant species populations. Medicinal plants are important to many people and are an important part of the South African cultural heritage (Van Wyk et al, 1997). Plants have been used traditionally for centuries to cure many ailments, as well as for cultural uses such as building material and for spiritual uses such as charms.

Table 5-3: Medicinal plant species (Van Wyk and Van Wyk 1997, Shearing 1997, Esler et. al. 2010)

SCIENTIFIC NAME	COMMON NAME	FORM
Argemone mexicana	Mexican Poppy	Forb
Hoodia gordonii	Ghaap	Succulent
Melianthus comosus	-	Shrub
Rhus undulata	-	Tree
Salvia disermas	-	Forb
Tamarisk ramosissima	Pink Tamarisk	Tree

5.7.3 Alien Invasive and Weed Species

In general the study area appeared to be moderately to heavily grazed, with three alien invasive and weed species found here (Table 5-4). Alien invasive species often tend to out-compete indigenous vegetation. This is due to the fact that they are vigorous growers that are adaptable and able to invade a wide range of ecological niches (Bromilow, 2010). They are tough, can withstand unfavourable conditions and are easily dispersed. This is indicative of early stages of succession and although these species are invasive their use in aid of the prevention of erosion, is valuable.

Table 5-4: Alien invasive and weed species recorded in the study area (Bromilow, 2010)

SPECIES	COMMON NAME	ECOLOGICAL STATUS	FORM
Argemone ochroleuca		Weed*	Dwarf Shrub
Prosopis glandulosa	Mesquite	Invader**	Tree
Tamarisk ramosissima	Pink Tamarisk	Invader*	Tree
Note: * Category 1 plants according to CARA ** Category 2 plants according to CARA *** Category 3 plants according to CARA			

According to CARA, Category 1 plants such as *Argemone ochroleuca* and *Tamarisk ramosissima* need to be eradicated using the control methods stipulated in Regulation 15D of CARA.

5.7.4 Landscape sensitivity

The Loeriesfontein study area has a number of drainage lines which have vegetation characteristics that are very different from the surrounding landscape vegetation. The main channel of the drainage line is situated to the east of the dirt road with the majority of the tributaries emanating from the footslopes of the western mountain slopes. The drainage lines are the concave part of the habitat also called the valley bottoms. Here the sediment (sand) collects during rainfall events, creating favourable habitat for certain plants while excluding others through niche differentiation (Figure 5-5).

The alluvial material present has created habitat for the grass species *Stipagrostis namaquensis,* the invasive shrub *Argemone ochroleuca* and the tree species *Prosopis glandulosa* and *Tamarisk ramosissima,* also a weed species (Figure 5-6). The graminoids *Scirpoides (Scirpus) dioecus, Juncus punctorius, Cyperus laevigatus, Cyperus marginatus* and*, Phragmites australis* were exclusively encountered within the drainage lines.

The vegetation community present in the drainage lines was designated as a no-go area, due to the ecological importance of the benefiting ephemeral river system.

Figure 5-5: Watercourse with deposited sediment, Loeriesfontein

Figure 5-6: Loeriesfontein drainage line east of the road

The hilltops, mountain footslopes (western boundary) and open plains that intersperse with the drainage lines consisted of a gravelly to rocky substrate, mainly due to surface water runoff. These areas are designated as a separate plant community (Figure 5-7). The shrubs *Ruschia intricata, Salsola tuberculata*, *Eriocephalus spinescens* and *Mesembryanthemum (Brownanthus) ciliatum*, were commonly found here, with the grass cover

was diminished due to grazing pressure and seasonality. Key grass species were *Stipagrostis obtusa*, *Stipagrostis uniplumis, Stipagrostis ciliata*, *Stipagrostis namaquensis* and *Enneapogon scaber.* No tree species were found in these habitats, although *Aloe falcata* (Vanrhynsdorp Aloe) was encountered in the northern corner of the study area.

The protected plant species, *Hoodia gordonii*, was also observed in this area. For this purpose, the northern part of the study area was classified as sensitive and should be avoided.

Figure 5-7: Shrubs and vegetation on the Loeriesfontein study area

5.8 Fauna

In addition to the species rich plant life of the Succulent Karoo, this biome has a diversity of tortoises, lizards, molerats, monkey beetles, bee flies, bees, wasps and scorpions. Mammals such as bat-eared fox, aardwolf, steenbok and duiker, as well as reptiles are abundant.

5.8.1 Mammals

The evidence of dung and spoor suggests that animals were present in the area although very few were recorded during the surveys. During the field survey, the presence of mammalian species such as *Rhaphicerus campestris* (Steenbok), *Otocyon megalotis* (Bat Eared Fox), *Lepus capensis* (Cape Hare) and *Hystrix africaeaustralis* (Porcupine) were confirmed.

5.8.2 Avifauna

The study area displayed low numbers of bird species, as listed in Table 5-5. A total of 226 species are known to occur in the ecoregion, of which the Karoo chat (*Cercomela schlegii*), Tractrac chat (*Cercomela tractracs*), long-billed lark (*Certhilauda curvirostris*), the bank cormorant (*Phalacrocorax neglectus*) and the recently described Barlow's lark (*Certhilauda barlowi*) are endemic and could occur in the study area.

Table 5-5: Bird species encountered in the study area

SPECIES	COMMON NAME
Buteo rufuscus	Jackal Buzzard
Meliorax canorus	Pale Chanting Goshawk
Corvus albus	Pied Crow
Telophorus capensis	Bokmakierie
Eupodotis afra	Southern Black Korhaan
Passer melanurus	Cape Sparrow
Ploceus capensis	Cape Weaver
Ploceus velatus	Southern Masked Weaver

5.8.3 Herpetofauna

The Succulent Karoo ecoregion has a relatively high species richness of reptiles and a high percentage of these are endemic. During the site survey, only the Namaqua Speckled Padloper (*Homopus signatus*) was identified on site. This tortoise is an endangered species.

From the desktop review completed for the study area it was found that approximately 15 amphibian species are also found in the Succulent Karoo, including three endemics, namely Boulenger's short-headed frog (*Breviceps macrops*), Namaqualand short-headed frog (*B. namaquensis*) and *Bufo robinsoni*.

Among the region's 115 reptile species, 48 are endemic and 15 are strict endemics. The genus *Cordylus* (spinytail lizards) includes six strict endemics and other strict endemics include Broadley's lance skink (*Acontias litoralis*), Richtersveld dwarf leaf-toed gecko (*Goggia gemmula*), Smith's sand lizard (*Meroles ctenodactylus*), Calvinia thick-toed gecko (*Pachydactylus labialis*), Namaqua thick-toed gecko (*P. namaqua*) and Meyer's legless skink (*Typhlosaurus meyeri)* (Hilton-Taylor, 2000).

5.9 Biodiversity importance

In relation to CBA, the study area falls outside any CBA (BGIS, 2010). In terms of the SKEP, the study area is not a geographic priority area, but has an irreplaceability value of 0.28. The irreplaceability value of a planning unit indicates how important that planning unit is for achieving conservation targets for the biodiversity features it contains. An irreplaceability value of 0.28 translates to flexibility in terms of which sites can be chosen to achieve the conservation target.

All of these findings have been integrated into the site layout design process, as discussed in Section 6.2 and illustrated in Plan 11c.

5.10 Visual environment

The baseline characterisation of the visual quality of the study area was undertaken as part of the VIA that was undertaken for the project. Please refer to Appendix G for a copy of the VIA report.

The Loeriesfontein study area is positioned on the farm Kleine Rooiberg, which was named after the landscape which displays outcropping areas that are reddish in colour and dominate the west and north of the study area. These unusual "rooiberge" definitely add to the aesthetic value of the study area. The landscape is dominated by vegetation that is comprised of low-lying shrubs and succulents and rocky areas.

The study area is situated approximately 40 km outside of the town of Loeriesfontein and there are no residences in close proximity.

Since the study area is nestled between mountains within a landscape that is not urbanised the sense of place on the site is not influenced by the present day social contexts that influence the sense of place of the town of Loeriesfontein. Instead, the site has a "sense of remoteness".

5.11 Tourism

Loeriesfontein falls into the Namakwa tourist district. The surrounding mountains, rivers, valleys and coastline are criss-crossed by hiking, biking, canoe and 4×4 trails. Loeriesfontein has a vibrant community with a growing tourism industry. Various annual events are held each year, such as the flowering festival and the annual agricultural show. South-western Loeriesfontein forms part of the wider region known as Namaqualand, an area well known for its spring flowers (August and September) and its variety of different plants. Loeriesfontein is the windmill capital of South Africa. This is one of the prime tourist attractions in the area. There are a number of accommodation options offered in Loeriesfontein for the traveller, including farmstays, guesthouses and the Loeriesfontein Hotel.

In the LED Strategy for the Namakwa District Municipality, the following opportunities have been identified to further develop the tourism industry in the area:

- Eco-tourism: Vast open land, unique natural flora and a number of national parks and conservancies;
- Adventure tourism: Numerous 4x4 trails and hiking;
- Historical and cultural tourism: A rich heritage of the Khoi San/Nama people in the area, as well as mining museums; and
- Technological tourism: Potentially the SKA radio telescope project (if awarded to the Northern Cape) and renewable energy tourism.

The proposed project site for the Loeriesfontein Solar PV Power Plant is not situated near a main tourist route, but is adjacent to the Granaatboskolk/Zout Dwaggas gravel road. The view of the project site from the road is shown in Figure 5-8.

Figure 5-8: View of project site from main tourist route

5.12 Traffic

A Traffic Impact Statement (TIA) for the proposed Loeriesfontein Solar PV Power Plant was prepared by BKS Consulting Engineers. Please refer to Appendix H for a copy of the report.

The development will be located approximately 40 km north of Loeriesfontein, along the Granaatboskolk/Zout Dwaggas gravel road. Several river crossings are encountered along the road and it is not ideal for large heavy vehicles, but with regular maintenance it should be able to accommodate the heavy vehicle traffic generated during the construction phase.

Sight distances along the Granaatboskolk/Zout Dwaggas gravel road are adequate to allow safe use of the access to the site. Conflicting traffic flows on the road at the access are low, and there are no noteworthy safety concerns.

5.13 Socio-economic context

The proposed Loeriesfontein project site is located in the Hantam Local Municipality of the Namakwa District Municipality in the Northern Cape Province.

5.13.1 Population

According to the classification system used by Statistics South Africa in census and community surveys, the most numerous population group in the Hantam Local Municipality is Coloured. In 2007, this group constituted 87% of the local municipality's population (Stats SA Community Survey, 2007). Whites are the second largest group making up 11% of the population. Black Africans and Asians are the least numerous population groups, each making up less than 1% of the municipality's population.

5.13.2 Employment and unemployment

Stats SA Community Survey (2007) reveals that almost half of the population is employed within the Hantam Local Municipality. Only 15.43% are unemployed and 35.45% are classified as not economically active. A large number of people have elementary jobs which can be attributed to the low levels of education with this region.

5.13.3 Education and skills level

According to Stats SA Community Survey (2007), a majority of the population have some primary and high school education. Approximately 20% of the population have no schooling background. Minority of the population have tertiary qualifications which include Diplomas, Bachelor Degrees and Post Graduate Degrees.

5.13.4 Economic overview

According to Stats SA Community Survey (2007), the largest contributor to employment in the municipal area was the community, social and personal services sector, contributing 7.37%. The second largest contributor was manufacturing and financial and business services at 4.46% and 4.04%, respectively as illustrated in Figure 5-9.

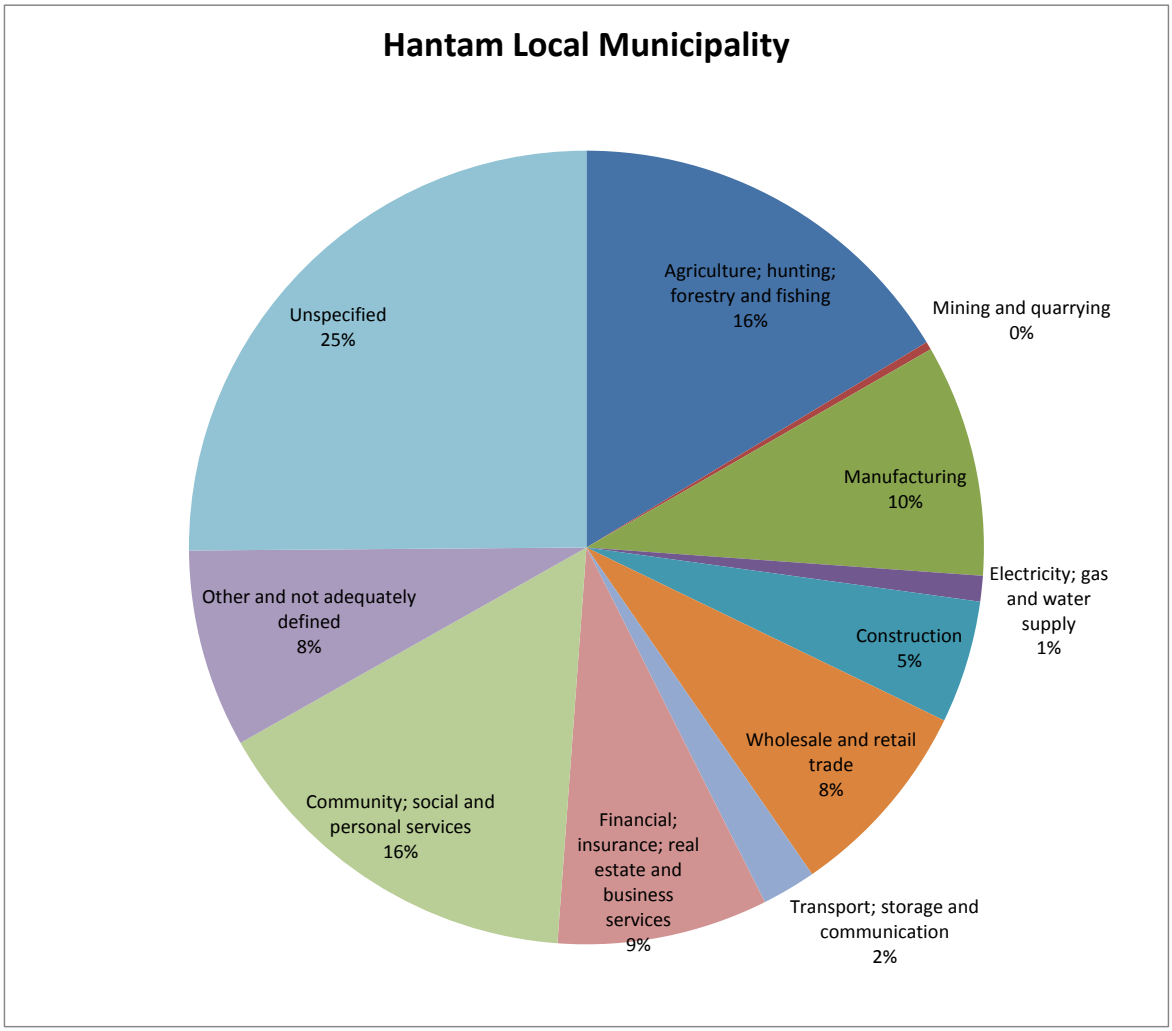

Figure 5-9: Contributions of sectors to local employment in the Hantam Local Municipality *(Source: Adapted from Stats SA Community Survey)*

5.14 Heritage

A Phase 1 AIA was undertaken and a Palaeontological Impact Statement prepared for the proposed project. Please refer to Appendix I for a copy of the heritage reports. The location of relevant heritage aspects of the study area is illustrated in Plan 12c.

5.14.1 Palaeontology

The study area is underlain by the Prince Albert Formation of the Ecca Group of the Karoo Supergroup. Trace fossils such as arthropod tracks and fish trails are common in the Prince Albert Formation. Rare fish remains have been found in nodules and marine invertebrates and fossil wood and leaves also occur.

The ephemeral drainage lines of the Rooiberg Mountains located to the west of the study area could well incorporate fossils eroded from the more abundantly fossiliferous Whitehill Formation that is exposed as the "White Band" on the hill slopes. The potential of discovering *in situ* fossils or eroded-out fossils scattered throughout the project site is moderate.

5.14.2 Archaeology

Background and context

There is very little published literature on the archaeology of the area around Loeriesfontein. Webley & Halkett (2010) undertook a study for a new substation between Aries and Helios, to the west of Brandvlei near to the Katkop Hills. They reported on weathered Middle Stone Age (MSA) artefacts on indurated shale scattered over a wide area. None of these appear to be *in situ*. They found no Later Stone Age (LSA) artefactual scatters in the area, despite suggestions in the literature (Deacon, 1996) that some of the Bleek and Lloyd informants may have originated in this area.

Van Schalkwyk (2011) undertook an HIA for a wind farm to the north of Loeriesfontein, very close to the proposed area. He reported on a number of open sites with surface scatters of MSA and LSA artefacts. However, there is no description or photographs of the LSA artefacts so that it is not possible to compare them with the findings from this assessment. He observed that they are mostly on top of small hills or at the foot of the hills. He also recorded an early 20th Century farmhouse and family cemetery.

Morris (2007) looked at the area around Loeriesfontein with respect to the upgrading of the Sishen-Saldanha railway line. He reported on MSA artefact scatters.

The draft Scoping Report reported on the presence of engravings on boulders between Loeriesfontein and Brandvlei. An article on the rock art of the Thirstland by Rudner & Rudner (1968) describes both scratched and pecked engravings and the presence of stone hut circles between these boulders associated with quartz microliths (probably Wilton), possible herder potsherds and ostrich eggshell beads (Rudner and Rudner, 1968).

Findings of the field survey

No clearly identifiable artefacts from the Early Stone Age (ESA) were found during the site survey and only scatters of very weathered MSA artefacts were found randomly scattered across the landscape.

The most significant discovery was that of a number of LSA archaeological sites, the majority located on the top of the seven little koppies or along the main drainage line. All of the LSA sites are easy to identify by the presence of white crypto-crystalline silica (CCS) flakes and blades and in some instances, large numbers of broken ostrich eggshell (OES) fragments.

The locations of these sites are illustrated in Plan 12c. All significant archaeological sites for which mitigation in the form of either avoidance or mitigation has been recommended are described in Table 5-6.

These LSA sites are discrete sites with a formal stone assemblage that includes scrapers and backed pieces, grooved stones as well as pottery and ostrich eggshell fragments. The sites are unique and offer the potential to inform on a regional archaeological pattern not recorded previously for this part of Bushmanland. For this reason, mitigation should take the form of avoidance of some of these sensitive sites and where avoidance is not possible, archaeological intervention in the form of excavations or systematic collections should take place.

Table 5-6: Significant archaeological sites

SITE NO.	DESCRIPTION	GRADE	LOCATION AND RECOMMENDED MITIGATION
086	Dense LSA scatter on top of a prominent koppie with no or minimal deposits. Large amounts of OES fragments and stone artefacts concentrated on the hilltop: • Bladelets, flakes, irregular and single platform cores and a miscellaneous retouch piece; • No formal artefacts were observed; • Pottery is present (4 mm to 6mm thick, fine temper, no burnish); • An unfinished OES bead suggesting outer diameter of ~6 mm; • Some bone was also noted (possibly recent); and • Raw materials include quartz and quartz crystal, hornfels and CCS.	Grade 11 (provincial significance)	Approximately 1.6 km east of project development footprint. **Avoidance of site is possible.*
122	LSA and MSA artefact scatter on top of a low koppie: • Big hornfels flakes as well as smaller debitage; • Most fresh-looking while some display weathering; • A piece of white CCS (opaline) observed; and • A cairn of dolerite rocks (beacon/marker) is present on the hill.	Grade 111 (local significance)	Approximately 1 km north of project development footprint. **Avoidance of site is possible.*
124	Extensive LSA artefact scatters on top of a low koppie. Some MSA elements are present. Most of the LSA material consists of: • Bladelets, flakes and cores on hornfels, while three backed blades and a scraper are on the white CCS material; • A small amount of OES fragments was observed; • A small cairn of the local dolerite rocks (beacon/marker) was noted on the hill; and • Also some recent glass.	Grade 11 (provincial significance)	Northern edge of project development footprint. **Avoidance of site is not possible and Phase 2 mitigation is recommended.*
132	Ephemeral MSA artefact scatter on top of a low koppie: • Consisted of patinated flakes and chunks; • Both fresh-looking and weathered specimens were noted; and • Some distinctive convergent MSA flakes are present.	Grade 111 (local significance)	Western project development footprint. **Avoidance of site is not possible and Phase 2 mitigation is*

SITE NO.	DESCRIPTION	GRADE	LOCATION AND RECOMMENDED MITIGATION
			recommended.
135	Ephemeral artefact LSA and MSA scatter on top of a low koppie: • Mostly hornfels, with a few white CCS pieces noted, including a bladelet core.	Grade 111 (local significance)	Central project development footprint. **Avoidance of site is not possible and Phase 2 mitigation is recommended.*
137	Ephemeral artefact LSA and MSA scatter on top of a low koppie: • Hornfels, white CCS and a piece of chalcedony; • A few OES fragments were observed; and • A fragment of bottle glass with a pinkish hue from solar radiation was noted.	Grade 111 (local significance)	Southern project development footprint. **Avoidance of site is not possible and Phase 2 mitigation is recommended.*
139	Ephemeral artefact LSA and MSA scatter on top of a low koppie: • Weathered and fresh looking hornfels and some white CCS; and • A metal item (possibly a mouth organ fragment) was also observed.	Grade 111 (local significance)	Southern project development footprint. **Avoidance of site is not possible and Phase 2 mitigation is recommended.*
140	LSA and MSA artefact scatter on top of a low koppie: • Greater number of hornfels pieces than on some of the other koppies, and a handful of white CCS; • Cores, flakes and chunks; and • Several pieces of bottle glass fragments (dark colour suggests some may be 19th Century).	Grade 111 (local significance)	Southern project development footprint. **Avoidance of site is not possible and Phase 2 mitigation is recommended.*
143	LSA and MSA artefact scatter on top of a low koppie: • Fresh looking hornfels predominant and starting to patinate; and • Cores and blades and a retouch.	Grade 111 (local significance)	Within drainage buffer zone in southern project area. **Avoidance of site is possible.*
149	Dense LSA artefact scatter on a low koppie immediately overlooking the river; • Abundant ostrich eggshell fragments and hornfels and CCS; • Chunks, flakes and cores predominate but a formal element is present in the form of side scrapers , a large	Grade 11 (provincial significance)	Eastern project development footprint. **Avoidance of site is not possible and Phase 2 mitigation is*

SITE NO.	DESCRIPTION	GRADE	LOCATION AND RECOMMENDED MITIGATION
	segment and a backed blade.		*recommended.*
150	LSA artefact scatter on a flat area close to the existing powerline, above and adjacent to the river: • Hornfels, CCS and a small amount of quartz; • Flakes and cores, thumbnail scraper (one white CCS), side scraper (one white CCS); • Small amount of OES fragments; • Quite unique in terms of this survey, are a number of lower grindstones found on this site (at least four). One has a deep single groove, another is moderately shallower. The other two are flat slabs showing polish without any groove having developed. Grindstones often mark the position of a campsite; and • It is entirely possible that buried material will be present in the vicinity give the loose sediments along the old river terrace.	Grade 11 (provincial significance)	Eastern project development footprint. **Avoidance of site is not possible and Phase 2 mitigation is recommended.*
LO46	Scatter of white opaline flakes, probably LSA. At least six photographed and there are probably a total of ten in the veld, in the open. Scattered over an area of 2 m² to 3 m².	Grade 111 (local significance)	Eastern project development footprint. **Avoidance of site is not possible and Phase 2 mitigation is recommended.*
LO57	Near stream. Flat area – deflated. Four opaline flakes, some hornfels. One core with flakes chipped off. Two bladelet elements. Many ostrich eggshell fragments over a 5 m² area.	Grade 111 (local significance)	Within drainage buffer zone in southern project area. **Avoidance of site is possible.*

5.14.3 Historical period

Background and context

Historical literature confirms that this part of Bushmanland was occupied by San hunter-gatherers during the early part of the 19th century. However, from approximately 1850 onwards, Dutch Trekboers started making seasonal use of the summer grazing around the large pans in the area. Many contemporary farmers in Namaqualand still own two farms, one in the Bushmanland and the other in Namaqualand. The livestock is transported between their farms by truck. The Basters, of mixed descent, also lived around the salt pans in Bushmanland during the 19th century but were eventually forced off the land as the farms were surveyed and made available to European farmers. Some of these Basters travelled north and settled in the southern Richtersveld. Many of the farms were only allocated after the introduction of the wind pump to South Africa in the 1870s made the more arid lands accessible and suitable for grazing.

Findings of the field survey

Some historical archaeological material was found, which points to some European contact. Two fragments of ceramics with spongeware decoration were found on the lower slopes of the highest koppie (Site 086). These pieces match another sherd of ceramic from the river bank. A number of metal lids, wire, tins, fencing posts and white bottle glass were found on the banks of the river suggesting that the river may have formed a focus for seasonal settlement by farm workers during the early 20th Century.

5.14.4 Built environment

A single semi-circular stone shelter (or “skerm”) was identified on the western edge of the river, overlooking the stream bed. It is clearly the remnants of a little stockpost, with some shale blocks arranged in a semi-circle. It is some 2 m in diameter and the entrance faces north. It is associated with an old enamel bowl, a tin, a wire hook and two rusted sardine cans.

5.14.5 Graves

While there is considerable evidence for Stone Age use of the area, formal burials have never been found in South Africa that date to the MSA. Graves from the LSA tend to be located in softer soils, such as the river banks. A few cairns were recorded on the top of low koppies but these may be elevation markers. No typical surface grave markers were observed with the exception of a single cairn in the open (Site 121).

6 ENVIRONMENTAL IMPACT ASSESSMENT

This section presents the findings of the assessment of potential environmental impacts associated with the proposed development of the Loeriesfontein Solar PV Power Plant.

The results of the impact assessment are presented as follows:

- *Issues and concerns* – The findings of the PPP undertaken for the proposed project are described;
- *Environmentally sensitive and no-go areas* – The process to delineate these areas and resulting sensitivity maps are presented;
- *Significance assessment* – An assessment of the significance of anticipated positive and negative environmental impacts associated with project activities is provided; and
- *Cumulative impacts* – The results of a qualitative assessment of the potential cumulative impacts of the proposed project, similar projects and other developments in the project area is presented.

Recommended measures to enhance the positive environmental impacts and mitigated negative environmental impacts have been detailed in the EMP for the project attached as Appendix J to this report.

6.1 Findings of the Public Participation Process

Issues and comments raised by I&APs during the EIA process have been recorded and addressed in Table 6-1. The table will be updated throughout the environmental authorisation process to capture all issues identified through on-going consultation and review of public documents and reports.

The main issues and concerns that were raised by I&APs related to:

- Potential employment opportunities;
- Potential training and skills development;
- Water availability;
- Safety and security regarding potential sheep theft;
- Requirements for rezoning and consent use applications for affected land;
- Impacts on existing Eskom transmission line servitudes; and
- Competitive bidding process for renewable energy in the area.

The significance of the impacts associated with the above mentioned issues and concerns are assessed in Section 6.2 and Section 6.3 that follow.

To summarise, I&APs generally had no objections regarding the proposed Aggeneys Solar PV Power Plant and feel that the proposed project will benefit them in terms of the supply of renewable energy to an area where it is much needed and through local socio-economic development.

Table 6-1: Issues and response table

ASPECT	REFERENCE	NAME AND FARM/ ORGANISATION	ISSUE	RESPONDER	RESPONSE
Water availability	Information sharing meeting (12 January 2012)	Mr Herman van Heerden: Farm owner (Portion 1of Kleine Rooiberg 227 RD)	Indicated that the groundwater at the farm Kleine Rooiberg is of good quality. He recommended that a water reservoir should be constructed in the area to store surface water which can later be used for various activities.	Orlight SA	Comment noted. **Orlight will not utilise the groundwater borehole, but will contract a water services provider to supply water to the project.*
Employment	Information sharing meeting (12 January 2012)	Ms Sophia Waterboere: Loeriesfontein Community Member	Enquired if there is a guarantee that local people will be employed.	Orlight SA	If the authorities approve this application, the project will create employment opportunities for local people. Employment of local people will be prioritised and it is also a requirement of the government to employ local people. The project will include a skills training programme, support for small business development and skills development.
	Information sharing meeting (12 January 2012)	Ms Sophia Waterboere: Loeriesfontein Community Member	Will candidates who have undergone skills training with Orlight SA receive certificates?	Orlight SA	Certificates can be awarded.
Stock theft	Information sharing meeting (12 January 2012)	Mr Herman van Heerden Farm owner (Portion 1of Kleine Rooiberg 227 RD)	Concerned that sheep theft will be common as there will be contractors on site. Previous problems regarding sheep thefts have been experienced with contractors, e.g. contractors responsible for road and transmission construction.	EAP	Comment noted. **Contractors will be given a Code of Conduct and made aware that stock theft will not be tolerated. Stock theft will result in an immediate dismissal.*

ASPECT	REFERENCE	NAME AND FARM/ ORGANISATION	ISSUE	RESPONDER	RESPONSE
Project consultation	Information sharing meeting (12 January 2012)	Mr David Okhuis: Loeriesfontein Community Member	Suggested that a community representative should be elected.	EAP	Comment noted. **It is recommended that Orlight SA engage with the community throughout the project phases to understand their needs and to address potential grievances that might arise.*
Project timeframes	Information sharing meeting (12 January 2012)	Mr Wilhelm Stout: Loeriesfontein Community Member	Enquired what the lifespan of the project.	Orlight SA	The project has a lifetime of approximately 20 to 22 years, including the construction phase. The contract with the government is for 20 years.
Legislative requirements	Letter Correspondence (06 February 2012)	Ms Toerien: Department of Agriculture, Land Reform and Rural Development	Indicated that the Department of Agriculture, Land Reform and Rural development is guided by Act 43 of 1983 as such the Department does not foresee any problems regarding the proposed development as long as the developer must adheres to the articles of Act 43 of 1983.	EAP	Comment noted. **The requirements of this Act will be taken into consideration in the rezoning process that is being undertaken for the project.*
	Email Correspondence (28 February 2012)	Dr Tiplady: South African SKA Project Office (SASPO)	Indicated that the nearest SKA station to the proposed Loeriesfontein study area is 32 km away and that there is only low risk to SKA associated with this installation. SASPO would like to be kept informed of progress with the projects and states that any transmitters that are to be established at the sites for the purpose of voice and data communication should comply with the relevant AGA regulations.	EAP	Comment noted.
Rezoning	Letter	Ms Toerien: Department	Indicated that rezoning will be applicable as the	EAP	**An application for rezoning is in the process of*

ASPECT	REFERENCE	NAME AND FARM/ ORGANISATION	ISSUE	RESPONDER	RESPONSE
	Correspondence (06 February 2012)	of Agriculture, Land Reform and Rural Development	land use will change from the current agricultural status.		*being undertaken.*
Land owner information	Letter Correspondence (06 February 2012)	Ms Toerien: Department of Agriculture, Land Reform and Rural Development	The developer must have information on who is the current landowner for the affected farm.	EAP	**The current land owner has been identified and has also been consulted. Mr Herman van Heerden is the current land owner of Kleine Rooiberg 227 RD.*
Lease agreements	Letter Correspondence (06 February 2012)	Ms Toerien: Department of Agriculture, Land Reform and Rural Development	Enquired if there will be a subdivision of land or a lease contract between the developer and the land owner	Orlight SA	**Long term lease agreements have been reached with the land owner. Land will not be subdivided.*
EIA	Email Correspondence (29 February 2012)	Mr John Geeringh: Eskom	Eskom is currently conducting network expansion in some areas which are in close proximity to the proposed sites and possible alternative sites.	EAP	Comment noted. **The proposed project does not impact on the construction of the transmission line. The proposed project will, however, contribute to the supply of electricity to the area.*
General	Information sharing meeting (12 January 2012)	Mr Herman van Heerden: Farm owner (Portion 1of Kleine Rooiberg 227 RD)	Indicated that there are developers in the area interested in the same project. Enquired on how will Orlight handle competition in the area?	Orlight SA	**Orlight SA is aware of other companies in the area. Various companies are applying in the Northern and Western Cape. The process is part of a national tender for alternative and renewable energy and Orlight SA will participate in the tender process.*
	Registration Form (16 January 2012)	Mr Willem Beukes: Loeriesfontein	Indicated that the proposed project will benefit the whole of South Africa	EAP	Comment noted.

ASPECT	REFERENCE	NAME AND FARM/ ORGANISATION	ISSUE	RESPONDER	RESPONSE
		Community member			
	Email correspondence (27 March 2012)	Mr Christopher Isherwood: CAA	The CAA ha no objection to the proposed development subject to a height restriction of 7 m.	EAP	Comment noted. **The infrastructure height will not exceed 7 m. This does not include transmission line infrastructure that will be required for the proposed project.*

6.2 Environmentally sensitive and no-go areas

The project design for the proposed project was finalised after suitable alternatives and necessary assessments were conducted. This was part of an integrated and dynamic process to ensure the most financially viable and environmentally sensitive designs were considered for the project.

Upon completion of the environmental and cultural assessments undertaken for the study area, including important feedback received from stakeholders during the PPP, sensitivity maps were created using a GIS. The approach and methodology used to determine sensitivity of the study areas is described in Table 6-2.

It should be noted that avoidance of significant archaeological sites is not possible in all instances, as this would pose significant technical restrictions to the plant layout design and results in a significant loss of available development footprint. Even though these sites are of provincial and local significance, they all occur on surface and are, therefore, likely to be destroyed due to natural and anthropogenic factors not related to the development, if not preserved. In these instances, systematic sampling of surface material may be the most expedient way of recording the sites and making the area available for development. It is not anticipated that the sites will have much deposit and a surface scrape of material may be sufficient, although, some depth of archaeological deposit may occur at Site 149 and 150 (along the river), in which case excavation would be required.

The following sensitive and no-go areas were delineated:

- *Drainage lines* – It is recommended that the main drainage line and associated system be avoided during construction and operation, owing to the sensitivity of the benefiting ephemeral river systems and the largely natural state of these systems. A buffer zone of 50 m is prescribed around the main drainage system, with 30 m buffer zones around all of its tributaries. Establishment of internal roads and trenches for underground cabling could be allowed, pending approval of WULA for associated water uses;
- *Ecologically sensitive areas* –The no-go area generally describes the drainage lines running through the project area. Other areas of high ecological sensitivity include the northern part of the site where *Aloe falcata* (Vanrhynsdorp Aloe) and the protected plant species, *Hoodia gordonii*, was encountered. Least sensitive and favourable areas exist in southern parts of the study area;
- *Areas with heritage value* – It is recommended that LSA sites that have been rated as significant in terms of local and provincial archaeological context that are found on the outskirts of the study area and within other delineated no-go areas (e.g. drainage lines) should be avoided to ensure they are conserved (Site LO57, Site 122, Site 143 and Site 086). Other sites will required Phase 2 mitigation to be undertaken prior to the development being undertaken; and
- *Eskom transmission line servitudes* – The existing 66 kV transmission lines that runs through the project site has a servitude width of 22 m. No construction will take place within these servitudes.

The site layout design process for the proposed Loeriesfontein Solar PV Power Plant is illustrated in Plan 11c. The infrastructure layout plan of the proposed project in relation to the environmentally sensitive and no-go areas is presented as Plan 2c.

Table 6-2: Approach and methodology to determining site sensitivity

ASSESSMENT	PHASE	DESCRIPTION
Delineation of drainage lines	EIA phase	Watercourses and drainage areas were delineated in accordance with the DWAF (2005) guidelines, "*A practical field procedure for identification and delineation of wetlands and riparian areas"*. A field investigation was conducted in order to delineate these systems. Wetland indicators such as topography, soil and vegetation were considered in order to identify areas of saturation. In addition to this, the riparian indicator referred to as "alluvial soils and deposited material" was also considered in order to delineate the associated drainage areas of the catchment. These indicators were jointly considered to identify and classify areas of the landscape/catchment that are important for the maintenance and functioning of the water resources.
Ecological assessments	EIA Phase: Research	Existing plans and maps were used to gain an understanding of the sites and to determine what to expect once on site. Sites of importance, such as drainage lines can often be determined from these and then investigated in detail during the field work.
	EIA Phase: Field work methodology	The primary objective was to characterise the vegetation in the study areas by conducting an in-depth vegetation survey. The findings were used to identify ecologically sensitive areas, which guided the placement of infrastructure. The presence of the plants with Red Data status; medicinal uses; cultural uses; and declared weeds and invader species were established. An animal survey was conducted in conjunction with the vegetation survey and mammals; avifauna; and herpetofauna known to occur in the area, or observed during surveys were recorded.
	EIA Phase: Sensitivity ratings	The findings from the vegetation and animal studies were used to delineate areas that are sensitive to disturbance from an ecological perspective. The sensitivity categories concentrate on landscapes that perform integral biophysical support and maintenance functions within the study area and surrounding landscapes. In addition to the sensitive landscapes, the protected plant and animal species are also regarded as sensitive and were used in sensitivity mapping. Sensitive areas included areas where protected species (*Hoodia gordonii*) and tree species *Aloe falcata* occur, as well as along the drainage lines. From this information various ratings were developed which defined "No go" areas, which are most sensitive, Highly Sensitive, Sensitive, Minimally Sensitive, Favourable and Least Sensitive Areas. "No Go' Areas within the study sites are to be avoided at all costs; these areas have a very high potential to support sensitive plant and animal species, but more importantly they are integral for ecosystem functioning within the general area and once removed will have a far reaching effect on the site and surrounding areas. "Highly sensitive" areas are areas that could very possibly provide habitat for sensitive flora and fauna species, and have a role to play in ecosystem functioning but are not integral to this function. Removal or damage to these areas will only affect the habitat present on site and

ASSESSMENT	PHASE	DESCRIPTION
		possibly surrounding habitats. "Sensitive" areas could once again provide habitat for sensitive flora and fauna species and they may contribute to ecosystem functioning within the study area, they are not integral and removal of them will not affect the surrounding ecosystems. "Minimal sensitive" areas have a small chance of containing sensitive flora and fauna species; however these areas have very little ecosystem functioning value on or off the study area. "Favourable" areas are areas where construction of the solar PV panels will have the least effect on the prevailing habitat; these are therefore favourable in that sense only. "Least sensitive" and "Favourable" areas could be interchangeable from a flora and fauna perspective; however the distinction is made due to the influence of other factors such as proximity of national roads.
Visual sensitivity analysis	EIA Phase: Identification of visual receptors	Potential receptors were identified using aerial imagery within a 5 km radius of the proposed study area. These receptors included the main gravel road (i.e. those people travelling on the road).
	EIA Phase: Viewshed analysis	A model was created in ArcGIS for the viewshed analyses to be run for each of the receptor groups. The results of this model were 12 polygon viewshed layers for each receptor group for each site, denoting which points they would be seen from and, concurrently, which points in the landscape the persons within these receptor groups would be able to see. Values were then assigned for the viewshed polygons based on the receptor group such that the areas visible by more sensitive visual receptors were given a higher value (i.e. the visibility areas for the towns and highways are likely to be experienced more frequently/by a larger number of people).
	Integration of EIA Phase: viewshed polygons	All of the viewshed polygons for all of the different receptor groups were then merged in order to obtain one comprehensive visual sensitivity layer. This merging process allowed both the number of receptors and the type of receptors to be factored into an all-inclusive visual sensitivity index that ranged from 0 (areas within the study site that are not visible from any of the identified receptors) to 7.25 (areas that are visible from a range of receptors, including the most sensitive receptors – towns and a highway).
	EIA Phase: Visual sensitivity rating	These scores were then grouped into visual sensitivity ratings. Based on the definition of the visual sensitivity scale, areas for potential construction that would lead to lower visual impacts were recommended.
Cultural and landscape	Sites of archaeological significance	Findings of the Phase 1 AIA and Palaeontological Impact Statement were integrated into sensitivity maps. Sites that were considered to be located within ecologically sensitive and other no-go areas were demarcated as sites that need to be preserved, owing to the fact that due to

ASSESSMENT	PHASE	DESCRIPTION
		other environmental factors, these areas would be demarcated and conserved. Sites within the development footprint that are likely to be destroyed should construction activities continue, were not designated as no-go areas, as suitable mitigation in the form of a Phase 2 AIA is possible.
Technical factors	Eskom servitudes	Consultation with Eskom regarding the prescribed servitude widths of existing transmission lines was undertaken by Aurecon Engineers. The proposed Solar PV Power Plant components were designed in such a way as not to impact on the existing Eskom transmission line servitudes.
	Integrated design workshop	An integrated design workshop was held between the EAP, the applicant and Aurecon Engineers and NETGroup who were responsible for the preliminary design layouts of the proposed Solar PV Power Plant. The objective of this workshop were to plan the layout of all Solar PV Power Plant components, including the construction lay-down yards and access points, taking into account the environmental sensitivity of the study area, as well as engineering practicality and technical design considerations. The outcomes of this workshop was a site layout plan for each of the Solar PV Power Plant, which could be considered the best-suited option in terms of the project footprint's' environmental and cultural impacts.

6.3 Assessment of potential impacts

Activities associated with the construction, operation and decommissioning of the proposed Loeriesfontein Solar PV Power Plant will result in impacts on the biophysical, socio-economic and cultural environments. The activities that will be undertaken during each phase of the project were described in Section 4.4.

The physical area that will be disturbed by the proposed project activities and components are summarised in Table 6-3 below.

Table 6-3: Scale of physical disturbances associated with the proposed project

COMPONENT	PHYSICAL DISTURBANCE
Solar panels, roads and cables (ha)	323.5
Area of laydown yard (ha)	8.1
Area of substation (ha)	0.7
Total (ha)	**332.3**
Area suitable for development (ha)	334.5
Portion of area suitable for development (%)	*99%*
Study area (ha)	1040.04
Portion of study area (%)	*32%*

In order to assess the significance of these impacts, use was made of a semi-quantitative impact assessment methodology which is based on an assessment of the following parameters:

- *Severity* – The magnitude of change from the current baseline status of the affected environmental, socio-economic or heritage aspect;
- *Spatial scale* – The physical area which is impacted on by the potential impact;
- *Duration* – The expected time period during which a potential impacted will be experienced; and
- *Probability* – The likelihood of occurrence of the impact, based on knowledge of the operating conditions and the type of activities that will be undertaken.

More detail on the quantitative ratings attached to each of the above parameters and the EIA methodology is attached in Appendix K.

6.3.1 Potential impacts on surface water systems

The main impacts on surface water systems will occur during the construction phase of the proposed project. These impacts were assessed to have **medium-low** to **high significance.** Activities that will result in changes to the surface water systems include:

- The clearance of vegetation at the footprint of the construction lay-down yard, substation and each solar PV mounting structure;
- Establishment of access roads, including crossings over drainage lines and dry river beds;
- Laying of underground cables, including crossings over drainage lines and dry river beds;

- Levelling of the terrain where it is too undulating for installation of panels; and
- Generation and handling of domestic and industrial wastes.

Tables summarising the significance of the potential impacts on surface water systems during the project phases are presented below.

Nature of impact	**Changes to surface water flow dynamics due to the site preparation activities.**				
Description of impact	The removal of natural vegetation from the project development footprint, levelling of undulating areas and creation of hard and compacted surfaces will alter the natural topography and drainage patterns of the project site. A significant impact would be the construction of road crossings over drainage lines and similarly, the laying of underground electric cables. During rainfall events, disturbed surfaces would be susceptible to erosion and altered surface flow dynamics will accelerate the very slow, natural erosion process and sediment transport off-site. The project site is situated in an arid area which received very little rainfall and therefore, this impact will not occur frequently. Owing to the sensitivity of the benefiting ephemeral river systems and the largely natural state of these systems, these impacts could be significant if not mitigated.				
Mitigation required	• All road crossings and underground trenches for electric cables that cross drainage lines in the project development footprint must be designed by a qualified road engineer in consultation with a surface water specialist; • A WULA must be obtained for each crossing of drainage lines prior to the commencement of the construction phase. All mitigation measures specified in the WULA must be implemented; • It is recommended that the majority of site preparation activities be undertaken during the dry season; • The storm water management plan (Appendix J - EMP) should be implemented during the construction phase and operational phase; • With the exception of the construction of road crossings and lying of underground cables, no other activities may be allowed with the delineated drainage lines and buffer zones; • Clearing of vegetation should be supervised to ensure that no more than the minimum area of land that is needed is cleared; and • Site remediation should be undertaken on a concurrent basis according to the rehabilitation plan (Appendix J) during the construction phase to ensure that vegetation is restored to disturbed areas, which will to some extent restore some of the site's flood attenuation capabilities and reduce vulnerability to erosion.				
Parameters	*Severity*	*Spatial scale*	*Duration*	*Probability*	*Significant rating*
Pre-Mitigation	Significant impact (6)	Regional (5)	Permanent (6)	Certain (7)	High (119)
Post-Mitigation	Moderate (3)	Local (3)	Long term (4)	Probable (4)	Medium-low (40)
I&AP concern	Yes, a concern was voiced regarding storm water management of the site and a request made that a management plan be implemented to mitigate its impacts.				
Residual impacts	The surface water dynamics will be altered permanently during the life of the project; however, the resulting impacts (i.e. soil erosion and sediment transport) can be limited through the implementation of a storm water management plan.				

Nature of impact	**Contamination of downstream water resources during surface flow events.**				
Description of impact	The main drainage direction of the site is towards the southeast from the Rooiberg Hills via a complex network of drainage channels. The main drainage channel leaves the site and joins the regional drainage network approximately 10 km southeast of the project site. During surface flow events, increased sediment transported due to accelerated erosion from disturbed areas, as well as other contaminants (i.e. waste products, effluents, construction materials) stored on the construction site, may result in contamination of downstream water resources. Owing to the sensitivity of the benefiting ephemeral river systems and the largely natural state of these systems, these impacts could be significant if not mitigated.				
Mitigation required	• All road crossings and underground trenches for electric cables that cross drainage lines in the project development footprint must be designed by a qualified road engineer in consultation with a surface water specialist; • A WULA must be obtained for each crossing of drainage lines prior to the commencement of the construction phase. All mitigation measures specified in the WULA must be implemented; • It is recommended that the majority of site preparation activities be undertaken during the dry season; • A storm water management plan (Appendix J) should be implemented during the construction phase; • Upslope water should be directed away from cleared areas, • Clearing of vegetation should be supervised to ensure that no more than the minimum area of land that is needed is cleared; • Site remediation should be undertaken on a concurrent basis during the construction phase to ensure that vegetation is restored to disturbed areas, which will restore some of the site's flood attenuation capabilities and reduce vulnerability to erosion; • All waste products must be managed according to a waste management plan (Appendix J); • All construction materials should be stored in bunded areas to ensure that material loss during surface flow events are prevented; • Vehicles should be services and checked for leaks on a daily basis to minimise spillage of hydrocarbon contaminants during the construction phase; • The vehicle hard park area should be separated from clean water areas with berms or channels; and • Spillage should be managed through an emergency spill response plan (Appendix J).				
Parameters	*Severity*	*Spatial scale*	*Duration*	*Probability*	*Significant rating*
Pre-Mitigation	Significant (6)	Regional (5)	Medium term (3)	Probably (4)	Medium-low (56)
Post-Mitigation	Moderate (3)	Local (3)	Short term (2)	Unlikely (3)	Low (24)
I&AP concern	No concerns regarding surface water contamination were voiced during the PPP.				
Residual impacts	Some erosion and surface water contamination could still occur during the construction phase and therefore, it is important to monitor water quality during surface water flow events and in the main drainage line to identify potential sources of contamination.				

6.3.2 Potential impacts on soil and agricultural potential

The main impacts on soils and the agricultural potential of the project site will occur during the construction phase of the proposed project. These impacts were assessed to have **medium-low significance.** Activities that will result in impacts include:

- The clearance of vegetation at the footprint of the construction lay-down yard, substation and each solar PV mounting structure;
- Creation of compacted surfaces, including roads, the vehicle hard park area and construction lay-down yard;
- The installation of solar PV panels and all associated infrastructure; and
- Generation and handling of domestic and industrial wastes.

Tables summarising the significance of the potential impacts on soils and agricultural potential during the project phases are presented below.

Nature of impact	**Loss of the soil resource to support existing land use and land capability.**				
Description of impact	Due to the sizes of the areas impacted upon, the loss of the soil resource as a medium of supporting the grazing capability of the land as well as forming part of a grazing rotational system with a farm management unit will be total for the life of the project. Due to the fact that the land cannot be replaced for the full life of the project, no mitigation is possible.				
Mitigation required	No mitigation is possible.				
Parameters	*Severity*	*Spatial scale*	*Duration*	*Probability*	*Significant rating*
Pre- Mitigation	Serious (4)	Very limited (1)	Project life (5)	Certain (7)	Medium-low (70)
Post- Mitigation	Serious (4)	Very limited (1)	Project life (5)	Certain (7)	Medium-low (70)
I&AP concern	No concerns regarding loss of soil was voiced during the PPP.				
Residual impact	After decommissioning it should be fairly achievable to restore the land to its original natural state, land capability and land use.				

Nature of impact	**Water and wind erosion of soils due to site preparation activities.**
Description of impact	Anticipated vulnerabilities of the identified soils to anticipated impacts such as erosion induced by water when the soils are exposed, is considered to be moderate. This will be partly due to the little cohesion between particles on the one hand, while the mass of the coarser fragments will reduce the susceptibility, depending on the force subjected to. The very fine material in-between the fragments will be subjected to wind erosion where exposed. Water erosion can only occur during the rainy season, while wind erosion can occur at any time of the year. Both types of erosion pose a threat to the soil as a support structure for sustaining a grazing land capability.
Mitigation required	• It is recommended that the majority of site preparation activities be undertaken during the dry season;

Nature of impact	**Water and wind erosion of soils due to site preparation activities.**				
	• Minimise construction activities on windy days. Temporary cessation of construction activities could be required during very windy periods; • A storm water management plan (Appendix J) should be implemented during the construction phase; • Clearing of vegetation should be supervised to ensure that no more than the minimum area of land that is needed is cleared; • Site remediation should be undertaken on a concurrent basis during the construction phase to ensure that vegetation is restored to disturbed areas, which will restore some of the site's flood attenuation capabilities and reduce vulnerability to erosion.				
Parameters	*Severity*	*Spatial scale*	*Duration*	*Probability*	*Significant rating*
Pre- Mitigation	Significant (6)	Limited (2)	Short term (2)	Probable (4)	Medium-low (40)
Post- Mitigation	Very serious (5)	Limited (2)	Short term (2)	Unlikely (3)	Low (27)
I&AP concern	No concerns regarding soil erosion were voiced during the PPP.				
Residual impact	Some erosion could still occur during the construction phase and therefore, it is important to monitor the site and soil stockpiles for visible signs of erosion (i.e. gullies, rills and bare patches).				

Nature of impact	**Soil compaction due to soil handling, stockpiling and vehicles use.**				
Description of impact	Site clearance and construction of compacted areas will induce soil compaction in the case where heavy machinery will be used. Soil compaction is a function of the composition of the soil and relates to the grading. The coarse graded soils that occur on site have little potential for compacting.				
Mitigation required	• Where feasible, activities that are usually undertaken by machinery (such as vegetation removal), should be replaced with manual labour; • Soils should be stripped from the footprint of the substation site and car hard park to conserve the soil and ensure that enough soil is available for site remediation; • Soils stockpiles should be vegetated to prevent wind and water erosion; • Where topsoil is partially compacted, the soil surface can be loosened via tillage/ripping; and • Soil should be loosened after construction activities, as per the rehabilitation plan (Appendix J).				
Parameters	*Severity*	*Spatial scale*	*Duration*	*Probability*	*Significant rating*
Pre- Mitigation	Moderate (3)	Very limited (1)	Project life (5)	Probable (4)	Medium-low (36)
Post- Mitigation	Moderate (3)	Very limited (1)	Long-term (4)	Probably (4)	Low (32)
I&AP concern	No concerns regarding soil compaction were voiced during the PPP.				
Residual impacts	Soil compaction in some areas of the project development footprint will be inevitable. During site remediation and final rehabilitation, all soils will have to be ameliorated as per the rehabilitation plan (Appendix J).				

Nature of impact	**Soils contamination due to spillage of hydrocarbons or wastes.**				
Description of impacts	The potential for contaminating the soil resource is dependent on the presence of vehicles, machinery and processes involving various types of chemicals. For the planned site use very little of these are anticipated during the life span of the project. The potential impact is thus assumed to be minor and localised if it should occur (i.e. oil leakage from vehicles and earth moving machines).				
Mitigation required	• All waste products must be managed according to a waste management plan (Appendix J); • All construction materials should be stored in bunded areas to ensure that material loss during surface flow events are prevented; • Soils should be stripped from the car parking yard prior to construction to conserve the soil and to have soil available for site remediation; • Vehicles should be services and checked for leaks on a daily basis to minimise spillage of hydrocarbon contaminants during the construction phase; • The vehicle hard park should have a concrete surface and drip trays installed overnight to minimise spillage of hydrocarbon contaminants. The vehicle hard park area should be separated from clean water areas with berms or channels; and • Spillage should be managed through an emergency spill response plan (Appendix J).				
Parameters	*Severity*	*Spatial scale*	*Duration*	*Probability*	*Significant rating*
Pre- Mitigation	Significant (6)	Very limited (1)	Long-term (4)	Likely (5)	Medium-low (55)
Post- Mitigation	Moderate (3)	Very limited (1)	Immediate (1)	Rare (2)	Low (10)
I&AP Concern	No concerns regarding soil contamination were voiced during the PPP.				
Residual impact	It is advisable to conduct a soil monitoring plan after construction through collecting and analysis of soil samples at and around the site of potential impact.				

6.3.3 Potential impacts on the ecology

The main impacts on the ecology will occur during the construction phase of the proposed project. These impacts were assessed to have **medium-low** to **medium-high significance.** Activities that will result in impacts include:

- The clearance of vegetation at the footprint of the construction lay-down yard, substation and each solar PV mounting structure;
- Access control and fencing of site during the construction and operational phases of the proposed project; and
- Site remediation activities.

Tables summarising the significance of the potential impacts on the ecology during the project phases are presented below.

Nature of impact	**Loss of habitat within indigenous natural vegetation types**
Description of impacts	During the site layout design process, no-go areas along the drainage lines running through the project area and other areas of high ecological sensitivity, such as the areas where protected and red data species occur were delineated. These areas were excluded from the development footprint and will not be directly impacted by development. However, due to the complex drainage pattern

Nature of impact	Loss of habitat within indigenous natural vegetation types				
	present on site, a boundary effect could occur that might impact on these areas. Therefore, buffer zones have been established. The least sensitive areas that were delineated and defined as suitable for development consist mostly of indigenous natural vegetation. During site preparation activities, 99% of this vegetation will be removed. There is also a possibility that Red Data or protected plant species that have not been identified in these areas during dry-season surveys could be destroyed. During site clearance, it is also likely that alien invasive and weed species will propagate on disturbed areas. Alien invasive species often tend to out-compete indigenous vegetation, due to the fact that they are vigorous growers that are adaptable and able to invade a wide range of ecological niches. An irreplaceability value of 0.28 was assigned to the site in terms of SKEP, which translates to flexibility in terms of which sites can be chosen to achieve the conservation target.				
Mitigation required	• The no-go and high ecologically sensitive areas should be demarcated and avoided at all costs; • A flora survey of the project development footprint should be undertaken during the wet-season to try and identify Red Data and protected plant species that might not have been identified during dry-season surveys. If found, the necessary permits should be obtained prior to the removal or destruction of these species; • No vegetation removal should be allowed outside the designated project development footprint; • During site remediation and rehabilitation, a representative sample of indigenous plant species should be selected and these species should be replanted on disturbed areas as per the rehabilitation plan (Appendix J); • Where possible, the removal and destruction of indigenous vegetation should be avoided (i.e. adhering to the designated internal road network); and • An alien invasive and weed control programme should be implemented throughout the project lifetime (Appendix J).				
Parameters	*Severity*	*Spatial scale*	*Duration*	*Probability*	*Significant rating*
Pre- Mitigation	Very serious (5)	Very limited (1)	Project life (5)	Certain (7)	Medium-high (77)
Post- Mitigation	Moderate (3)	Very limited (1)	Project life (5)	Likely (5)	Medium-low (45)
I&AP Concern	No concerns regarding the ecological impacts of the proposed project were voiced during the PPP.				
Residual impact	The destruction of indigenous vegetation, in spite of existing disturbances (i.e. due to grazing and transmission line infrastructure) is unavoidable. This impact will continue throughout the project life, although remediation of the site to an ecological state better than the status quo is possible during the decommissioning phase if an alien invasive eradication programme is implemented (Appendix J).				

Nature of impact	Ecological impacts of access control and fencing of the site.
Description of impact	The erection of fences during the construction and operational phases of the proposed project will have a dual effect on ecology of the project site. Firstly, animal that graze the project site and contribute to existing pressures on the quality of the vegetation type will be excluded from the

Nature of impact	**Ecological impacts of access control and fencing of the site.**				
	property and therefore, natural vegetation outside the project development footprint, but within the fence boundary will be allowed to recover from overgrazing. Secondly, fauna species that currently move freely across the project site will be prevented from doing so.				
Mitigation required	• Veld management measures will have to be employed in areas outside the project development footprint, but within the fence boundary. This can be achieved by allowing gaps in fencing for fauna species to move between grazing areas during prescribed times of the year.				
Parameters	*Severity*	*Spatial scale*	*Duration*	*Probability*	*Significant rating*
Pre- Mitigation	Moderate (3)	Limited (2)	Project life (5)	Certain (7)	Medium-low (70)
Post- Mitigation	Minor effect (2)	Very limited (1)	Medium-term (3)	Certain (7)	Medium-low (35)
I&AP Concern	No queries regarding fencing of the site or its ecological impacts were raised during the PPP.				
Residual impact	The impact on loss of grazing for wild animals cannot be prevented. However, it is likely that positive changes to ecological state of no-go areas and highly sensitive ecological areas will be experienced due to fencing of the site and exclusion of these areas from grazing by livestock.				

6.3.4 Potential impacts on the visual environment

The main impacts on the visual environment will occur during the construction phase of the proposed project. These impacts were assessed to have **medium-low significance.** Activities that will result in impacts include:

- Increase in vehicular and other activity levels during the construction phase;
- The clearance of vegetation at the footprint of the construction lay-down yard, substation and each solar PV mounting structure;
- Fencing of the project site;
- Installation of the solar PV panels and construction of all related project infrastructure; and
- Generation of electricity from the PV panels during the operational phase of the project.

Tables summarising the significance of the potential impacts on the visual environment during the project phases are presented below.

Nature of impact	**Change to the existing visual character of the project site.**
Description of impact	The largest visual impact will be experienced by the removal of natural vegetation and installation of the solar PV panels and associated infrastructure, since a possible change in the intangible heritage and sense of place landscape will occur. The construction activities themselves will lead to noise, dust and visual pollution due to the activities and transport requirements associated with labour, machinery and other materials. The pre-existing transmission lines that run north of and on the project site will lead to some level of absorption capacity of the visual and sense of place landscape as a whole. The visual impact from vegetation removal will not be severe since the pre-existing vegetation is low-lying and is not a dominant aspect of the dramatic and stark landscape. However, after installation of the solar PV panels, the impact significance will increase.

Nature of impact	**Change to the existing visual character of the project site.**				
	There will be few to no people experiencing a negative visual impact as there are very few identified potential receptors and the construction of Solar PV Power Plant might even bring about positive visual impacts. This positive visual impact could be introduced if the Solar PV Power Plant is constructed in a responsible manner that takes into account all of the aspects of visual (and ecological) sensitivity since the construction and presence of the infrastructure could introduce a sense of progress and opportunity to local and impoverished communities.				
Mitigation required	• No vegetation removal should be allowed outside the designated project development footprint; • A representative sample of indigenous plant species should be selected and planted during remediation and rehabilitation (Appendix J); • Where possible, the removal and destruction of indigenous vegetation should be avoided (i.e. adhering to the designated internal road network); • An alien invasive and weed control programme should be implemented throughout the project lifetime (Appendix J); and • The possible tourism aspect of the solar PV power plant should be explored and promoted.				
Parameters	*Severity*	*Spatial scale*	*Duration*	*Probability*	*Significant rating*
Pre- Mitigation	Minor (2)	Limited (2)	Project life (5)	Likely (5)	Medium-low (45)
Post- Mitigation	Limited (1)	Limited (2)	Medium-term (3)	Likely (5)	Low (30)
I&AP Concern	No concerns regarding the visual impact of the project were voiced during the PPP.				
Residual impact	The visual impact that the proposed infrastructure will have is dependent on the subject who is viewing it. Visual impacts are rated based on social norms. For some people, the proposed infrastructure may be an indication of urbanisation, new renewable energy and economic upliftment in the area, in which case a positive visual impact will be experienced. For other receptors, the construction of the infrastructure might be a negative factor which could impede tourism in the area. Ideally the perceptions of people residing in each and every household, shop or restaurant that will potentially be affected would be included in the VIA. For this purpose, the visual specialists attended the public information sharing meeting that was held during the scoping phase. The attendees were shown photos of other solar PV power plants and were made aware of how the potential infrastructure will look once constructed. No comments were made regarding the potential negative visual impact that the proposed infrastructure.				

6.3.5 Potential impacts on the tourism industry

The main impacts on the tourism industry will occur during the construction and operational phases of the proposed project. Positive impacts will be experience and was assessed to have **low significance.**

Tables summarising the significance of the potential impacts on the tourism industry during the project phases are presented below.

Nature of impact	**Impacts on the tourism industry.**
Description of impact	Loeriesfontein falls into the Namakwa Tourist District. The surrounding mountains, rivers, valleys and coastline are criss-crossed by hiking, biking, canoe and 4×4 trails. Loeriesfontein has a vibrant

Nature of impact	**Impacts on the tourism industry.**				
	community with a growing tourism industry. Various annual events are held each year, such as the flowering festival and the annual agricultural show. The main tourist attraction in the regional area is the unique natural and cultural resources found in this area and the removal of indigenous vegetation from the project site will have a negative impact on eco-tourism. Due to the fact the proposed project site is located 45 km from Loeriesfontein on a route that is not known as a main tourist route, the project is unlikely to have an impact on the tourism industry. The power plant may become a unique tourist attraction for this area and increased influx of workers may also boost the local tourism industry in terms of local procurement and accommodation or catering.				
Enhancement required	Orlight SA may consider contributing to the establishment of a visitor's centre in the town with educational opportunities on solar energy for tourists that visit the area.				
Parameters	*Severity*	*Spatial scale*	*Duration*	*Probability*	*Significant rating*
Pre- Mitigation	Minor (2)	Limited (2)	Medium-term (3)	Improbable (2)	Positive low (14)
Post- Mitigation	Minor (2)	Limited (2)	Medium-term (3)	Probable (4)	Positive low (28)
I&AP Concern	No concerns regarding the impact of the proposed project on the tourism industry was voiced during the PPP.				
Residual impact	The type of tourism on which the project area is currently dependent (i.e. eco-tourism) will change to energy tourism.				

6.3.6 Potential impacts on traffic

The main impacts on the visual environment will occur during the construction phase of the proposed project. These impacts were assessed to have **low** to **medium-low significance.** Activities that will result in impacts include:

- Increase in vehicular and other activity levels during the construction phase; and
- Off-site accommodation of employees during the construction phase of the project.

Tables summarising the significance of the potential impacts on traffic during the project phases are presented below.

Nature of impact	**Increased traffic and impact on road surfaces.**
Description of impact	Even if an 84 MW plant is developed, the construction phase truck trip generation will be less than 10 trucks per day (in and out combined). The total trip generation during the construction phase is not expected to exceed 30 trips per day, and during the operational phase it will be negligible. Vehicle trip generation is therefore of no concern from a traffic capacity point of view. The cumulative pavement loading contributed by inbound trucks will be only 0.01 million E80s. On the Granaatboskolk/Zout Dwaggas gravel road, the additional trucks will contribute to accelerated gravel loss, but the routine maintenance of the road should be adequate to cater for the additional traffic.

Nature of impact	**Increased traffic and impact on road surfaces.**				
Mitigation required	• No mitigation measures are required, but liaison with the Namakwa District Municipality might be required if routine maintenance is neglected to the point that the road cannot be used by articulated trucks.				
Parameters	*Severity*	*Spatial scale*	*Duration*	*Probability*	*Significant rating*
Pre- Mitigation	Limited (1)	Very limited (1)	Short-term (2)	Likely (5)	Low (20)
Post- Mitigation	Limited (1)	Very limited (1)	Short-term (2)	Probable (4)	Low (16)
I&AP Concern	No concerns regarding increases in traffic were voiced during the PPP.				
Residual impact	None, impacts will only be experienced during the construction phase.				

Nature of impact	**Safety impacts of traffic.**				
Description of impact	The construction phase of the proposed project will necessarily increase the volume of traffic in the vicinity of the project site, as well as change the nature of the traffic (there will be an increased number of heavy motor vehicles). This will likely result in the deterioration of roads (including an increase in potholes), which poses a safety risk for other road users. The mere presence of construction traffic may also result in an increased safety risk, or other roads users may feel as though they are at a greater safety risk, whether this is the actual case or not.				
Mitigation required	• Traffic and transportation rules should be implemented; • Directly affected individuals (including surrounding land owners) should be aware and satisfied with the contractor's traffic-related logistics; • Appropriate warning signs should be erected on the access road to the site; • Access roads should be maintained; and • All construction vehicles should be roadworthy and have the required permits and/ or licenses to carry their load.				
Parameters	*Severity*	*Spatial scale*	*Duration*	*Probability*	*Significant rating*
Pre- Mitigation	On-going (3)	Limited (2)	Short-term (2)	Likely (5)	Medium-low (35)
Post- Mitigation	On-going (3)	Limited (2)	Short-term (2)	Probable (4)	Low (28)
I&AP Concern	No concerns regarding increases in traffic were voiced during the PPP.				
Residual impact	None, impacts will only be experienced during the construction phase.				

6.3.7 Potential impacts on the socio-economic environment

The main impacts on the socio-economic environment will occur due to the creation of employment opportunities during the construction phase of the proposed project. **Positive impacts will be experience and were assessed to have medium-high significance.** Negative impacts were assessed to have **medium-low** to **medium-high significance**.

Tables summarising the significance of the potential impacts on the socio-economic environment during the project phases are presented below.

Nature of impact	**Procurement of goods and creation of employment opportunities.**				
Description of impact	The construction phase will require a workforce of an estimated 280 individuals. Some of these job opportunities will be for unskilled labourers, which will be sourced from the town of Loeriesfontein. The majority of residents in this town have low educational and skills levels, thus many are unemployed and well suited to unskilled labour. Additionally, the construction phase will necessitate procurement of goods and services, many of which could be sourced from local companies, SMMEs or entrepreneurs, thereby enhancing the socio-economic benefits associated with the project's construction phase. The operational phase will require a workforce of an estimated 70 individuals. Some of these job opportunities will be for un- and semi-skilled labourers, which will be sourced from the town of Loeriesfontein. Given the low educational and skills levels in the local municipal area, as well as the high unemployment rate, the small number of permanent long-term job opportunities constitutes a long-term (albeit small scale) socio-economic benefit for the directly-affected communities. Additionally, the use of local entrepreneurs, SMMEs and businesses further enhance the socio-economic benefit associated with the proposed project. Possible opportunities for local service providers include security, catering and cleaning services, maintenance of the accommodation facilities and operational equipment, as well as the provision of chemical toilets for use on site. Both local employees and entrepreneurs, SMMEs and businesses will likely gain significantly from appropriate skills training and capacity building. The project also stands to benefit from such training and capacity building as it will enable the employees and local service providers to better perform their duties.				
Enhancement required	• The employment of locals (particularly women and previously disadvantaged individuals) should be encouraged and contractors should be contractually bound to giving preference to local persons; • Positions should only be filled by outsiders if the required skills are not available in the local study area; • Goods and services should only be sourced from outside the local municipal area if it is not available in this area; and • Orlight SA should create conditions conducive to the involvement of local businesses, entrepreneurs and SMMEs.				
Parameters	*Severity*	*Spatial scale*	*Duration*	*Probability*	*Significant rating*
Pre- Mitigation	Minor (2)	Municipal (4)	Medium-term (3)	Likely (5)	Positive medium-low (45)
Post- Mitigation	On-going (3)	Municipal (4)	Medium-term (3)	Almost certain (6)	Positive medium-low (60)
I&AP Concern	Positive opinions were voiced regarding the potential of the proposed project to create opportunities for employment creation and local socio-economic development.				

Nature of impact	**Capacity building and skills training undertaken in local communities during the operational phase.**				
Description of impact	In addition to the skills training and capacity building for the employees and service providers utilised by the proponent, the proponent has a social responsibility towards the communities in which it operates.				
Enhancement required	• Orlight SA should actively seek to contribute positively to the local municipal area, and to build capacity and strengthen skills in this area; and • Orlight SA should either contribute to existing LED programmes implemented or planned by the local municipality, or initiate programmes of their own that are aligned with the local municipal LED objectives.				
Parameters	*Severity*	*Spatial scale*	*Duration*	*Probability*	*Significant rating*
Pre- Mitigation	Low-level (1)	Local (3)	Medium-term (3)	Probable (4)	Positive low (28)
Post- Mitigation	On-going (3)	Municipal (4)	Permanent (6)	Almost certain (6)	Positive medium-high (78)
I&AP Concern	Positive opinions were voiced regarding the potential of the proposed project to create opportunities for employment creation and local socio-economic development.				

Nature of impact	**Inflow of migrant job-seekers.**
Description of impact	News of the proposed project and employment opportunities may result in an influx of job-seekers into Loeriesfontein and surrounding towns. This may result in one or more of the following: • The development of informal settlements due to the limited housing available in the area; • Social conflict between the incumbent and migrant populations, due to the incumbent population feeling that the migrants are taking opportunities away from them; • An increase in social pathologies (prostitution, conflict and violence, alcohol abuse, drug use and crime). • Petty crimes and stock theft; • Risks to the security of the project site and equipment or goods. The negative socio-economic impacts could be severe and include health impacts emanating from poor hygiene associated with the lack of basic services such as sanitation and refuse removal and an increase in the prevalence of HIV due to the presence of migrants. Although some of these workers will be from the local and surrounding towns, some migrant job-seekers will be employed. The presence of these individuals may have adverse impacts on the local communities, especially if the well-being of the workforce is not maintained. Disgruntled workers may strike, abuse alcohol, use drugs, engages in sexual relations with local women or come into conflict with others. Should the adverse impacts materialise, the incumbent population may retaliate by mobilising against the project. All of these impacts could have a significant impact on the successful completion of the construction of the proposed project.
Mitigation required	• An influx of job-seekers should be proactively discouraged by being transparent about the local employment policy to be adopted by the project and by requiring verification of local residence status from job applicants; • The establishments of informal housing/ or settlements should be actively prevented by implementing an effective system through which the erection of such structures can be

Nature of impact	**Inflow of migrant job-seekers.**				
	reported and dismantled as soon as possible; • Adequate accommodation and ablution facilities should be made available to the construction workforce; and • A code of conduct for the construction workforce should be developed and they should be contractually bound to it and their working conditions should be fair.				
Parameters	*Severity*	*Spatial scale*	*Duration*	*Probability*	*Significant rating*
Pre- Mitigation	On-going (4)	Municipal (4)	Project life (5)	Almost certain (6)	Medium-high (78)
Post- Mitigation	Minor (2)	Local (3)	Medium-term (3)	Probable (4)	Low (32)
I&AP Concern	A concern was raised that an influx in job seekers might result in increased stock theft.				
Residual impact	The influx of migrant job-seekers cannot be entirely prevented and this will result in residual impacts, mainly on existing public infrastructure and privately owned land (i.e. in the form of informal settlements).				

Nature of impact	**Project dependence and decommissioning of project infrastructure.**				
Description of impact	It is likely that the proposed project will be decommissioned after an operational lifespan of 20 years, implying that an estimated 70 jobs will be lost at this time. Although this is an inevitable element of such projects, it holds negative socio-economic implications for the town of Loeriesfontein, the workforce (especially the local unskilled and semi-skilled individuals) and local entrepreneurs, SMMEs and businesses. Additionally, vacated project infrastructure (such as the on-site office, technical service buildings and laydown yard) could potentially be used for inappropriate purposes (shelter), which may give rise to health and safety impacts affecting the local population				
Mitigation required	• Employment opportunities during the decommissioning phase should go to as many local residents as possible, minimising the adverse effect the inevitable job losses will have on the local population; • Project infrastructure should be decommissioned appropriately and in consultation with the local municipality (Appendix J); • Retrenchments must be aligned with South African labour legislation, and workers should be notified in advance of impending retrenchments; and • Orlight SA should consider providing skills training to employees so as to improve their chances of gainful employment elsewhere.				
Parameters	*Severity*	*Spatial scale*	*Duration*	*Probability*	*Significant rating*
Pre- Mitigation	On-going (4)	Municipal (4)	Long term (4)	Certain (7)	Medium-high (84)
Post- Mitigation	On-going (3)	Municipal (4)	Long term (4)	Likely (5)	Medium-low (55)
I&AP Concern	No concerns regarding dependency on the project were raised during the PPP.				
Residual impact	Loss of jobs after the project has reached its full life time is unavoidable.				

6.3.8 Potential impacts on heritage

The main impacts on heritage of the project site will occur during the construction phase of the proposed project. After mitigation, these impacts were assessed to have **medium-low significance.** Activities that will result in impacts include:

- The clearance of vegetation at the footprint of the construction lay-down yard, substation and each solar PV mounting structure; and
- The installation of solar PV panels and all associated infrastructure.

Tables summarising the significance of the potential impacts on heritage during the project phases are presented below.

Nature of impact	**Impacts to the palaeontological environment.**				
Description of impact	According to the palaeontological specialist, the scale of subsurface disturbance and exposure is quite limited, comprising mainly "post holes" to support the PV panel frames. These holes will mainly affect the stony regolith and variously weathered Prince Albert shales. However, it is conceivable that eroded-out fossils could be found in places on the surface of the property. In view of the moderate fossil potential it is proposed that only a basic degree of mitigation is required.				
Mitigation required	• The field supervisor/foreman and workers involved in digging excavations must be encouraged and informed of the need to watch for potential fossil and buried archaeological material; • Construction workers seeing potential objects are to report to the field supervisor who, in turn, will report to the ECO. The ECO will inform the archaeologist and/or palaeontologist contracted to be on standby in the case of fossil finds; • Temporary pause in activity at a limited locale may be required; • Procedures in the event that isolated bone, bone cluster finds and major are observed should be followed (Appendix J).				
Parameters	*Severity*	*Spatial scale*	*Duration*	*Probability*	*Significant rating*
Pre- Mitigation	Irreparable (5)	Very limited (1)	Permanent (7)	Probably (5)	Medium-low (65)
Post- Mitigation	Low (2)	Very limited (1)	Permanent (7)	Improbable (2)	Low (22)
I&AP Concern	No concerns regarding heritage resources were raised during the PPP.				
Residual impact	Even with mitigation, some palaeontological material could be potentially destroyed if not recognised as such during construction and excavation.				

Nature of impact	**Impacts to the archaeological environment.**
Description of impact	The MSA artefact scatters recorded during the survey are widespread in the western part of Bushmanland and are of low significance as there are scatters of MSA artefacts across thousands of square kilometres of Bushmanland. The lack of *in situ* MSA open sites or indications of stratified archaeological deposits means that the archaeological material on site has limited scientific value. During the Phase 1 AIA, photographs were taken and small collections of material that is considered representative of the material as a whole were collected. Further mitigation is unlikely to result in a greater understanding of the material.

Nature of impact	**Impacts to the archaeological environment.**				
	The LSA sites located on low koppies and near the river exhibit a pattern of formal stone artefacts and raw material, as well as pottery and ostrich eggshell, which have not been recorded in combination in Western Bushmanland before. Impacts to the archaeological environment include the destruction of LSA artefact scatters recorded in the project development footprint during site establishment. The LSA sites have the potential to inform us on a regional pattern of LSA settlement and the sites are therefore considered to be of medium to high significance. The systematic excavation and/or collection of archaeological material will enhance the understanding of the regional LSA settlements and is, therefore, considered to be a positive impact in terms of archaeological research. There is a risk that LSA sites located outside the project development footprint might be damaged due to construction workers wondering into the no-go areas.				
Mitigation required	• No-go areas should be clearly demarcated throughout the project development and no workers will be allowed to wonder into these areas; • A Phase 2 AIA should be undertaken for all significant LSA sites that are located within the project development footprint prior to the commencement of the construction phase; • Necessary permits must be obtained from SAHRA prior to any excavations or destruction of sites; • In the unlikely event that unmarked graves are present and found during the construction phase, work at that location must be halted, the feature should be cordoned off and SAHRA notified. They are likely to suggest mitigation in the form of exhumation.				
Parameters	*Severity*	*Spatial scale*	*Duration*	*Probability*	*Significant rating*
Pre- Mitigation	Significant (4)	Regional (5)	Permanent (7)	Definite (7)	High (112)
Post- Mitigation	Damage (3)	Limited (2)	Permanent (7)	Probably (4)	Medium-low (48)
I&AP Concern	No concerns regarding heritage resources were raised during the PPP.				
Residual impact	Even with mitigation, some archaeological material or small sites could be potentially destroyed if not recognised as such during construction and excavation.				

Nature of impact	**Impacts to cultural landscape.**				
Description of impact	The proposed facility will result in the “industrialisation” of the landscape. However, the landscape is considered to have low cultural significance as it comprises a flat arid environment interspersed with small koppies. This type of landscape stretched for hundreds of kilometres to the north and south. This area is not visited by tourists and the potential visual impact is considered to be low.				
Mitigation required	• No mitigation is possible.				
Parameters	*Severity*	*Spatial scale*	*Duration*	*Probability*	*Significant rating*
Pre- Mitigation	Low (2)	Limited (2)	Long term (4)	Definite (7)	Medium-low (56)
Post- Mitigation	Low (2)	Limited (2)	Long term (4)	Definite (7)	Medium-low (56)
I&AP Concern	No concerns regarding heritage resources were raised during the PPP.				
Residual impact	The cumulative impact of several such facilities will result in “industrialization” of the archaeological landscape.				

6.4 Cumulative impacts on the receiving environment surrounding Loeriesfontein

This section considers and assesses the possible cumulative effects that may occur due to the incremental effects of the proposed Loeriesfontein Solar PV Power Plant in combination with other projects within the vicinity.

In order to analyse the cumulative impacts associated with a project, the following activities were undertaken:

- The geographic scope of the cumulative impact resource or environmental aspect analysis was defined, based on the potential areas within which impacts from other present or future projects could combine with the project in question; and
- The combined effects of the proposed project in combination with past, present and future projects or activities were analysed in terms of the potential cumulative impacts within the relevant geographical extent.

There has been increased interest by various parties to develop renewable energy facilities throughout South Africa, including the Northern Cape Province with its abundance of solar irradiation and vast open spaces. The cumulative impact assessment therefore mainly focusses on the interaction between proposed renewable energy projects surroundings Loeriesfontein. Known renewable energy projects that are proposed within the vicinity are illustrated in Plan 13c and include:

- *Mainstream Renewable Energy* – Proposed solar PV and wind farm site, located 16 km north of the proposed project site;
- *Mainstream Renewable Energy* – Proposed solar CPV/PV site, location 22 km south of the proposed project site; and
- *Solar Capital* – Proposed solar development, located directly east of the proposed project site.

Apart from potential renewable energy developments listed above, no other significant developments have been proposed or are likely to take place in the foreseeable future.

6.4.1 Cumulative impacts on surface water systems

All of these developments will result in changes to the natural topography of the area, which will also result in changes to the drainage patterns in the area. Impacts would include increased susceptible to erosion, aggravated erosion processes and sediment transport in the area. The proposed sites are spread throughout three different quaternary catchments (D53F, E31C and E31B) and therefore, the cumulative impacts on hydrology and water quality will be negligible if the main drainage lines that run through these areas are avoided.

Depending on the cumulative water requirements for the projects, there may be an increase in demand for water during the construction and operational phases of the renewable energy projects.

The impacts of wind farm construction on the topography, hydrology and water quality of surrounding systems are negligible.

6.4.2 Cumulative impacts on agricultural potential and land use

The area in which the proposed developments will occur occupy a total surface area of approximately 16 093 ha. Even though most of the land within the Hantam Municipality is currently used for grazing of livestock, the cumulative impact on loss of grazing land is considered negligible, due to the inherently low grazing capacity of the land and the fact that alternative land uses are limited.

6.4.3 Cumulative impacts on air quality and noise

The various renewable energy projects proposed in the area are all situated adjacent to the Granaatboskolk/Zout Dwaggas dirt road and consequently, significant amounts of dust and noise will be generated on this road if the construction phases of these projects were to coincide.

It is recommended that the different project developers establish a forum to manage impacts on air quality impacts and increased noise levels that will occur due to increased traffic on the road during the construction phase.

6.4.4 Cumulative ecological impacts

Construction of more than one solar PV power plant will lead to habitat loss where land is cleared for the erection of solar panels. The proposed sites are spaced a fair distance apart from one another so there will be a habitat fragmentation effect, but the cumulative impact will be negligible. Most of the proposed sites fall inside the SKEP planning domain (apart from the northern section of the proposed Mainstream development), but the areas that will potentially be disturbed have a low 'irreplaceability' status (i.e. they are not high priority areas for conservation targets).

A possible cumulative impact that should be considered is the loss of capacity of the area to perform provisioning, regulating, supporting and cultural ecosystem functions, but the cumulative impact should not be significant. It is unlikely that any significant cumulative ecological impacts will occur if important ecological areas, such as drainage lines, are avoided.

The negative effects of potential cumulative impacts can also be minimised if the mitigation and management actions are effectively implemented, as described in EMP.

6.4.5 Cumulative visual impacts

While considering only potential visual receptors, the cumulative visual impact will be negligible since all of the proposed project sites are situated in a remote landscape and are a fair distance form any human settlements. The only evident potential receptor is the Granaatboskolk/Zout Dwaggas gravel road that bisects the proposed Orlight SA and Mainstream Renewable Energy project sites.

If all of the projects are granted and construction of the solar parks takes place, the visual landscape will be altered due to the erection of solar panels which are a new attribute in the visual landscape. Commencement of all of the projects will result in a vast expanse of solar panels, separated by areas of natural land; when driving along the dirt road the visual impact will therefore be of a successive nature. Despite the successive visual impact that the solar panels will potentially create, the cumulative impact is likely to be negligible due to the visual context.

6.4.6 Cumulative impacts on tourism

The proposed project site is located within the 'Namakwa' tourism region and the town of Loeriesfontein itself is a tourist attraction. The little town is, however, approximately 45 km from the area in which the proposed solar and wind developments will take place and the single main dirt road that used most extensively within the area, is utilised by local farmers and not by tourists visiting the region. It is unlikely that there will be a negative cumulative impact on the tourism resources of the area.

On the contrary, the tourism industry present in the area will most likely change its focus from eco-tourism to energy tourism, due to the development of renewable energy projects in the area.

In order to maximise the benefits associate with the establishment of an energy-focused tourism industry, the different proponents of these projects in the area should consider the establishment of a visitors centre in the town with educational opportunities on solar energy for tourists that visit the area.

6.4.7 Cumulative impacts on traffic

The cumulative impacts that will be introduced to traffic will only possibly be significant during construction phase, if all of the proposed solar PV power plants are constructed during the same time. A fair amount of traffic will arise on the Granaatboskolk/Zout Dwaggas gravel road if all of the proposed parks are constructed simultaneously. The cumulative effect of increased traffic and vehicular movements may therefore adversely impact on traffic, health and safety, as well as the social environment.

6.4.8 Cumulative impacts on the socio-economic environment

The cumulative impacts of the proposed projects within the Hantam Local Municipality are likely to have significant positive cumulative impacts. The current unemployment rate (15.43%) is likely to decrease as employment opportunities, prospects for basic skills development and capacity building activities (as some of the project developers have indicated will take place) associated with the construction and maintenance of the proposed solar parks are introduced.

6.4.9 Cumulative impacts on archaeology and heritage

During consultation with SAHRA, they requested that the assessment should consider whether the cumulative impact of the solar energy facilities proposed in the area may compromise the cultural landscape and its archaeological significance.

There are no significant issues relating to the cultural landscape and the landscape comprises typical Bushmanland scrub. The occupation of the small koppies by LSA peoples suggests that they had a specific world view which incorporated the koppies as living sites. The koppies could be considered as part of an archaeological landscape. If such koppies that are scattered over the region are avoided (thereby conserving the LSA sites) then the long-term impact of these projects on the landscape will be limited. The systematic excavation and/or collection of archaeological material will enhance the understanding of the regional LSA settlements and is therefore considered to be a positive impact in terms of archaeological knowledge of the area.

7 ENVIRONMENTAL IMPACT STATEMENT

This report presents the findings of the EIA process that was undertaken for the development and operation of the Loeriesfontein Solar PV Power Plant proposed by Orlight SA.

The following Environmental Impact Statement (EIS) contains a summary of the main findings of the EIA process and recommendations of the EAP.

Public participation process

A comprehensive and fully transparent PPP was undertaken to ensure that I&APs were afforded the opportunity to participate in the EIA process.

I&APs generally had no objections regarding the proposed Loeriesfontein Solar PV Power Plant and feel that the proposed project will benefit them in terms of the supply of renewable energy to an area where it is much needed and through local socio-economic development.

Integrated sensitivity maps

Integrated sensitivity maps were prepared for the study area, based on the findings of environmental, socio-economic and cultural assessments undertaken for the project as input into the project design process.

It is recommended that the following areas be avoided during project development:

- *A buffer zone of 50 m is prescribed around the main drainage system, with 30 m buffer zones around its tributaries;*
- *Areas of high ecological sensitivity which includes the northern part of the site where Aloe falcata (Vanrhynsdorp Aloe) and the protected plant species, Hoodia gordonii, was encountered[3];*
- *A buffer zone of 22 m around the existing 66 kV transmission lines that runs through the project site; and*
- *LSA sites that have been rated as significant in terms of local and provincial archaeological context that are found on the outskirts of the study area and within other delineated no-go areas (Site LO57, Site 122, Site 143 and Site 086).*

Site design process

A study area of 1 040.04 ha was considered throughout the EIA process, although the actual development footprint of the proposed project, based on the avoidance of environmentally sensitive and other problematic areas, was defined as 334.5 ha in extent.

The optimal generation capacity of the power plant based on an estimated requirement of 4 ha surface area per MW generation capacity was determined to be 84 MW.

Soil and agricultural potential

The agricultural potential of the soils present in the study area is very low, with land capability restricted to grazing. Soils in the project area also show a moderate susceptibility to erosion by wind and water.

Due to the coarse rock fragments present in the soil of the project site, very little suitable topsoil will be available for stripping and use during site remediation and rehabilitation. Despite these factors, the overall impacts on soil

[3] Establishment of internal roads and trenches for underground cabling could be allowed, pending approval of WULA for associated water uses.

resources and land capability of study area can be mitigated to an acceptable level, conditional to the exclusion of the drainage lines from the development footprint.

Ecological sensitivity and biodiversity

During the field assessment, the study area was found to be under pressure from current and previous land use, most notably grazing. Despite these threats it was found that the natural habitat present within the study areas provide an ecological service to the plant and animal species encountered during the field survey and very possibly to the plant and animal species that were identified during the desktop survey. This was evident from the diversity of plant and animal species that were encountered in certain landscapes of the study area.

The opportunity to maintain or increase the ecological functioning of the study area exists, thereby indirectly supporting the population of animal species possibly reliant on this area for services. By increasing the natural habitat types and removing the threats, the ecological functioning of the area will be positively affected, thereby increasing the suite of ecological services offered to animals, making the area an attractive option for animals to re-colonise.

It is recommended that a management plan be implemented which will firstly monitor flora and fauna present in the area and secondly, that the destruction of the sensitive species and landscapes areas such as drainage lines and northern parts of the study area should be avoided.

Visual sensitivity

The study area lies 45 km from the town of Loeriesfontein and even though the landscape of the study area will definitely be transformed, there will be few to none people experiencing a negative visual impact as there are very few identified potential receptors. Construction of the proposed solar PV power plant might even bring about a positive visual impact for some of the infrequent receptors (it is unlikely that there will be frequent receptors).

It is believed that the identified visual impacts associated with the proposed Solar PV Power Plant, should not introduce limitations to the construction of the proposed project.

Heritage impacts

There is a possibility that eroded-out fossils could be found in places on the surface of the proposed project site and therefore it is recommended that the procedures detailed in the EMP be implemented in the event that fossil finds are discovered during the construction activities.

The MSA artefact scatters recorded during the survey are widespread in the western part of Bushmanland and are of low significance. Mitigation in the form of photographs and small collections of representative material was done during the Phase 1 AIA. Further mitigation is unlikely to result in a greater understanding of the material and as a result no further intervention from an archaeological point of view is necessary.

The most significant discovery was that of a number of LSA archaeological sites, the majority located on the top of the seven little koppies or along the main drainage line. The LSA sites have the potential to inform us on a regional pattern of LSA settlement and the sites are therefore considered to be of medium to high significance.

For this reason, mitigation should take the form of avoidance of Sites LO57, 122, 143 and 086, as well as a Phase 2 AIA which will include excavation or systematic collection of other significant LSA sites that are located in the project development footprint.

The systematic excavation and/or collection of archaeological material will enhance the understanding of the regional LSA settlements and is therefore considered to be a positive impact in terms of archaeological research. Necessary permits must be obtained from SAHRA prior to any excavations or destruction of sites.

Overall recommendation

Based on the nature and extent of the proposed project and the understanding of the significance of anticipated impacts that will be experienced, the EAP is of the opinion that the predicted impacts can be mitigated to an acceptable level. The EAP and specialist team supports the decision for an environmental authorisation.

The following conditions would be required in the environmental authorisation for the proposed project:

- All mitigation measures described in this report and in the EMP (Appendix J) should be implemented to ensure that the negative impacts of the project are mitigated and that positive impacts are enhanced;
- All no-go areas, sensitive areas and prescribed buffer zones that were defined unsuitable for development purposes should be avoided;
- Establishment of internal roads and trenches for underground cabling should be allowed, pending approval of a WULA for associated water uses;
- A flora survey of the project development footprint should be undertaken during the wet-season to try and identify Red Data and protected plant species that might not have been identified during dry-season surveys. If found, the necessary permits should be obtained prior to the removal or destruction of these species;
- A Phase 2 AIA should be implemented for all significant LSA sites that are located within the project development footprint prior to the commencement of the construction phase. The necessary permits should be obtained from SAHRA;
- The implementation of the EMP (Appendix J) is considered a key factor to the achievement of the environmental standards and long-term sustainability of the project. For this purposed, the EMP should form part of the contractual agreement with the contractors that are appointed for development and operation of the proposed project; and
- The EMP (Appendix J) should be considered a living document and should be updated during the project phases as more information on the significance of impacts and effectiveness of mitigation measures becomes known.

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