SKUITDRIFT 2 SOLAR PV ENERGY FACILITY, NEAR AUGRABIES, NORTHERN CAPE PROVINCE

ENVIRONMENTAL MANAGEMENT PROGRAMME: REVISION 1

January 2019

Prepared for
14th Floor, Pier Place
Heerengracht Street
Foreshore, Cape Town
8001

Prepared by:
Savannah Environmental (Pty) Ltd
First Floor, Block 2, 5 Woodlands Drive Office Park
Woodmead
Johannesburg, 2191
Tel: +27 (0)11 656 3237
Fax: +27 (0)86 684 0547
E-mail: info@savannahsa.com
www.savannahsa.com

PROJECT DETAILS

Title	:	Environmental Assessment Process Environmental Management Programme: Skuitdrift 2 Solar PV Energy Facility, Northern Cape Province
DEA Ref.	:	12/12/20/2600
Authors of the EMPr	:	Cape Environmental Assessment Practitioners (Pty) Ltd
Amendment of the EMPr	:	Savannah Environmental Lisa Opperman Jo-Anne Thomas
Specialists	:	Leigh-Ann de Wet of LD Biodiversity Consulting David Morris of McGregor Museum
Applicant	:	Khoi-Sun Development (Pty) Ltd
Report Status	:	Revision 1

When used as a reference this report should be cited as: Savannah Environmental (2019). Environmental Management Programme – Revision 1: Skuitdrift 2 Solar PV Energy Facility, Northern Cape Province.

TABLE OF CONTENTS

Appendices

ABBREVIATIONS

AC	Alternating Current
Alt.	Alternative
BGIS	Biodiversity Geographic Information System
ºC	Degree Centigrade
CARA	Conservation of Agricultural Resources Act (43 of 1983)
CBA	Critical Biodiversity Area
cctv	Closed Circuit Television (camera)
CDSM	Chief Directorate Surveys and Mapping
cm	Centimetre
DAFF	Department of Agriculture, Forestry & Fisheries
DEA	Department of Environmental Affairs (national)
DEA&DP	Department of Environmental Affairs & Development Planning (Western Cape)
DEANC	Department of Environmental Affairs & Nature Conservation (Northern Cape)
DEIR	Draft Environmental Impact Report
DME	Department of Minerals and Energy
DoE	Department of Energy
DWA	Department of Water Affairs
EA	Environmental Authorisation
EAP	Environmental Impact Practitioner
ECA	Environmental Conservation Act (73 of 1989)
ECO	Environmental Control Officer
ECR	Environmental Control Report
EHS	Environmental, Health & Safety
EIA	Environmental Impact Assessment
EIP	Environmental Implementation Plan
EIR	Environmental Impact Report
ELC	Environmental Liaison Committee
ER	Engineer Representative
ESA	Environmental Site Agent / Ecological Support Area
EMPr	Environmental Management Programme
FPA	Fire Protection Association
GPS	Global Positioning System
GWh	Giga Watt hour
ha	Hectare
HIA	Heritage Impact Assessment
I&APs	Interested and Affected Parties
IDP	Integrated Development Plan
IFC	International Finance Corporation
IPP	Independent Power Producer
ISO	International Organisation for Standardisation (ISO 9001)
Kl / Klt	Kilo Litre
Km	Kilometre
Km/h	Kilometres per hour
KNP	Karoo National Park
kV	Kilo Volt

LLRC	Low Level River Crossing
lt	Litre
LUDS	Land Use Decision Support
LUPO	Land Use Planning Ordinance
m	Metre
m^2	Metres squared
m^3	Metres cubed
MW	Mega Watt
NCHRA	Northern Cape Heritage Resources Authority
NCNCA	Northern Cape Nature Conservation Act (9 of 2009)
NEMA	National Environmental Management Act (107 of 1998, as amended in 2006)
NEMBA	National Environmental Management: Biodiversity Act (10 of 2004)
NERSA	National Energy Regulator of South Africa
NFA	National Forest Act (84 of 1998)
NHRA	National Heritage Resources Act (25 of 1999)
No.	Number
NSBA	National Spatial Biodiversity Assessment
NVFFA	National Veld and Forest Fire Act (101 of 1998)
NWA	National Water Act (36 of 1998)
pH	Potential of Hydrogen
PIA	Paleontological Impact Assessment
PM	Post Meridiem; "Afternoon"
PV	Photovoltaic
PVC	Polyvinyl Chloride (piping)
REDs	Road Environmental Dust Suppressant
SACAA	South African Civil Aviation Authority
SAHRA	South African National Heritage Resources Agency
SANBI	South Africa National Biodiversity Institute
SANS	South Africa National Standards
SDF	Spatial Development Framework
S&EIR	Scoping & Environmental Impact Reporting
SAPD	South Africa Police Department
WULA	Water Use Licence Application

1. INTRODUCTION

Savannah Environmental (Pty) Ltd has been appointed by the Applicant, Khoi-Sun Development (Pty) Ltd, as the independent **Environmental Assessment Practitioner** (EAP) responsible for the amendment of the **Environmental Management Programme** (EMPr) for the Skuitdrift 2 Solar PV Energy Facility, Northern Cape Province[1].

Khoi-Sun Development (Pty) Ltd is developing the solar PV energy facility on a portion of the Farm Skuitdrif 426. The total contracted capacity of the solar facility will not exceed 5MW Alternating Current (AC) for input into the national Eskom grid, at the local Schuitdrift Eskom Substation.

The key purpose of this EMPr is to ensure that the remedial and mitigation requirements identified during the Scoping and Environmental Impact Reporting process are implemented during the lifespan of the project (design to decommissioning). The EMPr is therefore a management tool used to minimise and mitigate the potential environmental impacts, while maximising the benefits.

This is the first revision (i.e. Revision 1) of the Skuitdrift 2 Solar PV Energy Facility EMPr, as approved in the Environmental Authorisation, dated 26 June 2013. The objective of the revision is to ensure that the EMPr is in line with the requirements as stated in the Environmental Authorisation, as well as to include the findings of the ecology and heritage walk-through survey reports. The final layout of the facility is also included as part of this revision (refer to Figure 3).

The Skuitdrift 2 Solar PV Energy Facility was awarded preferred bidder status under the second round of the Small Projects IPP Procurement Programme of the Department of Energy in 2017. Construction of the facility is expected to commence shortly after financial close.

A detailed description of the project and a description of the affected environment are provided in the Environmental Impact Report (EIR) (Cape EAPrac, 2013. Final Environmental Impact Report for the proposed Khoi-Sun Development).

1.1 EMPr Approvals and Provisions

This EMPr was approved as part of the Environmental Authorisation (EA) (dated 26 June 2013). This document is a legally binding document.

The EMPr may require amendment at certain stages through the lifespan of the project. The incidences which may require the amendment of this document include:

- Incorporation of conditions of approval contained in the Environmental Authorisation;
- The findings of the specialist walk-through surveys;
- Changes in environmental legislation;
- Results of post-construction monitoring (if required);
- Per instruction from the competent authority; and
- Changes in technology and best practice principles.

[1] This EMPr was compiled by Cape Environmental Assessment Practitioners (Pty) Ltd and has been amended by Savannah Environmental (Pty) Ltd to be in-line with the requirements of the Environmental Authorisation.

Should a significant amendment to this EMPr be required it must be undertaken in-line with the relevant legislation and regulations available at that time.

1.2 Contractual Obligation

This EMPr must be implemented and adhered to. This EMPr must be included in all tender and contract documentation associated with this project. It must be noted that this EMPr is relevant and binding not only on the activities associated with the construction of the solar project, but also for all associated infrastructure upgrades required, namely access road, substation, auxiliary buildings and power lines etc.

The EMPr is amendable and must be implemented and strictly enforced during all phases of the project. It shall be seen as a dynamic document and shall be included in all contract documentation for all phases of the development. Changes to the EMPr, which are environmentally defendable, shall be submitted to the DEA for acceptance before such changes can be considered.

The EMPr must form part of the contract with the EPC Contractor appointed to construct the facility and must be used to ensure the compliance with environmental specifications and management measures.

1.3 Organisational Requirements

In order to ensure effective implementation of the EMPr, it is necessary to identify and define the organisational structure for the implementation of this document.

The proposed organisational structure during implementation of the EMPr is as follows (**Figure 1**):

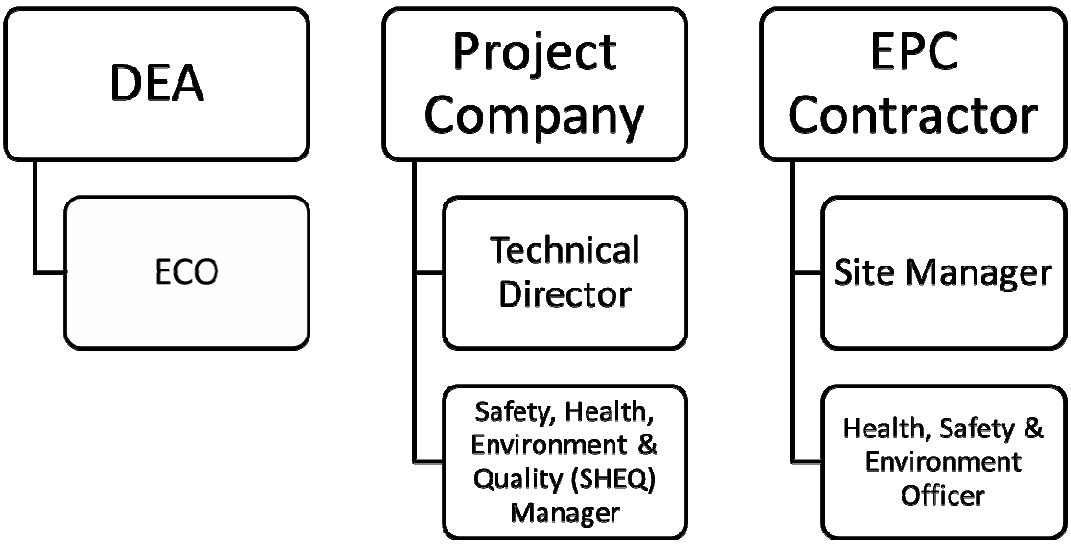


Figure 1: EMPr organisational structure during the implementation of the EMPr

Details regarding the roles and responsibilities of the various parties in these organisational structures are included in Section 2.

1.4 Project Description

The Skuitdrift 2 Solar PV Energy Facility consists of a **Photovoltaic System** (PV), mounted onto a tracker module, which uses a **single-axis tracking system** to follow the sun's movement. This system ensures that sunlight is always directly onto the cells.

The **single-axis tracker modules will be approximately 3m in height at full tilt and spaced approximately 5m apart** to avoid shading each other, while minimising the footprint of the facility. The trackers will be **oriented at a tilt, facing approximately North**, to maximise annual solar energy yield. The total solar facility, including tracker spacing and associated infrastructure, will occupy a **footprint not exceeding 20ha**. See the Environmental Sensitivity and Layout Map included as **Figure 2 and Figure 3**.

Associated infrastructure will typically include to the following:

- **inverter stations** (built within transporter containers, 25m^2 in size);
- an **on-site substation** (including a transformer to allow the generated power to be connected to Eskom's electricity grid);
- an overhead **transmission power line** to distribute the generated electricity from the on-site substation to the existing Schuitdrift Eskom substation (approximately 500m to the east of the site);
- **auxiliary buildings**, including:
  - administration / security offices,
  - on-site substation,
  - ablution & workshop and
  - storage area.
- an **internal electrical reticulation network** (underground cabling);
- an **access road** and **internal road / track network**;
- **temporary laydown area** for the storage and assembly of the solar infrastructure;
- 2 x 10kLt **rainwater tanks;** and
- **parameter fencing** around the solar facility.

1.5 Approach to the EMPr

This EMPr addresses the environmental management of the four key phases of the project, namely:

- The design and pre-construction phase;
- The construction phase;
- The operation phase; and
- The closure and decommissioning phase.

A copy of the Environmental Authorisation and the approved EMPr must be kept at the property where the activity will be undertaken. The Environmental Authorisation and approved EMPr must be produced to any authorised official of the DEA who requests to see it and must be made available for inspection by any employee or agent of the holder of the authorisation who works or undertakes work at the property.

1.5.1 Pre-construction Phase

The pre-construction phase of the development refers to the final layout design considerations and the site preparation (fine-scale design and placement, survey of development site and associated infrastructure, demarcation of no-go areas, establishment of site camp, vegetation clearing etc.).

1.5.2 Construction Phase

The construction phase of the development refers to the earthworks and the actual construction of the civil works (installation of the PV panel arrays, construction of internal roads, stormwater structures and auxiliary buildings etc.), as well as the external infrastructure such as power lines and access roads. The construction phase will also include parameter fencing around the facility, landscaping and re-vegetation / rehabilitation of the site and surrounding areas.

1.5.3 Operation Phase

The operation phase commences once the facility starts providing power into the national grid. There may be a stage where both construction and operation activities overlap, i.e. occur on site at the same time. The operation phase includes the monitoring and maintenance activities required for the efficient functioning of the facility (e.g. cleaning and repair of solar panels, brush-cutting of large vegetation etc.), as well as health and integrity of the surrounding environment (e.g. removal alien vegetation, removal of obstacles from drainage lines, management of erosion etc.).

1.5.4 Closure and Decommissioning Phase

Closure and decommissioning refers to the decommissioning of the panel arrays at the end of their operational lifespan. For the purpose of this report, two possible scenarios are considered, namely:

- The re-use, repair and/or upgrade of the facility for alternative power generation;
- The total decommissioning of the solar facility.

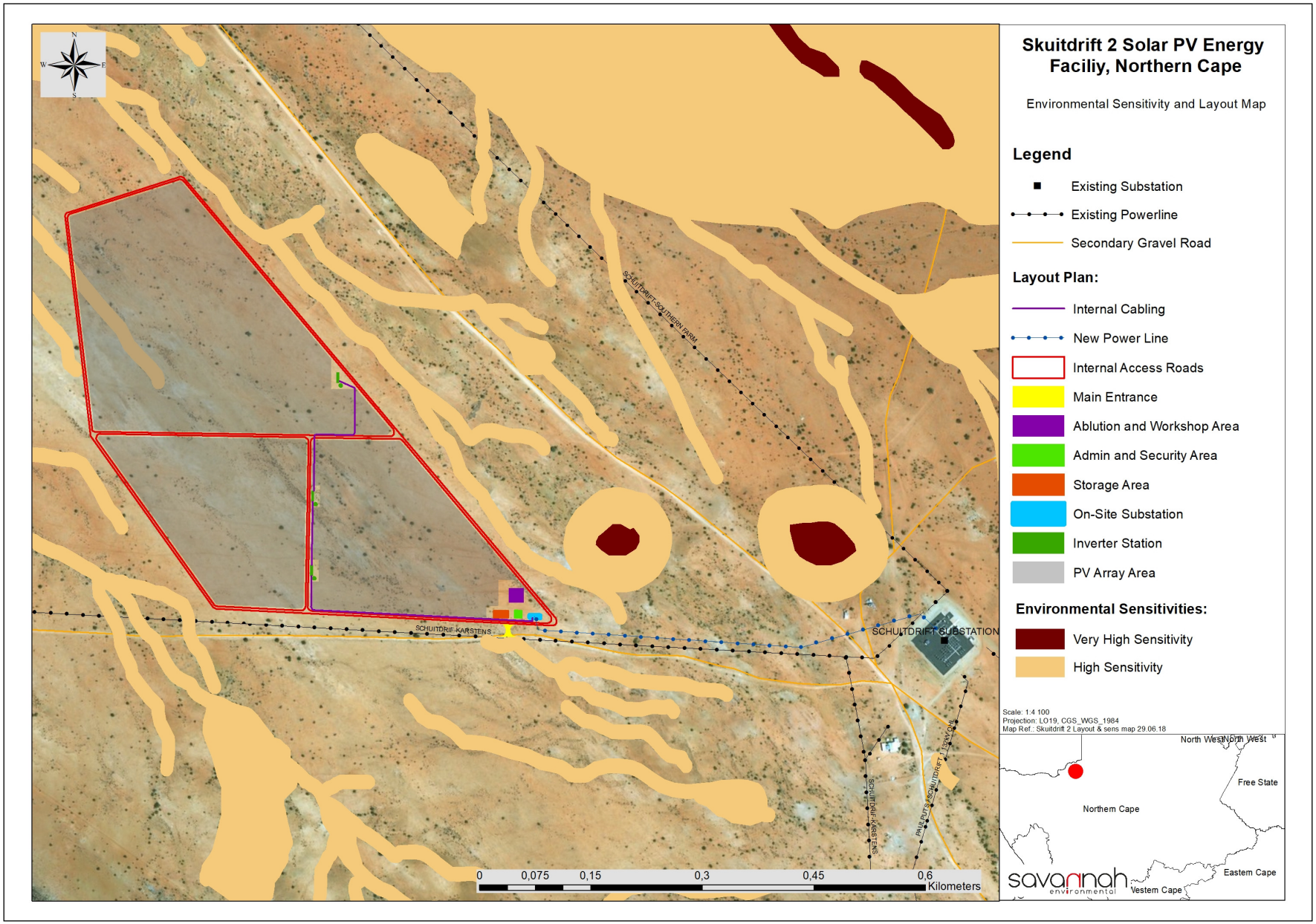


Figure 2: Environmental Sensitivity and Layout map of the Skuitdrift 2 Solar PV Energy Facility (**Appendix F**)

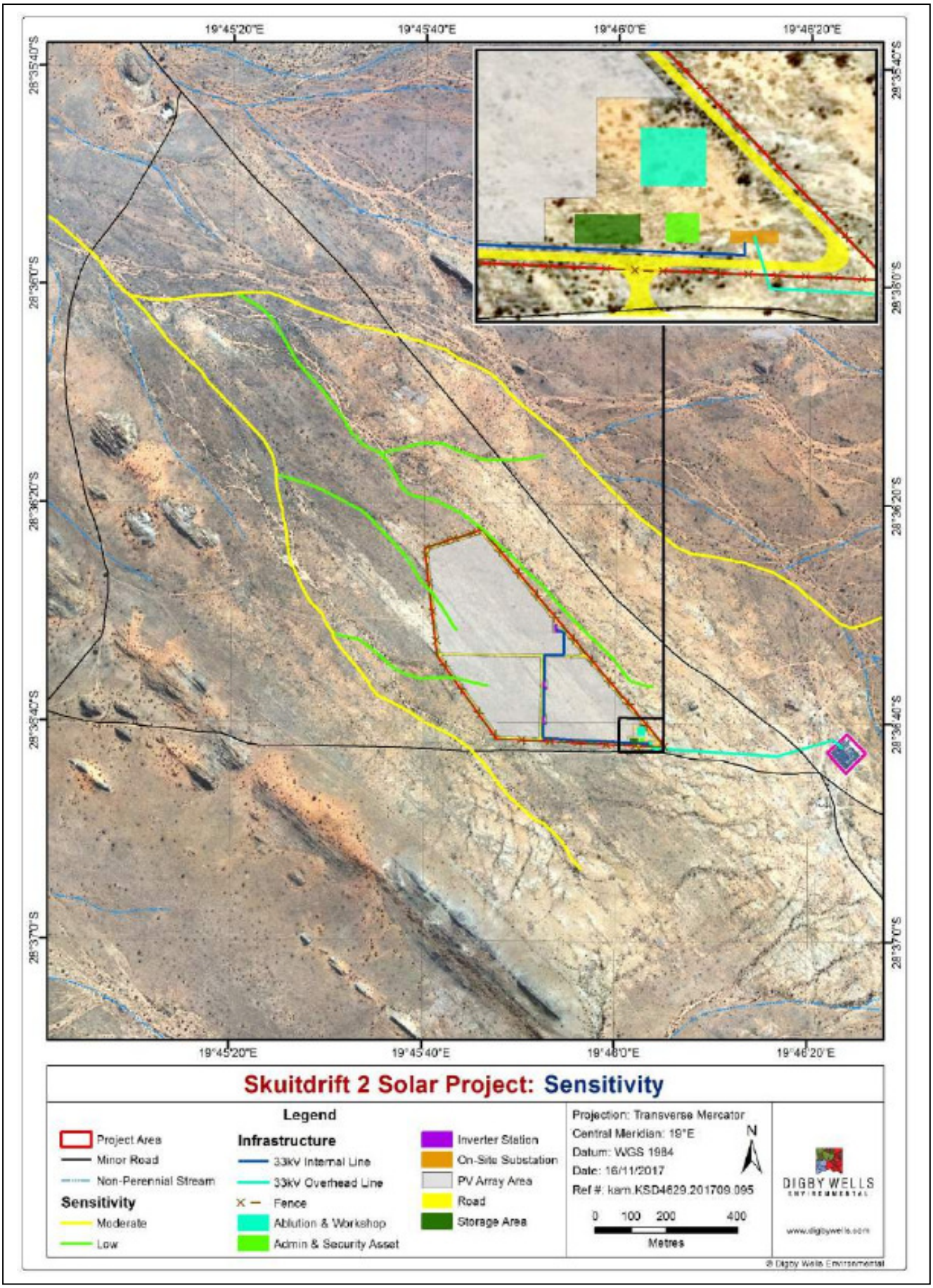


Figure 3: Surface water sensitivity map of the Skuitdrift 2 Solar PV Energy Facility (**Appendix E**)

2. ROLES AND RESPONSIBILITIES

Throughout the lifespan of this project, a number of individuals and entities will fulfil various roles and responsibilities to ensure the effective implementation of this EMPr. The key roles and responsibilities are detailed in **Table 1** below.

Table 1: Roles and responsibilities with regard to the implementation of this EMPr.

Role	Responsibility
Environmental Authority – Department of Environmental Affairs (DEA).	
The DEA is the competent/delegated authority responsible for compliance with the relevant environmental legislation.	» Ensure overall compliance with the Environmental Authorisation (EA) & EMPr. » Review this document and any revisions thereof, where required. » Undertake site audits at their discretion. » Review ECO Reports. » Review Audit Reports. » Review Incident Reports. » Enforce legal mechanisms for contraventions of this EMPr and EA.
Holder of the Authorisation – Khoi-Sun Development (Pty) Ltd.	
The holder of the Authorisation is responsible for ensuring compliance with all statutory requirements relating to the Solar facility.	» Ensuring compliance with the conditions set out in the Environmental Authorisation issued in terms of the NEMA, as well as those prescribed by other relevant legislation and guidelines. » Compliance with the requirements set out in this EMPr. » Ensuring all other permits, permissions and licences from all other statutory departments are in place. E.g.: Permit from provincial Department of Environment and Nature Conservation (DENC) to translocate or remove Hoodia gordonii plants.
Environmental Control Officer (ECO) – To be appointed	
The ECO fulfils an advisory role to monitor, guide and report compliance with the EMPr.	» Revise, update and amend the EMPr if necessary and submit the amendments to the competent authority for consideration. » Ensure all relevant persons have a copy of the EMPr and any amendments thereof. » Advise the employer's representative on any additional environmental authorisations and permits that may be required. » Review and comment on Method Statements relevant to environmental management and make recommendations to the employer's representative. » Report any non-compliance with the EMPr or EA to the employer's representative and competent authority if necessary. » Undertake regular site inspections in compliance with this EMPr. » Monitor, audit and verify that all works comply with the EA and the EMPr. » Keep record of EMPr implementation, monitoring and

Role	Responsibility
	audits, including a full photographic record of works. » Submit regular Environmental Control Reports to the competent authority, as well as the employer's representative and/or holder of the authorisation. » Report any environmental incidents or environmental impacts immediately to the employer's representative and the competent authority if necessary. » Advise the employer's representative on suggested "stop work" orders. » Provision of warnings and penalties and stop works if Contractor contravenes the EMPr or EA.
Environmental Officer (EO)	
The EO is responsible for implementation and for informing contractor employees and sub-contractors of their environmental obligations in terms of the environmental specifications, and for ensuring that employees are adequately experienced and properly trained in order to execute the works in a manner that will minimise environmental impacts	» Facilitate the Environmental Education / Induction Training with the contract staff. » Assist the contractor and employer's representative planning for and implementing environmentally sensitive problem solving. » Issue site instructions to the contractor based on the advice/guidance of the EO. » Give instructions on any procedures and corrective actions on advice from the EO. » Ensure that the conditions referred to in the Environmental Authorisation are implemented and to ensure compliance with the provisions of the EMPr.
Employers Representative	
The Employer's representative role is likely to be fulfilled by the project engineer and assumes overall responsibility for compliance with this EMPr, the EA, the conditions of the LUPO Approval and all applicable legislation for the duration of the construction phase.	» Ensure that all detailed design incorporates the requirements of the EMPr and EA. » Ensure that the EMPr is included in all tender documents issued to prospective contractors and sub-contractors. » Ensure the EMPr is included in final contract documents. » Ensure that the Tenderers/Contractors adequately provide for compliance with the EMPr in their submissions. » Ensure that the EMPr is fully implemented by the relevant persons. » Ensure the contractor provides the necessary method statements. » Be accountable, to the competent authority for any contravention or non-compliance by the Contractor. » Assist the contractor with input from the ECO in finding environmentally responsible solutions to problems. » Undertake regular site audits, site visits and inspections to ensure that the requirements of the EMPr are implemented. » Report environmental incidents or non-compliance with the EA or EMPr to the environmental authority. » Issue spot fines, penalties or 'stop-work' orders for

Role	Responsibility
	contravention of the EMPr and give instructions regarding corrective action.
Contractor – To be appointed	
The Contractor (main contractor) is responsible for the implementation of all construction activities associated with the Solar Facility.	» Overall project delivery for the construction of the Solar Facility to the satisfaction of the authorities and consultants. » Ensuring compliance with the Health and Safety requirements for the project. » Ensuring compliance with this Environmental Management Programme. » Promoting job safety and environmental awareness with Employees. » Ensure that all sub-contractors comply with this EMPr and all other statutory requirements.
Landowner	
The landowner is responsible for compliance with legislation applicable to the management of the property as a whole.	» E.g.: In terms of the National Veld and Forest Fires Act (101 of 1998) - an owner on whose land is subject to a risk of veldfire or whose land or part of it coincides with the border of the Republic, must prepare and maintain a firebreak on his or her land as close as possible to the border.

3. LEGISLATIVE FRAMEWORK

Several pieces of legislation were considered during the development of this EMPr. These include, but are not limited to the following:

3.1 The Constitution of the Republic of South Africa

The Constitution of the Republic of South Africa (Act 108 of 1996) states that everyone has a right to a non-threatening environment and that reasonable measures are applied to protect the environment. This includes preventing pollution and promoting conservation and environmentally sustainable development, while promoting justifiable social and economic development.

3.2 National Environmental Management Act (NEMA, Act 107 OF 1998, as amended)

The National Environmental Management Act (NEMA, Act 107 of 1998, as amended), makes provision for the identification and assessment of activities that are potentially detrimental to the environment and which require authorisation from the competent authority (in this case, the national Department of Environmental Affairs) based on the findings of an Environmental Impact Assessment (EIA). It also embraces the notion of sustainable development as contained in the Constitution of South Africa (Act 108 of 1996) in 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.

NEMA requires that measures are taken that "*prevent pollution and ecological degradation; promote conservation; and secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development*". In addition:

- That the disturbance of ecosystems and loss of biological diversity are avoided, or where they cannot be altogether avoided, are minimised and remedied;
- That a risk-averse and cautious approach is applied, which takes into account the limits of current knowledge about the consequences of decisions and actions; and
- Sensitive, vulnerable, highly dynamic or stressed ecosystems, such as coastal shores, estuaries, wetlands, and similar systems require specific attention in management and planning procedures, especially where they are subject to significant human resource usage and development pressure.

NEMA aims to provide for co-operative environmental governance by establishing principles for decision-making on all matters relating to the environment and by means of Environmental Implementation Plans (EIP) and Environmental Management Programmes (EMPr).

The Applicant may not undertake activities listed in terms of the NEMA without prior authorisation.

When considering **Section 24N** of NEMA, this EMPr must contain the following (**Table 2**):

Table 2: Compliance with Section 24N of NEMA

EMPr Provision	Report Reference
Information on any proposed management, mitigation, protection or remedial measures that will be undertaken to address the environmental impacts that have been identified in a report contemplated in subsection 24(1A), including environmental impacts in respect of **planning and design.**	This is addressed in **Sections 4, 5, 6 and 7** of this EMPr
Information on any proposed management, mitigation, protection or remedial measures that will be undertaken to address the environmental impacts that have been identified in a report contemplated in subsection 24(1A), including environmental impacts in respect of **pre-construction and construction activities.**	This is addressed in **Sections 4 and 5** of this EMPr.
Information on any proposed management, mitigation, protection or remedial measures that will be undertaken to address the environmental impacts that have been identified in a report contemplated in subsection 24(1A), including environmental impacts in respect of the **operation** or **undertaking** the activity in question.	This is addressed in **Sections 4 and 6** of this EMPr.
Information on any proposed management, mitigation, protection or remedial measures that will be undertaken to address the environmental impacts that have been identified in a report contemplated in subsection 24(1A), including environmental impacts in respect of the **rehabilitation** of the environment.	This is addressed in **section 5** of this EMPr – It has been dealt with under construction requirements for the specific reason that these works must take place during the construction phase.
Information on any proposed management, mitigation, protection or remedial measures that will be undertaken to address the environmental impacts that have been identified in a report contemplated in subsection 24(1A), including environmental impacts in respect of **closure**, if applicable	This is dealt with in **Section 7** of the EMPr.
Details and **expertise** of the person who prepared the EMPr.	These details are included at the beginning of the report and in **Appendix A**.
A detailed description of the **aspects** of the activity that are covered by the EMPr.	This is dealt with under the introduction in **Sections 1, 4, 5, 6 and 7** of this EMPr.
Information identifying the persons who will be **responsible** for the implementation of the measures addressed in the EMPr.	This is dealt with in **Section 2, Table 1** of this EMPr.
Information in respect of mechanisms proposed for **monitoring** compliance with the EMPr and for **reporting** on the compliance.	This is dealt with in **Section 8** of this EMPr.
Measures to **rehabilitate** the affected environment.	This is dealt with in **Section 5** of this EMPr.
Description of the manner in which **pollution** will be **prevented** and remedied.	This is dealt with throughout the EMPr, but specifically in **Sections 4.7, 5.4, 5.14, 5.16, 5.17, 6.2 and 6.3.**
The EMPR must furthermore, where appropriate;	
Set out **time periods** within which measures must be implemented.	This is dealt with in **Sections 5.19, 5.20, 5.21 and 12** of the EMPr.
Contain measures regulating responsibilities for any environmental damage.	This is dealt with is **Sections 1, 2, 12 and 13** of this EMPr.
Develop an **environmental awareness plan** describing the manner in which the applicant intends to inform his or her	This is dealt with in **Sections 4.2 and 4.3** of the EMPr.

EMPr Provision	Report Reference
Employees of any environmental risks and how to deal with these risks in order to avoid pollution or degradation of the environment.	

In addition to the above, the holder of the Authorisation is bound by "Duty of Care", as described in Section 28 of NEMA (107 of 1998, as amended), which "*...obliges every person who causes, has caused or may cause significant environmental degradation to take reasonable measures to prevent such degradation from occurring, continuing or recurring*". Therefore, all mitigation measures recommended by the relevant authorities and specialists must be implemented to avoid occurrence, continuation or repeat of environmental degradation.

3.3 National Environmental Management: Biodiversity Act (NEM:BA) (Act 10 of 2004)

This Act controls the management and conservation of South African biodiversity within the framework of NEMA. Amongst others, it deals with the protection of species and ecosystems that warrant national protection, as well as the sustainable use of indigenous biological resources. Sections 52 & 53 of this Act specifically make provision for the protection of critically endangered, endangered, vulnerable and protected ecosystems (under the ToPS Regulations - Threatened or Protected Species Regulations), that have undergone, or have a risk of undergoing significant degradation of ecological structure, function or composition as a result of human intervention through threatening processes. The conservation status and sensitivity of the ecosystem within which the Skuitdrift 2 Solar PV Energy Facility is discussed as follows:

No fine-scale conservation planning has been conducted for the area, and as a result **no Critical Biodiversity Areas have been defined** for the region. The Namakwa District Biodiversity Sector Plan includes this area as a broad-scale corridor, but since the area is outside of the planning domain of the Plan, the results cannot be considered reliable and are therefore not considered applicable to the current study. Although the site does not fall within a National Protected Areas Expansion Strategy (NPAES) focus area, a focus area does occur approximately 10km to the west of the study site. This suggests that the site itself is **not highly significant from a biodiversity maintenance perspective**, but that the broader area is potentially important for the maintenance of biodiversity and broad-scale ecosystem function. The development is relatively small in extent when considered in light of the overwhelmingly intact nature of the surrounding landscape. Furthermore, the proximity of the development to the existing Schuitdrift Eskom substation and powerlines would decrease the cumulative impact of the development on the connectivity of the landscape.

According to the national vegetation map (Mucina & Rutherford 2006), the site lies within the **Blouputs Karroid Thornveld vegetation type**, which occurs as a belt of irregular flat areas in the vicinity of Augrabies Falls in the east to Kotie se Laagte and Samoep se Laagte in the west. This vegetation type is listed as **Least Threatened** and less than 1% has been transformed. It is **well conserved (27%) within Augrabies Falls National Park**. At 607km^2 it is however the smallest mapped vegetation unit within the Nama Karoo Biome.

A detailed aerial and topographical screening exercise was undertaken to inform the siting of the solar facility development footprint and associated infrastructure, while an ecological impact assessment was undertaken to provide recommendations to avoid and mitigate potential negative impacts associated with the development. The **rocky outcrops must be maintained as a No-Go area at all times. The major drainage lines (i.e. drainage lines that are the primary path way into the second order streams) have been classified as being of a moderate sensitivity. These sensitive features are located outside of the**

development footprint of the facility. Two drainage lines are located in the north-western section of the development footprint and are considered to be of a low sensitivity (**Figure 7-1** of **Appendix E**).

A ToPS permit is required for any activities impacting on any ToPS listed plant species. In the Northern Cape this takes the form of an Integrated Permit which meets both national and provincial permitting requirements (see Section 3.4 and 15 below).

Sensitive habitats at the broader site include a number of **rocky outcrops**, as well as a major **drainage line** which traverses the site roughly east to west but is not located within the development footprint (**Figure 3**). A relatively large number of **protected plant species**, including *Acacia erioloba*, *Aloe dichotoma*, *Hoodia gordonii* and *Boscia foetida* are distributed across the site. The loss of some individuals of these species is likely to be unavoidable and only the succulent species can be translocated.

A preconstruction survey of the final development footprint will need to be conducted to ascertain the identity and exact number of individuals of protected species affected by the development. Species such as *Aloe and Hoodia* are suitable for translocation and should be translocated to a similar habitat outside the development footprint prior to the commencement of construction (see Sections 5.19 & 5.20 for details of the Plant Rescue, Re-vegetation and Rehabilitation Plans). Permits can also be applied for the cut or destruction of the protected species from the DENC.

An Ecological Walk-Through survey of the final facility layout has been undertaken (**Appendix B**). *Hoodia gordonii* (Bokhorings) listed as a Protected Species on the National Environmental Management: Biodiversity Act (Act 10 of 2004) under the Threatened or Protected Species (TOPS) regulations was recorded. Eleven (11) *Hoodia gordonii* individuals were recorded on site and close to the site and related infrastructure. Of the eleven (11) individuals recorded, two (2) were dead.

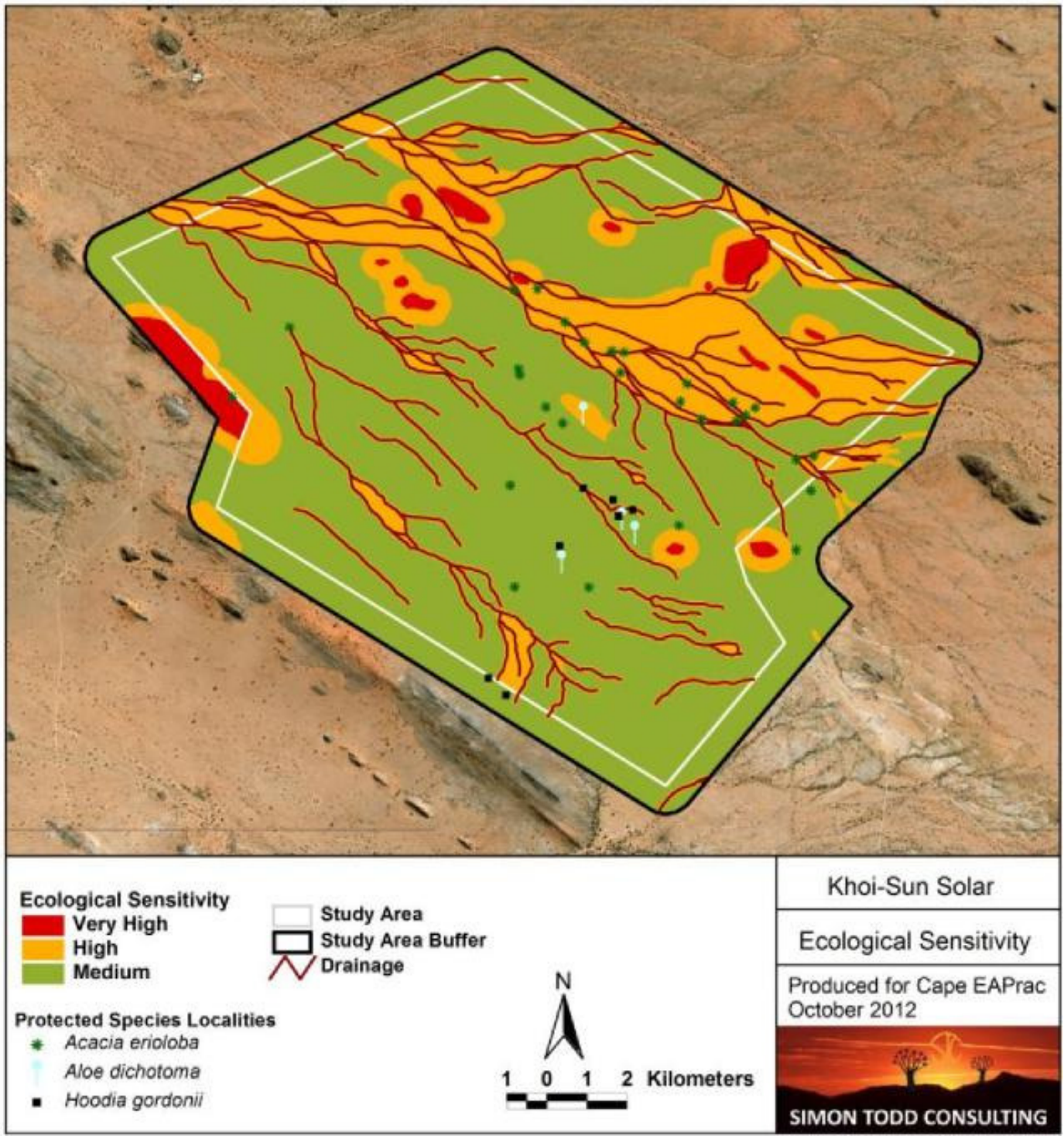


Figure 3: Environmental Sensitivity of the site

3.4 Northern Cape Nature Conservation Act (NCNCA) (Act No. 9 of 2009)

This Act provides *inter alia* for the sustainable utilisation of wild animals, aquatic biota and plants, as well as permitting and trade regulations regarding wild fauna and flora within the province. The following section may be relevant to the parameter security fencing of the solar development:

Manipulation of boundary fences

19. No Person may –

(a) erect, alter remove or partly remove or cause to be erected, altered removed or partly removed, any fence, whether on a common boundary or on such person's own property, in such a manner that any wild animal which as a result thereof gains access or may gain access to the property or a camp on the property, cannot escape or is likely not to be able to escape therefrom;

It is recommended that only the facility itself should be fenced-off by the parameter fencing which should be constructed in a manner to **allow for the passage of small and medium sized mammals**, at least at strategic places, such as along drainage lines or other areas of dense vegetation. **No electrified strands may be within 20cm of the ground** (tortoises retreat into their shells when electrocuted and eventually succumb from repeated shocks) (Todd, 2012 and 2013).

The Act also lists protected fauna and flora under 3 schedules ranging from Endangered (Schedule 1), Protected (Schedule 2) to Common (Schedule 3). The majority of mammals, reptiles and amphibians are listed under Schedule 2. A permit is required for any activities which involve species listed under Schedule 1 or 2.

There are a number of provincially protected species within the development footprint of the facility including *Acacia erioloba*, *Aloe dichotoma* and *Boscia foetida*, as well as one nationally protected species, *Hoodia gordonii*. The loss of some individuals of these species is likely to be unavoidable and only the succulent species (Hoodia & Aloe sp.) can be translocated.

The coordinate localities of the majority of the protected plant species that were found within the site have been recorded (Section 15.5). However, some of the less conspicuous individuals e.g. Hoodia may not have been found, therefore a preconstruction survey of the final development footprint will need to be conducted to ascertain the identity and exact number of individuals of protected species affected by the development (an ecological walk-through has been conducted and the findings of this walk-through have been detailed below). A single integrated permit, which covers nationally or provincially listed species permitting requirements, as well as meets TOPS regulations, must be obtained from the DENC permit office in Kimberly prior to the any vegetation removal or plant translocation activities (see Sections 5.19 and 5.20 for details of the Plant Rescue, Re-vegetation and Rehabilitation Plans).

An Ecological Walk-Through survey of the final facility layout has been undertaken (**Appendix B**). The following species were confirmed to be located within the development footprint of the facility:

- *Aloe dichotoma* (Quiver Tree) listed on Schedule 1 (Specially Protected Species);
- *Hoodia gordonii* (Bokhorings), listed on Schedule 1 (Specially Protected Species); and
- *Boscia foetida* (Shepperd's tree), listed on Schedule 2 (Protected Species).

There are three (3) *Aloe dichotoma* trees on site. Of these three (3) trees, two (2) are dead. The one (1) living tree is relatively small, being 1.5 metres tall with one trunk and no branches.

Eleven (11) *Hoodia gordonii* individuals were recorded on site and close to the site and related infrastructure. Of the eleven (11) individuals recorded, two (2) were dead.

There are eleven (11) *Boscia foetida* on site. Some *Boscia albitrunca* was found, but not within the development footprint. The individuals found were healthy.

In terms of fauna, a permit will be required before the commencement of the construction phase for the removal of a bird's nest located in a Quiver tree that may be impacted by the development. Overall the Skuitdrift 2 Solar PV Energy Facility site is not viewed as being highly ecologically sensitive and with standard mitigation measures in place, the risk of significant environmental impact or degradation as a result of the development is likely to be very low.

3.5 National Forests Act (NFA) (Act No. 84 of 1998)

The National Forests Act provides for the protection of forests as well as specific tree species, quoting directly from the Act: "*no person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree or any forest product derived from a protected tree, except under a licence or exemption granted by the Minister to an applicant and subject to such period and conditions as may be stipulated*".

One protected tree species (Acacia erioloba) was observed at the Skuitdrift 2 Solar PV Energy Facility. These individual protected trees will be avoided as far as possible, however those which need to be removed (approx. three (3) *A.erioloba*) will require the necessary permits which will be applied for from the Permit Office of the Department of Agriculture, Forestry & Fisheries (DAFF).

An Ecological Walk-Through survey of the final facility layout has been undertaken (**Appendix B**). There are a few *Acacia erioloba trees* on site, some of which are located within washes. These wash areas have been rated as high sensitivity in the Ecological Specialist Report (Todd, 2013). All the *Acacia erioloba* trees recorded (three) are relatively small, three (3) metres or less in height with a narrow crown. Recorded trees were otherwise healthy.

3.6 National Veld and Forest Fire Act (NVFFA) (Act 101 of 1998)

The purpose of the National Veld and Forest Fire Act is to **prevent and combat veld, forest and mountain fires** throughout the Republic of South Africa and to provide institutions, methods and practices for achieving this purpose. Institutions include the formation bodies such as **Fire Protection Associations** (FPA's) and Working on Fire. The Act provides the guidelines and constitution for the implementation of these institutions, as well as their functions and requirements.

Every owner on whose land a veldfire may start or bum or from whose land it may spread must prepare and **maintain a firebreak on his or her side of the boundary between his or her land and any adjoining land.** The procedure in this regard and the role of adjoining owners and the fire protection association are dealt with within this Act. An owner whose land is subject to a risk of veldfire or whose land or part of it

coincides with the border of the Republic, must prepare and maintain a firebreak on his or her land as close as possible to the border.

The solar site is arid and given the sparse, succulent nature of the vegetation, it is highly unlikely that fires are a normal occurrence in the area, and therefore fires at the site are not considered to be a significant risk. However, under exceptional circumstances, such as years of very high rainfall, sufficient biomass may build up to carry fires, especially in the fenced-off areas. Therefore, **management of plant biomass within the site** should be part of the management of the facility. Given the risk that this would pose to the development, it would be in the operators' interests to manage plant cover at an acceptable level through grazing or alternative management practice (brush-cutting). Grazing by livestock is the simplest and most ecologically sound way to manage plant biomass and is recommended as the preferred method to manage plant biomass at the site (Todd, 2012 & 2013).

3.7 Conservation of Agricultural Resources Act – CARA (Act 43 of 1983)

CARA provides for the regulation of control over the utilisation of the natural agricultural resources in order to promote the maintenance of ecological health of land, combating and preventing erosion and weakening or destruction of water resources, protecting vegetation and combating weeds and invader plant species i.e. conservation of soil, water and vegetation.

The hydrological features, which occur within the Skuitdrift 2 Solar PV Energy Facility development footprint include major drainage lines of a moderate sensitivity located outside of the development footprint and two drainage lines present in the north-western section of the development footprint which is considered to be of a low sensitivity. "Washes" are also present and are defined as areas which show visible signs of occasional water movement and sediment transport, but which do not receive sufficient runoff to develop characteristic soils or vegetation associated with wetlands or drainage lines.

The construction of the solar facility will require limited disturbance of vegetation or soil (rammed / driven piers) and therefore minimal impact on the small washes. Measures will be put in place to avoid drainage line obstruction, impeding surface and subsurface water flow and soil erosion, as well as to promote conservation of these resources (see Section 5.13 for details of the Storm Water Management Plan and the Erosion Management Plan).

The Conservation of Agricultural Resources Act defines different categories of alien plants:

- Category 1 - prohibited and must be controlled;
- Category 2 – must be grown within a demarcated area under permit; and
- Category 3 - ornamental plants that may no longer be planted, but existing plants may remain provided that all reasonable steps are taken to prevent the spreading thereof, except within the floodlines of water courses and wetlands.

The Skuitdrift 2 Solar PV Energy Facility site is relatively free of alien plant species, which can be ascribed firstly to the aridity of the site. Alien plants are however likely to become an issue if the site is highly disturbed during construction or if water runoff is not properly managed. Mitigation measures have been recommended to avoid the risk of increased alien invasion during the construction and operation phases of the solar facility (Todd, 2012 & 2013) (see Section 5.21 for details of the Alien Invasive Management Plan).

3.8 National Heritage Resources Act (NHRA) (Act 25 of 1999)

The protection and management of South Africa's heritage resources are controlled by the National Heritage Resources Act (Act No. 25 of 1999), with the South African National Heritage Resources Agency (SAHRA) as the enforcing authority.

In terms of Section 38 of the National Heritage Resources Act, SAHRA required a Heritage Impact Assessment (HIA) be undertaken as part of the S&EIR process, as this renewable energy project triggered certain categories of development applicable to the Act:

- the construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length (access and internal road network, underground cabling and transmission line);
- any development or other activity which will change the character of a site exceeding 5 000m^2 in extent (PV panel arrays covering an approximate area of 20ha, including auxiliary buildings);
- the re-zoning of a site exceeding 10 000m^2 in extent (re-zoning of approximately 20ha of land from Agricultural to Special Zone to allow for the renewable energy facility).

Furthermore, in terms of Section 34(1), no person may alter or demolish any structure or part of a structure, which is older than 60 years without a permit issued by the SAHRA, or the responsible resources authority. **No buildings or ruins older than 60 years and heritage or cultural significance were identified within the solar development site or will be disturbed by any activity related to the solar facility**.

Nor may anyone destroy, damage, alter, exhume or remove from its original position, or otherwise disturb, any grave or burial ground older than 60 years, which is situated outside a formal cemetery administered by a local authority, without a permit issued by the SAHRA, or a provincial heritage authority, in terms of Section 36 (3). **The grave sites found directly north of the solar development site are not considered to be of cultural significance and furthermore will not be affected by the development** (De Kock, 2012).

In terms of Section 35 (4), no person may destroy, damage, excavate, alter or remove from its original position, or collect, any archaeological material or object, without a permit issued by the SAHRA, or the responsible resources authority. **No archaeological occurrences were identified to occur with the solar development site (occurrences found outside the site is to be avoided by all activities** (Smith, 2012 & Almond, 2012).

The archaeological artefacts seen across the open veld constitute a low heritage potential. Sensitive archaeological areas include the koppies located outside of the solar facility footprint. If the preferred solar layout would affect these archaeological sensitivities, there would be **no inhibitors to the solar installation from an archaeological perspective,** subject to the avoidance of the quartz patches visible on and below the koppies. The **palaeontological sensitivity of the Skuitdrift 2 Solar PV Energy Facility site is assessed as very low**. Please see Sections 4.1.2 and 9 below for further details.

A Heritage Walk-Through survey of the final facility layout has been undertaken (**Appendix C**). It was concluded that the footprint of the proposed Skuitdrift 2 Solar PV Energy Facility has very low densities of isolated stone artefacts relating to the Middle and Later Stone Ages. The significance of impact is concluded to be low and no heritage permits are required to be obtained.

3.9 National Water Act (NWA), (Act No 36 OF 1998)

This Act controls / regulates the utilisation of natural water resources and provides provisions to safe-guard the integrity of these water resources.

It is estimated that approximately 1000kl of water in total should be required during the 6-month construction phase (an average of 6.41kl per day on average when construction is calculated at 6 days a week). In addition, the operation phase will require 500m^3 of water per year for panel cleaning, maintenance, ablution and human consumption.

Water will be sourced/from one on-site Borehole pump. One existing borehole is situated on the site and is considered as the preferred water source for the facility. The borehole closest to the site, Rooidraai, has a yield of approximately 70kl of potable quality water per day.

To supplement the abovementioned water source option, a rainwater collection (off the on-site substation and axillary building roofs) and storage system (2 x 10kl tanks) will be installed.

Due to the quaternary area within which the solar facility is to be situated, authorisation is required from the Department of Water and Sanitation (DWS) for the use of the borehole water, by way of a **full Water Use Licence Application (WULA)**. DWS recommended that a **full geo-hydrological study** must be done to ensure that the groundwater use will not affect any of the surrounding groundwater users and that this study be submitted when the Application for water use license is submitted.

The DWS have provided the following recommendations to inform the WULA for the Skuitdrift 2 Solar PV Energy Facility:

- A **24-hour pump test** must be undertaken on each borehole to determine the amount of water each can deliver. These pump test results must be submitted to the DWS when the application is submitted.
- The existing farm **boreholes must be fitted with flow meters** to measure the volumes of water abstracted (and keep record of such);
- That the water level of the **boreholes be monitored on a monthly basis** (and records kept);
- **Water used for dust suppression on gravel roads** must be of a quality compliant with the General Special Effluent Standards (31/03/2009): Temperature: max.25°C, pH: between 5.5 and 7.5 and conductivity: not be increased more than 15% above the intake water and not exceed 250 milli-Siemens per metre (determined at 25°C). The water used for dust suppression is likely to be borehole water, and not treated effluent. However, the water quality standards mentioned will be taken note of.

These recommendations must be implemented in furtherance of and support of the Water Use Licence Application (WULA) for this solar project.

3.10 Guidelines and Strategic Documents

The following guidelines and strategic documents were considered during the compilation of this EMPr.

3.10.1 National Waste Management Strategy

The National Waste Management Strategy presents the South African government's strategy for integrated waste management for South Africa. It deals among others with: Integrated Waste Management Planning, Waste Information Systems, Waste Minimisation, Recycling, Waste Collection and Transportation, Waste Treatment, Waste Disposal and Implementing Instruments.

3.10.2 Waste Minimisation Guideline Document for Environmental Impact Assessment Review (May 2003)

This guideline, although compiled on a provincial level, was considered pertinent to this EMPr. This Guideline raises awareness to waste minimisation issues and highlights waste and wastage minimisation practices. Part B of this document is of particular importance, as it addresses issues of general waste and wastage minimisation during construction activities.

3.10.3 National Building Regulations

The National Building Regulations and Building Standards Act as amended must be complied with. This act addresses, inter alia:

- Specifications for draftsmen, plans, documents and diagrams;
- Approval by local authorities;
- Appeal procedures;
- Prohibition or conditions with regard to erection of buildings in certain conditions;
- Demolition of buildings;
- Access to building control officers;
- Regulations and directives; and
- Liability.

3.10.4 Other Guidelines considered

In addition to those described above, the following guidelines were also considered during the compilation of this EMPr.

- DEADP (2003). Waste Minimisation Guideline for Environmental Impact Assessment reviews. NEMA EIA Regulations Guideline & Information Series, Department Environmental Affairs and Development Planning.
- DEAT (2004). Environmental Management Plans, Integrated Environmental management, Information Series 12, Department Environmental Affairs and Tourism.
- DEADP (2010). Guideline for Environmental Management Plans. NEMA EIA Regulations Guideline and Information Document Series, Department of Environmental Affairs and Development Planning.

4. DESIGN AND PRE-CONSTRUCTION PHASE

The following management considerations are to be adopted and implemented during the design and pre-construction phase.

4.1 PV Panel - Micro-Siting

Micro-siting of the individual panels within the solar facility should occur when the layout is nearing its final configuration during the detailed design phase (in approximation to the layout authorised by DEA). This micro-siting exercise involves assessing the exact footprints of the PV panels in each array row on site, so that all technical and environmental features can be considered with input from the participating specialists and the ECO.

The following recommendations made by the various specialists must be considered in the micro-siting exercise.

4.1.1 Ecology

The ecological specialist, Simon Todd (2012 & 2013), recommended that the sensitive areas with appropriate buffers at the site (drainage line and rock-outcrops) should be demarcated by an ecologist as part of the preconstruction activities for the site. In addition, a contracted ecologist should undertake a preconstruction survey of the final development footprint to ascertain the identity and exact number of individuals of protected species affected by the development. A single integrated permit, which covers nationally or provincially listed plant species permitting requirements, as well as meets TOPS regulations, must be obtained from the Department of Environment and Nature Conservation (DENC) permit office in Kimberly prior to the any plant rescue / transplant and/or removal activities. The appropriate permits from the Department of Agriculture, Forestry and Fisheries (DAFF) must be obtained for the removal or destruction of plants listed in the National Forest Act, Act 87 of 1998.

An Environmental Control Officer (ECO) should be present for the site preparation and initial clearing activities to ensure the correct demarcation of no-go areas, facilitate environmental induction with construction staff and supervise any flora relocation and faunal rescue activities that may need to take place during the site clearing.

A water use license will be required from the Department of Water and Sanitation (DWS) prior to the commencement of the project should the facility impact on any wetland or water resource. A copy of the license must be kept on record by the ECO.

4.1.2 Heritage

The Heritage (De Kock, 2012), Archaeological (Smith, 2012) and Paleontological (Almond, 2012) specialists recommend that the **koppies** and the area surrounding them, must be **demarcated as NO-GO areas and be avoided at all times**. In addition, areas with quartz scatters must be avoided as far as possible (please see Section 9 below).

A buffer zone of 50 meters must be established around the base of each koppie. No construction activities will be allowed within this buffer zone. The EO should be made aware of the presence of archaeological resources there, so that their safeguarding can be ensured during construction.

A buffer zone of at least 20 meters must be established around graves that are younger than 60 years. No construction activities will be allowed within this buffer zone.

4.2 Pre-construction Environmental Compliance Workshop

It is recommended that a pre-construction environmental compliance workshop be undertaken before any construction commences on site. This workshop can be combined with a site handover meeting but must take place before any activities take place on site and before any plant is moved onto site. The purpose of this workshop is to ensure that all relevant personnel are familiar with the provisions of the EMPr, as well as the conditions of the Environmental Authorisation.

The following people must be present at this Environmental Compliance Workshop:
» The ECO;
» The Main Civil Contractor (including contract manager, site agent and foreman);
» The Electrical Contractor (including contract manager, site agent and foreman);
» The Consulting Engineers (electrical, civil and structural, whichever applicable); and
» Project Management.

Provision should be made in contract and tender documentation to attend a 6-hour workshop that will be chaired by the ECO.

4.3 Environmental Induction Training and Environmental Education

The ECO, in consultation with the contractor and engineer, shall ensure that all construction workers receive an induction presentation, as well as on-going environmental education and awareness, on the importance and implications of the EMPr and the environmental requirements it prescribes. The presentation shall be conducted, as far as is possible, in the Employees' language of choice. The contractor should provide a translator from their staff for the purpose of translating, should this be necessary.

There are a number of protected and conservation-worthy plant species on and in proximity to the solar development site, including ***Acacia erioloba, Aloe dichotoma, Hoodia gordonii*** **and** ***Boscia sp.*** – the localities of these plants have been recorded (see Section 15.5 below for coordinates). Further plant species may well be identified by the ecological specialist to occur within the development area during the pre-construction survey. It is important that the ECO and all construction staff be made aware of these species and how to identify them, so that they can be suitably avoided and/or protected were possible (see Section 15 of the EMPr for photographs and description of important plant species). Section 16 provides details of the alien plant species, *Prosopis glandulosa, Argemone ochroleuca* and *Salsola kali* that will need to be removed from site on a systematic basis. It is the ECO's responsibility to print enlarged posters of these photographs and descriptions for use in the Environmental Induction / Education training sessions. It is also the ECO's responsibility to ensure that the required permit be obtained from the Kimberly DENC office prior to the transplant and/or removal of protected plant species, as well as to provide instruction on and guide all plant rescue, transplant and rehabilitation activities (i.e. *Hoodia* and *Aloe*

plants must be carefully removed and transplanted outside the development area in proximity to other *Hoodia* plants).

As further plant species of conservation value, as well as archaeological occurrences, are likely to occur in proximity of the **koppies** nearby, these must **be demarcated as NO-GO** areas and must be avoided by all staff.

As a minimum, induction training should include:

» Explanation of the importance of complying with the EMPr;
» Explanation of the importance of complying with the Environmental Authorisation;
» Discussion of the potential environmental impacts of construction activities;
» The benefits of improved personal performance;
» Employees' roles and responsibilities, including emergency preparedness (this should be combined with this induction, but presented by the contractors Health and Safety Representative);
» Explanation of the mitigation measures that must be implemented when carrying out activities;
» Explanation of the specifics of this EMPr and its specification (no-go areas, etc.); and
» Explanation of the management structure of individuals responsible for matters pertaining to the EMPr.

Furthermore, the induction training must ensure that construction workers/staff understand that **no form of wildlife poaching**, **collecting (plant or animal) or other form of disturbance will be permitted** on the construction site or the adjacent areas.

Safety representatives, managers and workers must be trained in workplace safety. All applicable safety standards and regulations, including the subcontractors must be enforced.

Should the staff turnover be high and with additional appointment of sub-contractors, it may be necessary to conduct additional induction training sessions, as well as regular environmental education debriefings. This is at the discretion of the ECO.

The contractor must keep records of all environmental training sessions, including names, dates and the information presented. Details of the environmental induction are also to be included in the environmental control reports.

4.4 Demarcation of No-Go Areas

The demarcation of no-go areas is of extreme importance to ensure that disturbance is restricted to the future developed area and that areas outside this demarcated area are protected and not damaged unnecessarily.

The process for this is as follows:

» No-go areas must be clearly demarcated (using fencing and appropriate signage) before construction commences.
» The exact footprint of the construction area, including panel foundations and all roads (including access, haul and internal roads which must make use of the final road layout) and infrastructure are to be surveyed and pegged before any physical construction commences on site.

- The contractor, in conjunction with the ECO, must walk the areas determined and mark the full extent of the area to be disturbed (allowing sufficient space for the construction activity);
- All areas beyond these demarcated areas are considered as "no-go" areas (i.e. the drainage line and rock-outcrops / koppies); and
- Construction staff must be briefed as part of the environmental induction on the requirements regarding the no-go areas.

4.5 Construction Phase

There are a number of important aspects of the construction phase that must be implemented to ensure that the potential impact on the environment is kept to a minimum. The contractor must consider the following requirements regarding phasing, when developing the construction programme. This construction programme must be approved by the engineer's representative with input from the ECO.

- The road network to access the panel arrays should be established first and then all vehicular movement must be restricted within this road network - This will minimise the impact of construction traffic on the undeveloped portion of the property.
- Sites that will be temporarily disturbed by the construction activities (e.g. material loading, temporary storage, turning circles, etc.) must also be included in the road access network.
- A lighting engineer must be consulted to assist in the planning and placement of light fixtures in order to reduce the impacts associated with glare and light trespass.

Roads must be designed so that changes to surface water runoff are avoided and erosion is not initiated.

Fourteen (14) days written notification must be given to the DEA that the activity will commence. Commencement for the purposes of this condition includes site preparation. The notice must include the date on which it is anticipated that the activity will commence.

4.6 Establishment of Contractors Site Camp

The Contractors Site Camp must be established in consultation with the ECO. The site camp may not be erected on any areas considered sensitive as defined by the participating specialists. The following points are applicable:

- The Contractors Site Camp must be situated within the development area. Site Camps that are allowed off-site may only be erected once written permission from the landowner is obtained and any other necessary authorisations are in place;
- Topsoil from the site camp area must be stripped and stockpiled for re-use during rehabilitation. This must be done to ensure no contamination of the topsoil while the site camp is in use;
- The site camp must be fenced off with shade netting;
- All construction material must be stored in the site camp, unless otherwise approved by the ECO. This may exclude PV panel mounting structures and panel components which will be stored at each of the assembly points, as per the manufacturer plans;
- No personnel may overnight in the site camp, except in the case of a night watchman / security;
- Fires for cooking and/or heating are only allowed within the site camp after consultation with the Health and Safety Representative;
- Fuel may only be stored in the site camp;
- Storage of waste must take place within the site camp and must be removed on a regular basis; and

» The site camp must be provided with sufficient ablution facilities (chemical toilets and potable water) of which the content must be disposed of regularly and at the suitable facilities.

It must be noted that no temporary site camps will be allowed outside the footprint of the development area as the establishment of such structures might trigger a listed activity as defined in the Environmental Impact Assessment Regulations.

4.7 Water Conservation in Infrastructure

The following recommendations must be considered in the design and construction of the associated structures / infrastructure (on-site substation, auxiliary buildings etc.) to be constructed as part of the Skuitdrift 2 Solar PV Energy Facility:

4.7.1 Ablution / Sanitation Facilities /Waste Management

The on-site substation, control and workshop buildings should be fitted with rainwater collection and storage systems to supply water to all taps and toilets in these buildings, as well as any outdoor requirements (landscaping, washing etc.). Water will also be abstracted from the borehole to supplement this.

All toilets should be fitted with dual flush systems. Conservative estimates have shown that a saving of more than 22 000 litres per household (this could apply to the workshops that are occupied by day and night staff) can be achieved annually with the installation of dual flush toilets (Aquanotion, 2008).

All taps to be installed in the control / substation / workshop buildings must be fitted with low-flow faucets. Low flow faucets use aerators to reduce the flow of the water. These can either be built into the faucet or added as an aftermarket product. The faucets in bathrooms should have a peak flow of less than 10 litres per minute.

Sanitation facilities must be provided within the construction camps and along the road so that workers do not pollute the surrounding environment. These facilities must be removed from the site when the construction phase is completed, together with associated waste to be disposed of at a registered waste disposal site.

An integrated waste management approach must be implemented that is based on waste minimisation and must incorporate reduction, recycling, re-use, and disposal where appropriate. Any solid waste must be disposed of at a landfill licensed in terms of section 20(b) of the National Environmental Management Waste Act, 2008 (Act No 59 of 2008). Copies of all waste disposal certificates must be kept on site.

4.8 Environmental Control Officer

An Environmental Control Officer (ECO) must be appointed for this project. The appointed ECO must be suitably qualified and have experience of environmental monitoring and control on similar scale projects.

The ECO must be appointed before the commencement of any authorised activity.

Once appointed, the name, and contact details of the ECO must be submitted to the Director: Compliance Monitoring of the DEA.

The ECO must remain employed until all rehabilitation measures, as required for implementation due to construction damage, are completed and the site is ready for operation.

The responsibilities of the ECO include but are not limited to the following:

- Keep record of all activities on site, problems identified, transgressions noted, and a schedule of tasks undertaken by the ECO;
- Provide environmental induction training to contractors on site prior to commencing of construction activities;
- Review, maintenance and update of the EMPr;
- Liaison between the Project Proponent, Contractors, Authorities and other lead stakeholders on all environmental concerns, including the implementation of the EMPr;
- Compilation of Environmental Control Report/s (ECR) to ensure compliance with the EMPr and authorisations. Reports should be submitted to the relevant authority (DEA) on a monthly basis;
- Compilation of the Environmental Audit Report or Environmental Completion Statement, six months after completion of construction or at a frequency in compliance with the Environmental Authorisation. Reports should be submitted to the relevant authority and the Project Proponent;
- Monitor compliance with this EMPr;
- Monitor compliance with the Environmental Authorisation once issued;
- Monitor implementation of the mitigation and rehabilitation measures and recommendations referred to in the Environmental Authorisation, Final Basic Assessment Report, participating specialist reports and this EMPr.
- Recommend the issuing of site instructions to the Contractor for corrective actions required (formal site instructions are to be issued by the Engineers Representative with input from the ECO);
- ECO site inspections to be undertaken once a month to ensure compliance with the EMPr. The duration of these visits may be increased or decreased at the discretion of the ECO in consultation with the Engineers Representative;
- Attendance of contractors site meetings;
- Keep and maintain a detailed incident (including spillage of bitumen, fuels, chemicals or any other material) and a complaint register on site indicating how these issues were addressed and what rehabilitation measures were taken and what preventive measures were implemented to avoid re-occurrence of the incidents/complaints.
- Engineers Representative (with input from the ECO) has the authority to stop work on site if he / she consider that any actions of excessive non-compliance of the EMPr, authorisations or General Duty of Care are taking place.
- Keep and maintain a daily site diary.
- Keep copies of all reports submitted to the DEA.
- Keep and maintain a schedule of current site activities including the monitoring of such activities.
- Obtain and keep record of all documentation, permits, licenses and authorisations such as waste disposal certificates, hazardous waste landfill site license etc. required by the facility.

4.8.1 ECO competency

The ECO must have a minimum of a tertiary level qualification in the natural sciences field, as well as at least 3 years' experience and proven competency as an ECO, preferably with experience on similar scale Developments.

5. CONSTRUCTION PHASE

The items contained in this section of the EMPr must be implemented during the construction phase of the development of the Skuitdrift 2 Solar PV Energy Facility.

Construction must be restricted to demarcated areas to restrict the impact on vegetation, birds and animals.

5.1 Water Supply

The contractor must ensure a supply of water is available on site for sanitation, drinking, dust suppression etc. It is estimated that approximately 1 000kl of water in total should be required during the 6-month construction phase (an average of 6.41kl per day when construction is calculated at 6 days a week).

Water used for dust suppression on gravel roads must be of a quality compliant with the General Special Effluent Standards (31/03/2009): Temperature: max.25°C, pH: between 5.5 and 7.5 and conductivity: not be increased more than 15% above the intake water and not exceeding 250 milli-Siemens per metre (determined at 25°C). The water used for dust suppression is likely to be borehole water / municipal water, and not treated effluent. This item is specific to water supply during the construction phase. Water supply for the washing of panels is discussed under the operation phase requirements.

5.2 Topsoil Handling

In terms of best practice and for rehabilitation purposes, it is essential that a 150mm layer of topsoil from the building and road footprints (i.e. the on-site substation, auxiliary buildings and contractor's site camp) be stripped and stockpiled prior to the commencement of construction activities in each area. Topsoil is of utmost importance for use in the rehabilitation of disturbed areas and should therefore under no circumstances be mixed with sub-soils. Since the panels are to be installed using low impact pile installation, topsoil from underneath the panel arrays must be left *in situ*.

The following requirements regarding topsoil handling must be considered:

- A minimum 150mm layer of topsoil from the access and internal roads, on-site substation, auxiliary buildings and contractors site camp;
- The topsoil stockpile site must be approved by the ECO and may not be within the sensitive areas as defined by the participating specialists;
- The topsoil may not be stockpiled within any of the remaining natural areas. An existing disturbed area should rather be chosen for this purpose;
- The topsoil stockpile must be protected from erosion and dust as indicated by the ECO and this EMPr; and
- The topsoil must be replaced into disturbed areas (road verges, cable trenches and contractors site camp) on completion of construction.

5.3 Transport and Traffic Management Plan

5.3.1 Access to Site

Access to the solar facility site is off the R359 and DR3256, which leads from the town of Augrabies. The solar facility site can also be accessed via the N14 between Pofadder and Kakamas on DR3256, however this is considered to be an additional access route. Transport of solar equipment and construction material will make use of the tarred national road, as well as provincial (divisional roads R359 and DR3256) and local farm gravel roads. In some instances, these provincial and farm roads may require some alterations (e.g. widening of corners etc.) to accommodate the dimensional requirements of the loads to be transported during the construction phase (e.g. transformers of the onsite substation). Permission from the local authority, Northern Cape Roads Department and private land owners will need to be sought in this regard if required.

Figure 4: Nous turn-off the N14

Figure 5: Gravel road to Skuitdrif Farm no. 426

In general, the surfaces of the N14 and gravel road to the Skuitdrif Farm no. 426 should handle construction traffic and traffic involved in the operation phase.

The existing farm roads must be used as far as possible for the solar facility access and internal road network. Where necessary, gravel may be used to service sections of the existing road. The new sections of the access road and the internal road network will either be comprised of gravel tracks or of compacted rock-fill with layers of higher quality surface stone on top. The preferred alternative is still to be confirmed. If compacted rock-fill is used, a geotechnical survey is to be undertaken to assess the strength and durability properties of the rock strata at the site. It may be necessary to strip off some of the existing vegetation and level the exposed ground surface, in order to form an access track surface. Such access tracks (less than 4m in width) will form part of the approximately 20ha development footprint. The exact and final layout and alignment of these internal roads must be informed by recommendations made by the ecological specialist, as well as the topographical survey. Pathways / tracks (less than 4m in width) between the Solar PV panel rows will allow for ease of maintenance and cleaning of the panels.

5.3.2 Trip Generation

The PV panels will be transported to site by means of normal super-link trucks. Less than 30 super-link trucks will be required. Approximately 14 Interlink trucks will be required for the transportation of structural steel

components as well as transformers and inverters. The PV components are brought in as they are needed and therefore the delivery of equipment will be spread out over this 6-month period. Roughly estimated this will amount to **less than one super-link / Interlink trucks visiting the site per day, which equates to approximately 2 truck trips spread over an eight-hour day.**

It is estimated that approximately 10-75 people could be employed during the construction period. It can be expected that the bulk of these workers will commute to/from the construction site via buses from Kakamas, and/or nearby communities. With an average occupancy of 20 passengers per bus this equates to **approximately 1-4 buses visiting the site in the morning and afternoon peak hours (2-8 bus trips).** It is expected that approximately 3-10 permanent staff members will be employed at the development during the operation phase. Should they all travel to work with their private vehicles; it would amount to 6-20 trips a day, 3-10 trips in morning peak hour and 3-10 trips out during afternoon peak hour).

Normal construction traffic will also need to be taken into account: civil engineering construction equipment will need to be transported to the site (e.g. excavators, trucks, graders, compaction equipment, cement trucks, etc.), as well as components required for the establishment of the onsite substation and power line. Some of the power equipment may be defined as abnormal loads in terms of the Road Traffic Act (Act No.29 of 1989). Much of the equipment will be kept in the site camp during the construction phase, therefore a conservative estimate of **4-8 light vehicles a day (8-16 trips) and 2-5 heavy vehicles a day (4-10 trips).**

In total, it is estimated that there will be **approximately 34 vehicle trips to and from the solar development site per day**, 17 in the morning and 17 in the afternoon, over the estimated 6-month construction period. Based on the expected number of construction trips generated by the development the existing road network has sufficient capacity to accommodate the additional trips from an operational perspective.

5.3.3 Traffic and Delivery Requirements

All construction and delivery traffic must be **restricted to the designated and approved access, haul and internal roads** and no vehicle may drive anywhere else on site. No construction vehicles should be allowed to drive over the vegetation – should a situation arise where a vehicle needs access to an area where no cleared roads are available, only a single track should be used in consultation with the ECO and resident engineer. Multiple paths should not be formed.

The PV panels and associated equipment / material must be delivered to a central point on the site and then moved to their assemble point / final position using smaller vehicles (i.e. forklifts or bakkies). This **temporary laydown area** would be used during the construction period to store equipment and construction material before it is installed or used during the development stage of the project. The area must be near the site access, in proximity to the workshop and office areas, to avoid excessive traffic during this period while conveying equipment and materials.

The **traveling speed of all vehicles** (construction, delivery, taxi or private) must be defined and enforced in terms of the Health and Safety requirements, to minimise the generation of dust and minimise impacts on local commuters (particularly on the Divisional Roads to the site). In general, vehicle speeds shall not exceed 40km/h along dust roads or 20km/h when traversing unconsolidated and non-vegetated areas. See Section 5.9 on dust control for further mitigations in this regard.

During the construction and delivery period, landowners and land-occupiers along the access route must be informed of the expected extent and duration of the increase in traffic. The engineer must keep a photographic record of the condition of the road prior to the increase in heavy construction vehicles. If any damage is caused to the road by the delivery traffic, the contractor should be responsible for the reinstatement.

It is recommended that construction activities be confined to **normal working hours** (08:00 - 17:00 on workdays). Should the Contractor / Engineer wish to deviate from these work hours, this must be discussed during the Pre-Construction / Initial Environmental Compliance Workshop with the ECO and recorded in the necessary Method Statements.

5.4 Concrete Management

Proper concrete management is of utmost importance. Concrete works are likely to be limited to the construction of the on-site sub-station and auxiliary buildings and are not likely to be extensive (the preferred alternative for the panel support structures will make use of a technology that does not require concrete footings, due to rammed piers/earth screws/rock anchors).

Cement powder has a high alkaline pH that may contaminate and adversely affect both soil pH and water pH negatively. A rapid change in pH can have consequences on the functioning of soil and water organisms, as well as on the botanical component.

The use of ready-mix trucks delivering concrete directly to site is recommended. Mass batching of concrete on site should be limited as far as possible.

The following must be implemented regarding the delivery of concrete to site:

- Trucks should deliver pre-mixed concrete to the site and pour the concrete directly into the prepared excavations.
- When concrete trucks have unloaded, there is a requirement to wash out the inside of the concrete drum. Water can be provided to the trucks for this purpose (at the discretion of the contractor). Concrete suppliers may not dispose of this wash water anywhere on site. Trucks should return to their depot for this purpose.
- Any spillages of concrete outside of the excavations (including haulage routes) must be cleaned up immediately by the supplier.
- Where small batching of concrete or plaster takes place on site, the following must be implemented:
  - Concrete batching may only take place outside of sensitive areas (preferably in the Site Camp). The area must be shown on the site plan.
  - Concrete mixing areas must have bund walls or a settling pond in order to prevent cement run off.
  - Once the settling ponds dry out, the concrete must be removed and dispatched to a suitable disposal site. Ideally, all concrete batching should take place on an area that is to be hard surfaced as part of the development (building floor, road or paved area).
  - In order to avoid resource contamination, concrete batching should not be located within 60m of a drainage line / watercourse, within a watercourse flood plain or where there is a potential for any spilled concrete to enter a watercourse or groundwater (boreholes).
  - If an area outside of the site camp is identified for batching it must first be approved by the ECO and all topsoil must be stripped and stockpiled for re-use.

* Batching at satellite sites must be done on a batching plate i.e. wood or metal sheet, to prevent soil contamination.

5.5 Cable Trenches

Electric cables required to connect the PV Panels to the on-site substation within the boundaries of the Skuitdrift 2 Solar PV Energy Facility area will be installed underground, **within or parallel to the internal road network and/or paths between the panel rows**, as far as possible.

Cable trench excavation, cable laying and backfill must be carried out in a systematic and continuous operation, **minimising the length of trench open at any one time** in order to reduce the risk of runoff. Cable trenches must be backfilled in such a manner as to prevent the trench from acting as a ditch or a conduit for water flow. In this regard, cable trenches, as with the internal road network, should follow the contours of the land as far as possible.

The following measures must be implemented by the contractor:

- Trenching shall be kept to a minimum through the use of single trenches for multiple service provision;
- The planning and selection of trench routes shall be undertaken in liaison with the ER and cognisance shall be given to minimising the potential for soil erosion;
- Trench routes with permitted working areas shall be clearly defined and marked with prior to excavation;
- The stripping and separation of topsoil and subsoil shall occur as stipulated by the ER. Soil shall be stockpiled for use as backfilling as directed by the ER with input from the ECO;
- Trench lengths shall be kept as short as practically possible before backfilling and compacting;
- Trenches shall be backfilled to the same level as (or slightly higher to allow for settlement) the surrounding land surface to minimise erosion. Excess soil shall be stockpiled in an area approved by the ER with input from the ECO;
- Stockpiled topsoil must be replaced at the top of excavated trenches; and
- The ER with input from the ECO may require the planting of additional vegetation along trench routes in order to speed up rehabilitation (particularly in areas that may be prone to erosion).

5.6 Overhead Transmission Line

Electricity transmitted to the on-site step-up substation will be transmitted via new overhead transmission power line of 33kV to the existing Schuitdrift Eskom substation, located approximately 500m east of the development site. The installed length of the new power line should be kept to a minimum.

Collisions and electrocution of birds from power-line infrastructure are significant causes of mortality for bustards, flamingos, eagles and vultures. The construction of new power lines is therefore a potentially significant source of impact for these species. These impacts can to a large degree be mitigated by configuring the infrastructure in a bird-friendly manner, **fitting bird flappers to the new line to reduce collisions, as well as insulating the live infrastructure to avoid electrocution**. The bird flappers must be installed where power lines cross avifaunal corridors e.g. wetlands, roosting sites etc. The input from an avifaunal specialist must be obtained for the fitting of the anti-collision devices onto specific sections of the line once the exact positions of the towers have been surveyed and pegged.

5.7 Management of Archaeological Resources

From a heritage, archaeological and paleontological perspective, there are no inhibitors to construction of the Skuitdrift 2 Solar PV Energy Facility. The archaeologist, Smith (2012) stated that the distinct lack of any concentration of cultural material across the property implies that this is not a rich archaeological environment. However, the **inselbergs / koppies** (incl. dense quartz scatters) outside the solar development area have been identified as potentially sensitive archaeological areas and should be avoided during construction activities. The dense scatters of white quartz stand out (white stones), so they are easily recognisable. The **Environmental Officer should be made aware of the potential occurrence of archaeological resources** associated with these koppies and quartz patches, so that they can be safeguarded during construction.

Should any archaeological and/or paleontological remains, including (but not limited to) fossil bones, fossil shells, coins, indigenous ceramics, colonial ceramics, marine shell heaps, stone artefacts, bone remains, rock art, rock engravings and any antiquity be discovered during construction, the ECO should safeguard these (preferably *in situ*) and report the find immediately to the South African Heritage Resources Council (SAHRA) and the Northern Cape Heritage Resources Authority (NCHRA), so that they are not disturbed further until the necessary guidance and approval have been obtained and the appropriate action (*e.g.* recording, sampling or collection) can be taken by a professional archaeologist or palaeontologist. Assessment of the heritage resources must be made by the relevant specialist.

5.8 Noise Management

Although the development is located outside of an urban edge, the following noise management requirements are applicable to the construction phase of the Skuitdrift 2 Solar PV Energy Facility due to its proximity to farm homesteads:

- It is recommended that noise generation be kept to a minimum and that construction activities be confined to normal working hours (08:00 - 17:00 on workdays). Should the Contractor / Engineer wish to deviate from these work hours, this must be discussed during the Pre-Construction / Initial Environmental Compliance Workshop with the ECO and recorded in the necessary Method Statements;
- Provide baffle and noise screens on noisy machines as necessary;
- Provide absorptive linings to the interior of engine compartments;
- Ensure machinery is properly maintained (fasten loose panels, replace defective silencers);
- Switch off machinery immediately when not in use; and
- Reduce impact noise by careful handling.

The Contractor shall be responsible for compliance with the relevant legislation with respect to noise *inter alia* Section 25 of ECA (73 of 1989) and the standards applicable to noise nuisances in the Occupational Health and Safety Act (No. 85 of 1993).

5.9 Dust Control and Management

Every effort to minimise dust pollution on the site must be undertaken. The contractor must implement the following measures with regards to the management of dust on site:

The most important dust control measure is achieved by maintaining as much of the vegetative cover as possible (the method of securing panels with minimal excavations supports this measure). The recommendations made with regards to the demarcation of no-go areas are important in this regard.

- Construction vehicles must adhere to speed limits and minimisation of haul roads must be implemented.
- During dry, dusty periods haul roads should be kept dampened to prevent excess dust. No potable water may be used for damping haul roads.
- All vehicles used to deliver or remove loose material (sand, soil, gravel etc.) to and from site must be covered with a 60% shade cloth to avoid dust blowing from the vehicle.
- As an alternative, products such as Road Environment Dust Suppressants (REDS) would be recommended in order to minimise the use of water to control dust pollution. This is to be determined by the Contractor and EO during construction as required;
- Other dust suppressant measures include covering surfaces with straw chippings and re-vegetation of open areas;
- Exposed stockpile materials must be adequately protected against wind (covered) and should be sited in consideration of the prevailing wind conditions.
- Apart from those measures detailed above, the following additional measures must be implemented:
  - Dust nuisances shall comply with the applicable standards according to the Occupational Health and Safety (Act No. 85 of 1993). The contractor shall be solely responsible for the control of dust arising from the contractor's operations and for any costs against the Employer for damages resulting from dust;
  - The contractor shall take all reasonable measures to minimise the generation of dust as a result of construction activities to the satisfaction of the Engineer's Representative (ER);
  - Removal of vegetation shall be avoided until such time as soil stripping is required and similarly exposed surfaces shall be re-vegetated or stabilised as soon as is practically possible;
  - Excavation, handling and transport of erodible materials shall be avoided under high wind conditions or when a visible dust plume is present;
  - During high wind conditions the site manager, with input from the EO, must evaluate the situation and make recommendations as to whether dust damping measures are adequate, or whether work should cease altogether until the wind speed drops to an acceptable level;
  - Where possible, soil stockpiles shall be located in sheltered areas where they are not exposed to the erosive effects of the wind. Where erosion of stockpiles becomes a problem, erosion control measures shall be implemented at the discretion of the site manager.
  - Vehicle speeds shall not exceed 40km/h along dust roads or 20km/h when traversing unconsolidated and non-vegetated areas.
  - Appropriate dust suppression measures shall be used when dust generation is unavoidable, e.g. dampening with water or use of REDS, particularly during prolonged periods of dry weather in summer. Such measures shall also include the use of temporary stabilising measures (e.g. chemical soil binders, straw, brush packs, clipping etc.).
  - Straw stabilisation shall be applied at a rate of one bale per $10m^2$ and harrowed into the top 100mm of top soil material for all completed earthworks (i.e. all those areas that are not hard surfaced as part of the Solar Facility). This is only relevant to areas disturbed through the construction activities (such as cable trenches) and not areas where vegetation remains intact.
  - Should water be used for dust suppression on gravel roads, it must be of a quality compliant with the General Special Effluent Standards (31/03/2009): Temperature: max.25°C, pH: between 5.5 and 7.5

and conductivity: not be increased more than 15% above the intake water and not exceeding 250 milli-Siemens per metre (determined at 25°C). The water used for dust suppression is likely to be borehole water / water from Southern Farms, and not treated effluent. However, the water quality standards mentioned must be taken note of.

5.10 Security Fencing

During construction it may be necessary to fence off the Contractor's Site Camp (to avoid theft of construction equipment and materials) and the PV Laydown Area/s (to avoid theft of the solar panels and associated infrastructure). These temporary fencing will be restricted to these areas and be removed at the end of the construction phase. The completed solar facility will be fenced with a permanent parameter electrified fence in order to prevent theft of infrastructure during operation. Recommendations made by the ecologist applicable to the erection of this permanent fence are as follows:

- The fencing should be constructed in manner which allows for the passage of small and medium sized mammals, at least at strategic places, such as along drainage lines or other areas of dense vegetation. Steel palisade fencing (20cm gaps minimum) is a good option in this regard as it allows most medium-sized mammals to pass between the bars but remains an effective obstacle for humans. Alternatively, the lowest strand or bottom of the fence should be elevated to 20 cm above the ground at least at strategic places to allow for fauna to pass under the fence.
- Electrified strands should not be within 20cm of the ground, because tortoises retreat into their shells when electrocuted and eventually succumb from repeated shocks.
- Only the facility itself should be fenced-off.
- Any security lighting associated with the fencing should be kept to a minimum and be of the low-UV emitting kind that attracts fewer insects.

The final fencing plan should be submitted to the ECO for comment.

5.11 Blasting

Due to the fact that the PV panel mountings will be drilled / rammed into the earth and will therefore not require extensive excavation for foundations, it is unlikely that blasting will be required. Should blasting however be required, the following measures must be implemented:

- No blasting may take place within 50m of a borehole without approval of a suitably qualified engineering geologist. Preventative mitigation actions could include installing PVC casing and screens in potentially affected boreholes before blasting, while damaged boreholes will have to be re-drilled (this scenario is however highly unlikely, as blasting will probably not take place);
- A current and valid authorisation needs to be obtained from the relevant authorities and copied to the ER prior to any blasting activity;
- A method statement shall be required for any blasting related activities;
- All laws and regulations applicable to blasting activities must be adhered to at all times;
- A qualified and registered blaster must supervise all blasting and rock splitting operations at all times;
- The contractor shall ensure that appropriate pre-blast monitoring records are in place (i.e. photographic and inspection records of structures in close proximity to the blast area);

- The contractor must allow for good quality vibration monitoring equipment and record keeping on site at all times during blasting operations;
- The contractor must ensure that emergency services are notified, in writing, a minimum of 24 hours prior to any blasting activities commencing on site;
- The contractor shall take necessary precautions to prevent damage to special features and the general environment, which includes the removal of fly-rock. Environmental damage caused by blasting / drilling shall be repaired at the contractor's expense to the satisfaction of the ER and the ECO;
- The contractor shall ensure that adequate warning is provided immediately prior to all blasting. All signals shall also be clearly given;
- The contractor shall use blast mats for cover material during blasting. Topsoil may not be used as blast cover;
- During demolition, the contractor shall ensure, where possible, that trees in the area are not damaged;
- Appropriate blast shaping techniques shall be employed to aid in the landscaping of blast areas, and a method statement to be approved by the ER, shall be required in this regard;
- At least one week prior to blasting, the relevant occupants/owners of surrounding land must be notified by the contractor and any concerns must be addressed. Buildings within the potential damaging zone of the blast shall be surveyed, preferably with the owner present and any cracks or latent defects pointed out and recorded either using photographs or video;
- Failing to do so shall render the contractor fully liable for any claim which may arise. The contractor shall indemnify the employer in this regard.

5.12 Ramming Operations

It is envisioned that ramming will be the preferred method of installing the panel support structures, if site conditions allow. If necessary options such as boring will be considered. The following measures must be implemented in this regard. Please refer to the engineering report (**Appendix D**) for further detail in this regard.

- The contractor shall submit a method statement detailing his proposals to prevent pollution (from hydraulic fluids, fuel or oil leaks) during ramming operations. This shall be approved by the ER (with input from the ECO) prior to the onset of any ramming operations;
- The contractor shall take all reasonable measures to limit dust generation as a result of ramming operations (also see Section 5.9 addressing management of dust);
- Noise and dust nuisances shall comply with the applicable standards according to the Occupational Health and Safety Act (Act No. 85 of 1993);
- Any areas or structures damaged by the ramming and associated activities shall be rehabilitated by the contractor to the satisfaction of the ER with input from the ECO.

5.13 Stormwater Management and Erosion Control Plan

Given the relatively flat nature of the site and the coarse sandy nature of the substrate, erosion risk is likely to be low at the Skuitdrift 2 Solar PV Energy Facility site, and provided that vegetation clearing is kept to a minimum, few measures to combat erosion will need to be implemented (Todd, 2012 & 2013).

Stormwater management is covered under the construction phase management, but aspects thereof will also be **applicable to the Operation Phase**. It is important that the engineers responsible for the detailed design of the Stormwater Systems must take the requirements of this EMPr into consideration, as well as the recommendations by the participating specialists.

Due to the extremely low annual rainfall experienced in the Skuitdrift area, the risk of water erosion is relatively low. The preferred method of installing the panel mounting structure via ramming / drilling results in a small footprint therefore **allows arrays to be constructed over the wash lines and high sensitivity areas**, while having a minimal effect on the vegetation, mitigating the chances of erosion. It is however important to recognise that any **plant removal and soil disturbance during construction may result in erosion**. In addition, the **presence of the solar panel arrays, buildings and associated hard surfaces would potentially generate a large amount of runoff**, which could impact the drainage patterns of the site and increase the risk of erosion. This may impact downstream riparian and wetland habitats if a lot of silt enters the drainage systems. Although the effects would probably only become apparent during the operation phase, the impact stems directly from the construction phase and suitable mitigation measures will also need to be applied at this stage. Cumulative impacts relating to erosion would only occur if alien plants are not controlled and if regular erosion monitoring and timeous rectification methods are not applied.

All buildings must be fitted with guttering to **capture all rainwater runoff off roofs to be stored in rainwater tanks**. Stormwater which cannot be captured via this system must be channelled into energy dissipating structures to spread the water and slow it down to allow infiltration into the soil and reduce the risk of erosion. Such dissipation structures may be temporary or permanent and be either moulded from precast concrete, loosely packed rock or perforated bags filled with stone.

Rainfall onto the solar panels will be welcomed due to its cleaning effect. The panel surfaces will be installed at a relatively high incline with gaps between panels, which will reduce the energy of falling raindrops, while avoiding water build up on the panel surfaces. In addition, the tracking system on which the panels will be mounted, will ensure that raindrops leaving the solar panel surfaces will not drop onto the same ground surface / area.

The following requirements/recommendations must be considered/implemented for stormwater management and erosion control (as well as those detailed under Topsoil Handling (Section 5.2), Cable Trenching (Section 5.5) and Dust Control and Management (Section 5.9) above, as well as Protection of Hydrological Resource (Section 5.14) and the Rehabilitation Plan (Section 5.20)):

- Particularly near the **drainage lines on the site** - precautions should be taken to avoid excessive disturbance and re-vegetation should take place as soon as possible after construction to avoid water and wind erosion;
- Wherever possible, roads and tracks should be constructed so as to **run along land contours**;
- All roads and tracks located along or down a slope must have **water diversion structures** present to redirect runoff and dissipate the energy of the water so as to reduce erosion potential;
- Sections of the access and internal road network that are to cross the washes and the drainage line, should do so by way of **Low-Level-River-Crossing (LLRC) structures** (causeways or drifts) and must be undertaken in-line with the requirements of the WUL;
- Any extensive cleared areas that are no longer or not required for construction activities should be **re-seeded with locally-sourced seed of locally-occurring indigenous species**. Bare areas can also be

packed with brush removed from other parts of the site to encourage natural vegetation regeneration and limit erosion;

- A **method statement** shall be developed and submitted to the engineer to deal with erosion mitigation and prevention prior to bulk earthworks operations commencing;
- The concentration of stormwater run-off must be avoided at all costs;
- All stormwater **runoff drains** alongside the access road and internal road network which may channel runoff into nearby drainages must be constructed with "erosion-proof" outlets as designed by the engineer with input from the EO – the engineer is to determine whether formal drainage is in fact necessary;
- During construction, the contractor shall protect areas susceptible to erosion by installing necessary **temporary and permanent drainage works**, as well as anti-erosion measures in areas susceptible to erosion (the washes and drainage line) as soon as possible and by taking other measures necessary to prevent the surface water from being concentrated in streams and from scouring the slopes, banks or other areas;
- Any **erosion channels** that develop during the construction period or during the vegetation establishment period must be backfilled and compacted and the areas restored to a proper condition;
- The principles of **sustainable urban drainage systems** should be followed for all panel footings and hard surfaces, namely:
  - the runoff should not be concentrated by piped/trenched systems or similar, and
  - runoff should preferably be directed towards soak-aways or depressions in the ground.
- No goods, building material or equipment must be stored in proximity to the washes / drainage lines;
- Protective measures must be installed where there are possibilities of surface water sheet flow causing erosion (compacted areas etc.);
- **Stabilisation of cleared areas to prevent and control erosion** must be actively managed. The method of stabilisation must be determined in consultation with the ECO and the ER.
- Consideration and provision must be made for the following methods (or a combination thereof):
  - Brush cut packing and/or mulch or chip cover;
  - Straw stabilising;
  - Watering;
  - Re-vegetation and/or sodding;
  - Hand seed-sowing and/or hydro seeding of locally-occurring indigenous species;
  - Soil binders and anti-erosion compounds;
  - Gabion bolsters and mattresses for flow attenuation;
  - Geofabric and/or hessian covers;
  - Log / pole fencing.
- Traffic and movement over stabilised areas shall be restricted and controlled and damage to stabilised areas must be repaired and maintained to the satisfaction of the ECO.
- Anti-erosion compounds must consist of all organic or inorganic material to bind soil particles together and must be environmentally friendly and effective to suppress dust and erosion. The application rate must conform to the manufacturer's recommendations. The material used shall be approved by the ER with input from the ECO;
- During operation, regular monitoring for erosion must be undertaken (particularly in the drainage line and red dune areas) to ensure that no erosion problems are occurring at the site as a result of the roads and other infrastructure. All erosion problems observed must be rectified as soon as possible;

» All maintenance vehicles to remain on the demarcated roads.

5.14 Protection of Hydrological Resources

There are two drainage lines of a low sensitivity present within the north-western section of the development area. Although the solar facility infringes on these drainage lines, the solar arrays are to be installed on driven / rammed piers/poles and spanned over the washes, the following requirements are applicable for the long-term protection of these watercourses (please refer to Section 5.13 above as well):

» Sections of the access and internal road network that are to cross the drainage lines and washes, should do so by way of Low-Level-River-Crossing (LLRC) structures (causeways or drifts), as these structures are known to have the least possible impact on watercourses in arid areas;
» The clearing of vegetation must be limited to the development footprint area, and the use of existing access roads must be prioritised to minimise the construction of new access roads in these areas;
» If possible, construction activities must be prioritised to the dry months of the year (June – August) to limit mobilisation of sediments or hazardous substances from construction vehicles used during site clearing;
» Dust suppression measures must be undertaken on the cleared areas during construction;
» Any construction work that involves site clearance, digging or trenching during the installation services should be suspended during heavy rains to avoid erosion and sedimentation of the water course;
» The major drainage lines are to be avoided by the solar development footprint and must be demarcated by the ecologist and ECO as no-go areas, as part of the pre-construction activities for the site (no major drainage lines are present within the development footprint area);
» The natural topographical surface profile should be maintained as far as possible to allow the normal runoff drainage into the main stream;
» Sections of the abovementioned major drainage line and the washes outside of the solar development area should also be demarcated as no-go areas by the ECO;
» Implement practices to reduce water use during construction;
» Any wastewater generated during construction must be discharged to a temporary holding tank for disposal, and not into the drainage lines. Wastewater must be removed from the site and disposed of to a licensed wastewater treatment facility;
» The spillage of fuels, lubricants and other chemicals should be prevented by providing bunded and impervious storage areas, located well away from the drainage lines;
» Fuel storage facilities must be located on a hard-standing area (paved or concrete surface that is impermeable), roofed and bunded in accordance with SANS 1200 specifications. This will prevent mobilisation of leaked hazardous substances into the hydrological resources;
» An emergency spillage response plan and spill kits should be available and accessible to the responsible monitoring team. The Material Safety Data Sheets (MSDS) should be kept on site during construction for reference (at any time) in terms of handling, storage and disposal of materials;
» Temporary and permanent ablution / sanitation facilities may not be located in proximity to the on-site drainage line without the relevant water use licensing;
» Placement of the solar panel laydown supporting structure on the drainage lines should be avoided where possible;
» Personnel should inspect the facility/development footprint to determine the effectiveness of the erosion control structure during or immediately after a heavy rainfall event (both construction and operation phases);

- When wet season construction cannot be avoided, sedimentation control measures, such as hay bales, sedimentation basins or any silt trap method should be in place during digging and the installation of service infrastructure;
- The existing drainage lines within the site and within the immediate surrounding area of the site must be monitored to ensure that the natural surface profile is still intact and capable of conveying runoff into the main drainage stream. This must be undertaken on a regular basis;
- Measure rainfall to determine the rainfall trend and the influence it has on the magnitude of erosion impacts. Use data from a real time weather system if in place, otherwise collect rainfall readings after every rainfall event or on a monthly basis (both construction and operation phases);
- Grab sampling should also be undertaken (upstream and downstream of the development footprint).

5.15 Fire Management and Protection

As mentioned above in Section 3.5 above, it is the landowner's responsibility to develop and maintain firebreaks as well as be sufficiently prepared to combat veld fires.

The solar development site is arid, with sparse vegetation cover and fires are not a natural phenomenon in the area. However, under exceptional circumstances, such as years of very high rainfall, sufficient biomass may build up to carry fires. Therefore, management of plant biomass within the site should be part of the management of the facility. Grazing by livestock is the simplest and most ecologically sound way to manage plant biomass and is recommended as the preferred method to manage plant biomass at the site. Alternative management practices include brush-cutting.

The following points must however be considered with regards to fire protection on site:

- Fires should **only be allowed within fire-safe demarcated areas** (preferably within the site camp);
- **No firewood collection** should be allowed on-site;
- The **total removal of all invasive alien vegetation** should take place in order to decrease the fire risk. Although there were few invasive plants identified during the environmental process, these may establish to a degree as a result of site disturbance;
- Cigarette butts may not be thrown in the veld, but must be disposed of correctly. The contractor, with input from the ECO, must **designate smoking areas** (in compliance with the Tobacco Products Control Amendment Act 63 of 2008) with suitable receptacles for disposal;
- In case of an emergency, the **contact details of the local fire and emergency services** must be readily available;
- Contractors must ensure that **basic firefighting equipment and suitably qualified/experienced personnel** are available on site at all times, as per the specifications defined by the health and safety representative / consultant;
- The fire risk on site is a point of discussion that must take place as part of the pre-construction compliance workshop and the environmental induction training prior to commencement of construction; and
- The contractor must also comply with the requirements of the Occupational Health and Safety Act with regards to fire protection.

5.16 Sanitation during Construction

Portable chemical ablution facilities must be made available for the use by construction staff for the duration of the construction period. The following must be implemented in this regard:

- Toilet and washing facilities must be available to the site personnel at all times;
- These facilities must be situated within the site camp and away from any washes or drainage lines;
- One toilet for every 15 personnel is required;
- The facilities must be serviced on a regular basis to prevent any overflow or spillage;
- The servicing contractor must dispose of the waste in an approved manner (e.g. via the municipal waste water treatment system);
- The ECO must be provided with the service providers' details and the service schedule for the site;
- The toilets should be secured to ensure that they do not blow over in windy conditions;
- All toilet facilities must be removed from site on completion of the contract period, and;
- Should the construction period be interrupted by a builder's break, the toilets must be emptied prior to the break.

Sanitation during operation is discussed above in Section 4.7.

5.17 Fuel Storage and Waste Management

The above ground storage of fuel is subject to authorisation in terms of the National Environmental Management Act (NEMA as amended 2006) if more than 30m^3 is stored on site at any one time.

Should a temporary storage of hazardous or toxic materials / liquids (chemicals, fuels, lubricants and oils) be required, the Contractor must ensure that he/she complies with legislation and that the following measures are in place:

- Temporary fuel storage must take place within the contractors site camp. This area must be located outside of sensitive areas and must be appropriately bunded;
- The management of general or other forms of waste must ensure collection and disposal into clearly marked skip bins that must be collected by approved contractors for disposal to the appropriate disposal sites;
- No storage of fuel may take place on any other portion of the site;
- All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site must be cleaned up immediately in the appropriate manner, as related to the nature of the spill.
- Mobile fuel units used to refuel vehicles and machinery on site must make use of drip trays when refuelling;
- Storage facilities may not be located within 60m of on-site drainage lines or where there is a potential for any spilled fuel to enter a watercourse or groundwater;
- Fuel storage facilities should be located on flat ground. No cut and fill should take place immediately on or adjacent to fuel storage areas;
- All storage tanks should be double lined and be ISO 9001 certified;
- All storage tanks must be enclosed by bund walls;

- Bund walls must be constructed to contain at least 110% of the total capacity of the storage tanks;
- Bund walls must be constructed of impermeable material or lined to ensure that petroleum products cannot leak;
- A suitable material should be placed in the base of the bund walls to soak up any accidental spillages;
- The tanks should be locked and secured when not in use;
- Automatic shut-off nozzles are required on all dispensing units;
- Storage tanks should be drained within one week of completion of activities (only unused fuel can be used by the contractor on other work sites or returned to the supplier). If the construction program extends over the Christmas shutdown, the contractor must ensure that storage tanks are emptied prior to this period;
- All storage tanks, containers and related equipment should be regularly maintained to ensure safe storage and dispensing of material. The Engineer is to sign off on the condition and integrity of the storage tanks;
- Defective hoses, valves and containment structures must be promptly repaired;
- Vehicle and equipment fuelling must be undertaken on a hard-impermeable surface, over drip pans or bund walls to ensure spilled fuel or toxic liquids is captured and cleaned up, and;
- The area must be totally rehabilitated on completion of the contract and all contaminated material must be carefully removed and disposed of at a licensed dumping site for that purpose.

5.17.1 Construction Waste Management

Litter management

Wind and scavenger proof bins must be installed at the Contractor Site Camp and must be emptied on a weekly basis.

Construction Rubble and Waste

All construction rubble must be disposed of at an approved site established and registered for this purpose (no construction rubble may be disposed of anywhere on site). No construction rubble may be used as fill in landscaping or any other areas on site.

Scrap Metal

Recycling of scrap metal is recommended. Scrap metal must be disposed of off-site at suitable facilities (e.g. municipal dump registered for this purpose).

Hazardous Waste

All hazardous waste (including chemicals, bitumen, fuel, lubricants, oils, paints etc.) must be disposed of at an approved / registered hazardous-waste landfill site. The Contractor must provide disposal certificates to the ECO.

Used oil and grease must be removed from site to an approved used oil recycling company.

Under no circumstances may any hazardous waste be disposed of on the site.

Where possible, the maintenance of construction and delivery vehicles must take place off-site.

5.18 Theft and other Crime

An increase in crime during the construction phase is often a concern. In the case of the Skuitdrift 2 Solar PV Energy Facility, this is likely to be negligible due to the extremely remote nature of the site. Theft and other crime associated with construction sites is not only a concern for surrounding residents, but also the developer and the contractor. Considering this, contractors need to be proactive in order to curtail theft and crime on and resulting from the construction site. It is recommended that the contractor develop a **jobsite security plan** prior to commencement of construction. This jobsite security plan should take into account the protection of the construction site from both internal and external crime elements, as well as the protection of surrounding communities from internal crime elements. All incidents of theft or other crime should be reported the South African Police Service, no matter how seemingly insignificant. A copy of the jobsite **security plan must be included in the first environmental control report to be submitted to the competent authority.**

It is likely that the Contractor's Site Camp and the PV Laydown area/s will be fenced with a temporary fence to avoid theft during construction. Additional security measures during construction will include one/two security guards.

The following considerations are relevant in this regard (refer to Section 5.10 above details of the facility permanent fencing):

- All portable construction equipment and material must be locked away within the Contractor's Site Camp overnight and during holiday periods;
- Fuel storages tanks must be locked when not in use;
- All unassembled / un-installed PV materials must be locked within the fenced laydown areas overnight and during holiday periods; and
- The minimum amount of lighting must be used at night and this should be of the low-UV emitting kind that attracts less insects.

It must be noted the **collection, hunting or harvesting of any plants or animals** at the site is **strictly forbidden**, and therefore any person found undertaking any of these actions will be considered guilty of committing a crime. Any incidents of such crimes on nature must be reported to the EO immediately.

5.19 Vegetation Clearing and Plant Rescue Plan

5.19.1 Vegetation Clearing

The objective of mitigation for any development is to firstly avoid and minimise impacts where possible and where these cannot be completely avoided, to compensate for the negative impacts of the development on vegetation and animal habitats, and to maximise re-vegetation and rehabilitation of disturbed areas. Some loss of vegetation is an inevitable consequence of the development of the Skuitdrift 2 Solar PV Energy Facility and vegetation clearing required for the PV panel laydown area, roads, buildings etc. could impact listed plant species, as well as high-biodiversity plant communities. Vegetation clearing will also lead to habitat loss for fauna and potentially the loss of sensitive faunal species, habitats and ecosystems.

A number of nationally and provincially protected species occur within the site, including *Hoodia gordonii, Boscia foetida, Acacia erioloba* and *Aloe dichotoma* (see photos, descriptions and location co-ordinates in Section 15).

An Ecological Walk-Through survey of the final facility layout has been undertaken (**Appendix B**). The following species were confirmed to be located within the development footprint of the facility:

- *Aloe dichotoma* (Quiver Tree) listed on Schedule 1 (Specially Protected Species);
- *Hoodia gordonii* (Bokhorings), listed on Schedule 1 (Specially Protected Species); and
- *Boscia foetida* (Shepperd's tree), listed on Schedule 2 (Protected Species).
- *Acacia erioloba,* listed under the National Forest Act (Act No. 84 of 1998)

There are three (3) *Aloe dichotoma* trees on site. Of these three (3) trees, two (2) are dead. The one (1) living tree is relatively small, being 1.5 metres tall with one trunk and no branches.

Eleven (11) *Hoodia gordonii* individuals were recorded on site and close to the site and related infrastructure. Of the eleven (11) individuals recorded, two (2) were dead.

There are eleven (11) *Boscia foetida* on site. Some *Boscia albitrunca* individuals were recorded, but not within the development footprint. The individuals recorded were healthy.

There are few *Acacia erioloba trees* on site, some of which are located within washes. These wash areas have been given a high sensitivity in the Ecological Specialist Report (Todd, 2013). All the *Acacia erioloba* trees encountered (three) are relatively small, three (3) metres or less in height with a narrow crown. Encountered trees were otherwise healthy.

The following recommendations apply to vegetation clearing activities for the solar facility:

- A single integrated permit, which covers the removal of nationally or provincially listed species permitting requirements, as well as meets TOPS regulations, must be obtained from the Northern Cape Department of Environment and Nature Conservation (DENC) permit office in Kimberly prior to the any vegetation removal or plant translocation activities;
- Vegetation clearing must be kept to a minimum and be limited to the required footprint and mitigation measures must be implemented to reduce the risk of erosion and the invasion of alien species. If possible, the ground grass layer should be left intact and only the larger woody plants cleared or trimmed. All areas to be cleared should be clearly demarcated, prior to the commencement of clearing activities;
- Vegetation cleared / removed as part of the site clearing activities must be stockpiled for use during the re-vegetation and rehabilitation stage for brush-packing. The location of the vegetation stockpile can be in the same area as the topsoil stockpile, as designated by the contractor in consultation with the ECO;
- Cleared alien vegetation must not be dumped on adjacent intact vegetation during clearing but should be temporarily stored in demarcated areas.
- Only those individuals of protected plant species directly within the development footprint should be cleared. Those which can be safely left intact (e.g. below or between the solar panel arrays) must not be disturbed;

» Any vegetation clearing that needs to take place as part of maintenance activities (during construction and operation phases) should be done in an environmentally friendly manner, using the most effective methodology suited to the target species (herbicides and/or manual clearing).

5.19.2 Plant and Animal Rescue and Protection

Considering the relatively high number of national and provincially protected plant species that may occur within the solar development area, a search and rescue operation for protected species, which could survive translocation such as *Hoodia* and *Aloe,* should be conducted prior to construction (see Section 15 for photographs on important species).

The abovementioned integrated permit application, to be obtained from the DENC, must make provision for the translocation of the abovementioned listed plant species.

Rescue operations should ensure that translocatable plant species are carefully removed from the ground with their root systems intact, before being translocated and planted to a similar habitat outside the development footprint as soon as possible, as designated in consultation with the ecological specialist and ECO.

Any animals (including snakes, tortoises and lizards) directly threatened by the clearing or construction activities should be removed to a safe location outside of the construction area (within the property boundary) by the ECO or other suitably qualified person.

5.20 Re-vegetation and Habitat Rehabilitation Plan

Re-vegetation and rehabilitation activities must commence at the end of the construction phase and continue into the operation phase. A rehabilitation plan must be developed within 6 months of commencement of construction and must define the rehabilitation of natural areas in the construction, operation, as well as decommissioning phases of the project. This rehabilitation plan must be developed by a suitably experienced consultant in consultation with the ecological specialist. This plan must include a detailed programme / action timeframe for the implementation of the rehabilitation plan.

This rehabilitation plan should also take the climatic and area-related water-restrictions into account, as well as conditions of the authorisation, the provisions of this EMPr and the recommendations made by all participating specialists.

Besides the rehabilitation of area disturbed during the construction phase, the plan must make provision for the rehabilitation of all areas of the site not affected by the solar facility and the long-term maintenance thereof. This plan must include the following recommendations, which should be updated based on site conditions and construction progress at the time:

» Bare soil should be kept to a minimum, and at least some grass or low shrub cover should be encouraged under the panels, and surrounding the auxiliary buildings;
» **Any cleared areas within the development footprint that are no longer or not required during construction** must be covered with a layer of topsoil (from the topsoil stockpile) and be **brush-packed with vegetation from the vegetation stockpile** (see Section 5.19 above) and/or re-seeded with locally-sourced seed of suitable species. Brush-packing with locally cleared indigenous vegetation will allow

local plant seed to enter the topsoil and allow the re-establishment / re-generation of vegetation on these bare areas, as well as limit erosion (see Section 5.13 above for further details);

- The verges of completed roads and tracks must be covered with a layer of topsoil and brush-packed to encourage vegetation re-generation and limit erosion;
- No exotic plants may be used for rehabilitation purposes. Only indigenous plants of the area may be utilised;
- Regular monitoring for erosion must be conducted across the site (particularly near constructed roads and infrastructure) to ensure that no erosion problems are occurring. Rectification of erosion problems must include the brush-packing and re-vegetation methods as far as possible;
- Regular monitoring to ensure that alien plants do not establish or increase as a result of the disturbance (see Section 5.21 below) is required.

5.21 Alien Plant Management Plan

As confirmed by the ecological specialist (Todd, 2012 & 2013), the abundance of alien plant species at the solar development site is very low, which can be ascribed firstly to the aridity of the site, as well as the low rainfall in the area.

Disturbance created at the site during construction could leave the site vulnerable to alien plant invasion. The invasion of alien vegetation could result in the decrease in biodiversity of indigenous species, as well as affect ecosystem function and hydrology, especially in cases where species such as *Prosopis* reach dense levels of infestation (see Section 15 and 16 for photograph and description of this alien species for easy identification).

The following recommendations apply to the management of alien vegetation:

- Soil disturbance and vegetation clearing should be kept to the minimum i.e. bare soil must be kept to a minimum and at least some grass or low shrub cover must be encouraged under the panels.
- Cleared areas that are not going to be used during operation should be brush-packed with indigenous vegetation (clearing and stockpiled during site preparation activities) and/or re-vegetated with indigenous species.
- Removal of alien invasive species or other vegetation and follow-up procedures must be undertaken in accordance with the relevant legislation.
- Regular monitoring must be conducted to ensure that alien plants are not establishing or increasing as a result of the disturbance that has taken place. Monitoring and alien clearing programme / timeframes must be applied as follows:
  - 8 months after start of construction;
  - Follow-up at 3 months before the end of construction, and then
  - Once annually during the operation phase.
- All alien plants found to be present at the site must be controlled using the best practice methods for the specific species present, as determined with guidance from the ecological specialist and ECO.

5.22 Open Space Management Plan

The solar facility development has been designed to be as concentrated / condensed as possible to keep it as small as is viably possible, and thereby limit the disturbed area associated with its construction and operation. As such, no open space areas have been designated and included in the development

design. However, the major drainage line and the rock outcrops / koppies avoided by the solar development footprint, could be considered and managed as pockets of 'open space' within the development area.

The management of these no-go / 'open space' areas should essentially include the following three aspects:

- As no-go open space areas, access through the drainage line and onto the koppies must be controlled (i.e. avoided as far as possible), in order to maintain the integrity of ecological, agricultural and archaeological resources found there. The no-go area demarcation (e.g. danger tape, signage etc.) erected during pre-construction, must be maintained throughout the construction and rehabilitation phases.
- During the rehabilitation and operation phases alien plant invasion monitoring of these 'open space areas' must be undertaken on a 6-monthly basis and all alien plants found must be destroyed (ring-barking) and/or removed (cut down and herbicide applied).
- The Low-Level-River-Crossings (LLRC) which allow the crossing of the major drainage line by the internal road network, must be inspected on a regular (2-monthly) basis to ensure that no erosion is occurring and that there is no obstruction of the natural water flow. Any evidence of erosion found during the inspections must be rectified immediately and the cause of erosion pro-actively sought and remedied to avoid recurrence.

Any impacts arising from within or associated with the development footprint i.e. erosion or invasion of alien vegetation etc. and entering the open space areas outside the solar facility, must be rectified immediately. The parameter of the solar facility must be monitored on a regular basis to ensure that these impacts are timeously identified and not allowed to re-occur.

6. OPERATION PHASE

The following environmental requirements are to be adopted and implemented during the operation phase:

Fourteen (14) days written notice must be given to the DEA that the activity operation phase will commence.

The holder of the Environmental Authorisation must compile an operational EMPr for the operation phase of the activity or alternatively, if the holder has an existing operational environmental management system, it must be amended to include the operation of the authorised activity.

6.1 PV Panel Maintenance Requirements

Due to their nature, once installed, the photovoltaic panels will not require intensive maintenance other than periodic cleaning, greasing of bearings and inspection. The key maintenance activity is the cleaning / washing of the panels in order to remove dust and maintain optimum power generation.

6.1.1 Cleaning of PV Panels

Any rainfall on the solar panels would be welcomed due to its cleaning effect, but as mentioned before, the annual predicted rainfall is very low. An estimated 500kl of water will be required during the operation phase for the cleaning of solar panels and for other operation phase requirements. This should take place using water from lawful sources on site or from the rainwater collection / storage systems. To further reduce the use of water at the solar facility, the use of alternative panel cleaning methods should be investigated. The use of robotic PV cleaners or high-pressure/low volume water cleaners, as well as compressed air can be considered, should the technology become commercially viable and available during the lifespan of the project.

No detergents may be used for washing purposes. Care must be taken that the wash-water does not cause any erosion.

Water used in the cleaning process is likely to encourage the growth of natural vegetation around the panel arrays and rows, which will require routine brush-cutting / trimming / mowing to avoid vegetation shading the panels, interfering with tracking mechanisms or the risk of fires. Under no circumstances should vegetation beneath or around the panel arrays and rows be cleared / removed entirely, as this will result in significant erosion and the associated sand-blasting of infrastructure. Due to stunted nature of the xerophytic vegetation, it is unlikely that this will need to be done often. Biomass produced from these trimming activities could be chipped and used as mulch under the PV panels (to increase stormwater infiltration and reduce erosion).

6.1.2 Other Operation / Maintenance Requirements

» Lubricants used to grease bearing of panel tracking systems should be conservatively used to avoid leakage or spills. Any **leaks or spills** that occur during maintenance operations must be cleaned up

immediately and the contaminated soil / material must be disposed of at a registered disposal site for hazardous materials.

» The **tracks / pathways** (<4m width) between the PV panel rows used for cleaning and maintenance of the panels, should be maintained as single tracks and regularly brush-cut and/or mowed to allow reasonable access.

» **Access roads and the internal road network** must be maintained in a condition that allows for reasonable access and minimised erosion potential. All drainage, stormwater management and erosion control structures must be maintained to ensure their proper functioning.

» **Regular monitoring for erosion** to ensure that no erosion problems are occurring at the site as a result of the roads and other infrastructure. All erosion problems observed must be rectified as soon as possible.

» All maintenance vehicles to remain on the demarcated roads.

» The **septic tank**, associated with the ablution facilities at the on-site sub-station / maintenance buildings, must be maintained in full working condition.

» The **parameter security fence** should be routinely patrolled to ensure that it still allows for the passage of small and medium sized mammals, at least at strategic places (drainage lines etc.), and that the electrified strands are not causing animal electrocution.

» No unauthorised persons should be allowed onto the site.

» The **maintenance of the transmission line infrastructure** must retain the bird-friendly design features (bird-flappers and insulation). Any **bird electrocution and collision events** that occur must be recorded, including the species affected and the date. If repeated collisions occur within the same area, then further mitigation and avoidance measures may need to be implemented in consultation with a qualified avifaunal specialist.

» Staff present during the operation phase must receive environmental education so as to ensure that that **no hunting, killing or harvesting of plants and animals** occur.

» All **alien plants present at the site should be controlled** at least twice a year using the best practice methods for the species present.

» **No pets** (cats and dogs) should be allowed within the solar facility.

6.2 Maintenance of Hydrological Resources during Operation

The following management measures associated with the on-site water resources should be implemented during the operation phase of the PV facility:

» The major drainage lines located outside of the development footprint must be maintained as a no-go area as far as possible. However, alien plant monitoring must be undertaken within this drainage line every six (6) months and all alien plants removed and/or destroyed. In addition, the Low-Level-River-Crossings (LLRC) which allow the crossing of the drainage line by the internal road network, must be inspected on a regular basis to ensure that no erosion is occurring and that there is no obstruction of the natural water flow. Any evidence of erosion found during these inspections must be rectified immediately and the cause of erosion pro-actively sought and remedied to avoid recurrence;

» The washes that traverse the solar facility and are straddled by the solar arrays/rows must be inspected on a regular, routine basis to remove any obstructions which could impede natural water flow or damage the solar infrastructure;

» During operation the drainage lines within the solar facility must be regularly inspected and any impediments / obstructions removed immediately to allow natural water flow beneath the installed solar frames;

- Implement practices to reduce water use i.e. conservative use of water to clean panels etc.;
- Sedimentation control measures, such as hay bales, gabions or a layer of rock sedimentation basins or any silt trap method should be placed at the outlet of the drainage line along the project boundary to trap and contain and prohibit eroded soil materials from being deposited into the main drainage which eventually links into the Orange River.
- Any wastewater generated during operation should be disposed of in an efficient septic tank or conservancy tank system and removed to a registered Wastewater Treatment Works on a regular basis; and
- The spillage of fuels, lubricants and other chemicals should be prevented by providing bunded and impervious storage areas. These will however be extremely limited, if any, due to the nature of Photovoltaic Power generation;
- The existing drainage lines within the site and within the immediate surrounding area of the site must be monitored to ensure that the natural surface profile is still intact and capable of conveying runoff into the main drainage stream. This must be undertaken quarterly during the operation phase.

6.3 Operation Waste Management

The following items are to be implemented with regard to waste management during the operation phase of the project.

Litter management
Wind and scavenger proof bins must be installed at the maintenance / control buildings and the on-site substation and must be emptied on a weekly basis.

Scrap Metal
Recycling of scrap metal is recommended. Scrap metal must be disposed of off-site at suitable facilities.

Hazardous Waste
All hazardous waste (including bitumen, fuel, oils, paints etc.) used during the operation and maintenance of the solar facility must be disposed of at an approved/registered hazardous-waste landfill site. The Contractor shall provide disposal certificates to the Site Manager.

Used oil and grease must be removed from site to an approved used oil recycling company.

Under no circumstances may any hazardous waste be disposed of on the site.

Where possible, the servicing of operation/maintenance vehicles must take place off-site.

7. CLOSURE AND DECOMMISSIONING PHASE

Should the activity ever cease or become redundant, the applicant shall undertake the required actions as prescribed by legislation at the time and comply with all relevant legal requirements administered by any relevant and competent authority at that time.

Within a period of at least 12 months prior to the decommissioning of the site a Decommissioning Method Statement or Plan must be prepared and submitted to the Local Planning Authority (Kai!Garib Municipality), as well as the Provincial and National Environmental Authorities (DENC and DEA) for input and approval. This method statement must provide detail pertaining to site restoration, soil replacement, landscaping, pro-active conservation, and a timeframe for implementation. Furthermore, this Method Statement / Plan must comply with any legislation and guidelines that may be applicable at the time.

Two possible scenarios are considered for this decommissioning phase, as follows:

7.1 Scenario 1: Total Closure and Decommissioning of the Solar Facility

If the decision is taken at the end of the project lifespan (30-years) to completely decommission the solar facility i.e. make the land available for an alternative land use, the following should take place:

- All concrete and solar infrastructure etc. must be removed from the solar site i.e. panels, support structures etc.;
- The holes where the panel support structures are removed must be levelled and covered with subsoil and topsoil;
- Tracks that are to be utilised for the future land use operations should be left *in situ*. The remainder of the tracks are to be removed (ripped), topsoil replaced and brush-packed to encourage re-vegetation and minimise erosion;
- All auxiliary buildings and access points should be demolished and rubble removed, unless they can be used for/by the future land use. The competent authority may prescribe that the landscaping and underground infrastructure i.e. foundations be left *in situ;*
- The underground electric cables must be removed, if they cannot be used in the future land use;
- All material (cables, PV Panels etc.) must be re-used or recycled wherever possible; and
- The site must be brush-packed, replanted and/or seeded with locally sourced indigenous vegetation (as prescribed by the competent authorities) to allow re-vegetation and rehabilitation of the site (see plant species list attached).

7.2 Scenario 2: Partial Decommissioning / Upgrade of Solar Facility

Should more advanced technology become available it may be decided to continue to use the site as a renewable energy / photovoltaic / solar facility. Should this be the case, it is likely that much of the existing infrastructure will be re-used in the upgraded facility.

All infrastructure that will no longer be required for the upgraded facility must be removed as described in Scenario 1 above. The remainder of the infrastructure should remain in place or upgraded depending on the requirements of the new facility. Any upgrades to the facility at this stage must comply with relevant legislation and guidelines.

8. MONITORING AND AUDITING

Environmental audits are fundamental in ensuring the implementation of the management actions contained within this EMPr, environmental sustainable development and maintenance of the Skuitdrift 2 Solar PV Energy Facility.

The results of these audits must be submitted to:
» The operators of the facility;
» The local authority (Kai!Garib Municipality);
» The provincial environmental authority: Department of Environment and Nature Conservation (DENC);
» The national environmental authority: Department of Environmental Affairs (DEA); and
» Eskom.

The results of the audit must be recorded in an environmental audit report and any non-compliance must be formally recorded, along with the response-action required or undertaken. Each non-compliance incident report must be issued to the relevant person(s), so that the appropriate corrective and preventative action is taken within an agreed upon timeframe.

The holder of the authorisation must keep all records relating to the monitoring and auditing on site and make it available for inspection to any relevant and competent authority.

All documentation, e.g. audit/monitoring/compliance reports and notifications, required to be submitted to the DEA in term of the Environmental Authorisation, must be submitted to the Director: Compliance Monitoring.

8.1 General Construction Monitoring

The ECO is responsible for environmental monitoring during construction as per the requirements of this EMPr. The monthly environmental monitoring reports compiled by the ECO, as well as the photographic record of works, must be submitted to the operators of the facility, the local authority, the provincial environmental authority, the national environmental authority and Eskom.

An Environmental Audit Report must be submitted to the DEA within 30 days of completion of the construction phase (i.e. within 30 days of the site handover) and within 30 days of completion of rehabilitation activities.

The Environmental Audit Report must:
» Be compiled by an independent environmental auditor;
» Indicate the date of the audit, the name of the auditor and the outcome of the audit;
» evaluate compliance with the requirements of the approved EMPr and the Environmental Authorisation;
» Include measures to be implemented to attend to any non-compliances or degradation noted;
» Include copies of any approvals granted by other authorities relevant to the development for the reporting period;
» Highlight any outstanding environmental issues that must be addressed, along with recommendations for ensuring these issues are appropriately addressed;

- Include a copy of the Environmental Authorisation and the approved EMPr;
- Include all documentation such as waste disposal certificates, hazardous waste landfill site licenses etc. pertaining to the Environmental Authorisation;
- Include evidence of adherence to the conditions of the Environmental Authorisation and the EMPr where relevant such as training records and attendance records.

8.2 Additional Monitoring Requirements during Operation

The following additional monitoring should be undertaken during the operation phase of the facility:

- Monitoring of washes and drainage line for erosion, obstruction and diversion (any erosion, obstructions and diversions should be rectified immediately);
- The emergence of invasive vegetation should be monitored. Any invasive vegetation established should be removed immediately;
- Monitoring of overhead lines for bird collisions. All bird collisions must be recorded and reported to the provincial environmental authority and BirdLife Africa;

The first two points should be monitored on a 6 monthly basis and the final point monitored on a biweekly basis. The results of this monitoring should be summarised in an annual audit report that should be submitted to the DEA, the Provincial Environmental Authority and the Local Municipality.

9. METHOD STATEMENTS

Method statements are written submissions by the Contractor to the Engineer and ECO in response to the requirements of this EMPr or in response to a request by the Engineer or ECO. The Contractor shall be required to prepare method statements for several specific construction activities and/or environmental management aspects.

The Contractor shall not commence the activity for which a method statement is required until the Engineer and ECO have approved the relevant method statement.

Method statements must be submitted at least five (5) working days prior to the date of commencement of the activity. Failure to submit a method statement may result in suspension of the activity concerned until such time as a method statement has been submitted and approved.

An approved method statement shall not absolve the Contractor from any of his obligations or responsibilities in terms of the contract. However, **any damage caused to the environment through activities undertaken without an approved method statement must be rehabilitated at the contractor's cost**.

Additional method statements can be requested at the ECO's discretion at any time during the construction phase.

The method statements should include relevant details, such as:
» Responsible person
» Construction procedures and location on the construction site;
» Start date and duration of the specific construction procedure;
» Materials, equipment and labour to be used;
» How materials, equipment and labour would be moved to and from the development site, as well as on site during construction;
» Storage, removal and subsequent handling of all materials, excess materials and waste materials;
» Emergency procedures in case of any potential accident / incident which could occur during the procedure;
» Compliance / non-compliance with an EMPr specification and motivation for proposed non-compliance.

9.1 Method Statements Required

Based on the specifications in this EMPr, the following method statements are likely to be required as a minimum (more method statements may be requested at any time as required under the direction of the ECO):
» Vegetation clearing and topsoil stripping, and associated stockpiling;
» Hazardous substances declaration of use, handling and storage – e.g. for fuels, chemicals, oils and any other harmful / toxic / hazardous materials;
» Cement and concrete batching;
» Traffic, transport and delivery accommodation e.g. need for traffic diversion/turning circles etc.;
» Solid waste management / control procedures;

- Stormwater and wastewater management / control systems;
- Erosion remediation and stabilisation;
- Fire control and emergency procedures;
- Job site security plan;
- Blasting activities (if necessary);
- Ramming and jack hammering or boring;
- Re-vegetation, rehabilitation and re-seeding.

10. HEALTH AND SAFETY

The Occupational Health and Safety Act (No. 85 of 1993) aims to provide for / ensure the health and safety of persons at work or in connection with the activities of persons at work and to establish an advisory council for occupational health and safety.

The main Contractor must ensure compliance with the Occupational Health and Safety Act, as well as that all subcontractors comply with the Occupational Health and Safety Act.

The following is of key importance (Section 8 of the aforesaid Act):

General duties of employers to their employees:

(1) Every employer shall provide and maintain, as far as is reasonably practicable, a working environment that is safe and without risk to the health of his employees.

(2) Without derogating from the generality of an employer's duties under subsection (1), the matters to which those duties refer include in particular-

- *(a) the provision and maintenance of systems of work, plant and machinery that, as far as is reasonably practicable, are safe and without risks to health;*
- *(b) taking such steps as may be reasonably practicable to eliminate or mitigate any hazard or potential hazard to the safety or health of employees, before resorting to personal protective equipment;*
- *(c) making arrangements for ensuring, as far as is reasonably practicable, the safety and absence of risks to health in connection with the production, processing, use, handling, storage or transport of articles or substances;*
- *(d) establishing, as far as is reasonably practicable, what hazards to the health or safety of persons are attached to any work which is performed, any article or substance which is produced, processed, used, handled, stored or transported and any plant or machinery which is used in his business, and he shall, as far as is reasonably practicable, further establish what precautionary measures should be taken with respect to such work, article, substance, plant or machinery in order to protect the health and safety of persons, and he shall provide the necessary means to apply such precautionary measures;*
- *(e) providing such information, instructions, training and supervision as may be necessary to ensure, as far as is reasonably practicable, the health and safety at work of his employees;*
- *(f) as far as is reasonably practicable, not permitting any employee to do any work or to produce, process, use, handle, store or transport any article or substance or to operate any plant or machinery, unless the precautionary measures contemplated in paragraphs (b) and (d), or any other precautionary measures which may be prescribed, have been taken;*
- *(g) taking all necessary measures to ensure that tire requirements of this Act are complied with by every person in his employment or on premises under his control where plant or machinery is used;*
- *(h) enforcing such measures as may be necessary in the interest of health and safety;*
- *(i) ensuring that work is performed and that plant or machinery is used under the general supervision of a person trained to understand the hazards associated with it and who have the authority to ensure that precautionary measures taken by the employer are implemented; and*
- *(j) causing all employees to be informed regarding the scope of their authority as contemplated in section 37 (1) (b).*

11. CONTRACTORS CODE OF CONDUCT

The Contractor's Code of Conduct is a document to be drawn up by the solar facility Developer and provided to all contractors or subcontractors that undertake any service on site. This code of conduct should include generic conduct rules for construction and operation activities on the Skuitdrift 2 Solar PV Energy Facility site and must be signed by all contractors. **This code of conduct does not exonerate contractors from complying with this EMPr and must not be viewed as a standalone document**.

The following general template is suggested for this Code of Conduct document and must be adapted and updated to include the provisions of this EMPr, recommendations of participating specialists, conditions of approval of the Environmental Authorisation, conditions imposed by the Local Authority (as part of the rezoning and consent use), as well as the all service agreements.

11.1 Objectives

- To ensure compliance with the Conditions of the Environmental Authorisation, the Environmental Management Programme (EMPr), recommendations of participating specialists, conditions imposed by the Local Authority as part of the rezoning and subdivision, as well as the service agreements.
- To ensure the least possible damage to:
    - Existing infrastructure on and adjacent to the site;
    - Indigenous flora and fauna (biophysical environment); and
    - Water quality of surface and groundwater on and surrounding the site. Particularly the water quality entering and exiting the on-site washes/minor drainage lines.
- Construction and development are undertaken with due consideration to all environmental factors;
- Where such damage occurs, provision is made for re-instatement and rehabilitation;

11.2 Acceptance of Requirements

In order to achieve these objectives, the Developer and Contractor bind themselves jointly and severally to fulfil and comply with all the obligations contained herein, as well as prescriptions and obligations contained in other documents controlling the development of the Skuitdrift 2 Solar PV Energy Facility.

11.3 Contractor's Pre-Construction Obligations

Contractors may not commence any construction on the Skuitdrift 2 Solar PV Energy Facility until:

- The Contractor and the ECO have carried out a joint site inspection (this is to be done as part of the pre-construction compliance workshop as detailed in the EMPr);
- A qualified ecologist has undertaken an inspection of the final development footprint and determined the number, species and extent of protected / listed plant species within this area;
- A permit for the removal or relocation-and-transplant of these protected / listed plant species has been obtained from the Northern Cape Department of Environment and Nature Conservation (DENC);
- Search and rescue of sensitive plants, particularly *Hoodia gordonii, Boscia foetida* and *Aloe dichotoma*, within the development footprint has been carried out;
- The construction and no-go areas are suitably demarcated to the satisfaction of the ECO;

- Where necessary, approval of Building / Construction Plans has been obtained from the local authority (Kai!Garib Municipality); and
- All contract staff has attended the required environmental induction training and on-going environmental education sessions, as necessary.

11.4 Contractor's Obligations During Construction

- The Contractor is required to comply with the necessary Health and Safety requirements as required by the Occupational Health and Safety Act of 1993;
- The Contractor must comply with the construction requirements as detailed in the EMPr, including the following plans detailed therein:
    - Transport and Traffic Management Plan,
    - Stormwater and Erosion-Control Management Plan,
    - Vegetation Clearing and Plant Rescue Plan,
    - Re-vegetation and Rehabilitation Plan,
    - Alien Management Plan,
    - Open Space Management Plan
- The contractor must comply with all the requirements detailed in the Environmental Authorisation;
- All conditions, processes and fees as prescribed by the Local Authority must be complied with; and
- The Contractor will only be permitted to erect a single signboard which must comply with legislative requirements.

12. IMPLEMENTATION

The following table is provided to assist the developer, design team, engineer and contractor with the effective implementation of this EMPr. The **Table 3** below serves as a quick reference guide to the EMPr but must be read in conjunction with the entire document.

Table 3: Implementation of the Skuitdrift 2 Solar PV Energy Facility EMPr

Item	Management Action	Timing	Responsible Party	Monitoring
Design and Pre-Construction Phase				
Familiarisation with the contents of the EMPr & EA.	Attendance of a pre-construction environmental compliance workshop	Prior to commencement of site clearing and earthworks.	ECO, Engineers, Contractor and Project Management.	ECO to include details of this in the first environmental control Report.
	Environmental induction of all staff.	Prior to commencement of earthworks.	ECO and all contract staff.	Contractor to keep records of all staff attending inductions.
Demarcation of Development Areas and No-Go Areas.	All areas outside of the construction / development area to be clearly demarcated. Koppie areas, and all sensitive drainage lines & vegetation outside development area are considered no-go.	Prior to commencement of site clearing & earthworks.	Contractor with input from the Engineer, ECO and participating specialists, where necessary. Contractor responsible for maintaining demarcation throughout the construction phase.	ECO to maintain photographic record of demarcation.
Obtain Permit for removal / translocation of protected plant species.	Permit application to be informed be list of protected plant species found by the ecological specialist within the final facility development footprint. Permit requirements & list to inform updated plant rescue plan.	Prior to plant rescue and vegetation clearing.	EO, ESA, Ecological Specialist and Contractor	EO and Ecological specialist to provide photographic record of protected plant species (to be used in on-going Environmental Education) and of plant rescue and translocation operation.
Panel and Powerline Pylon micro-siting	As defined in the EMPr	Prior to finalisation of detailed design.	Developer with input from EO, Engineer and relevant participating specialists	ECO to include details in monthly reports.
Environmental Induction Training	As defined in the EMPr	Prior to commencement of site clearing and earthworks.	EO and Contractor	Contractor to provide details to ECO. ECO to provide details in

Item	Management Action	Timing	Responsible Party	Monitoring
				monthly reports.
Construction Phase				
Minimise impact of construction vehicles	Implementation of recommendations of Transport and Traffic Plan defined in EMPr.	Throughout construction phase	Contractor	Engineer
Prevent concrete contamination	Use of delivered ready-mix concrete. Control at batching sites	Throughout construction phase	Contractor	Engineer, ESA and ECO.
Prevention of erosion of cable trenches	Implementation of recommendations of Erosion Management Plan defined in EMPr.	During detailed design and throughout the construction phase.	Contractor	Engineer, ESA and ECO.
Protection of Archaeological Resources	Avoidance of inselbergs / koppies within and outside development area and quartz patches as far as possible. Report archaeological occurrences found during earthworks to NCHRA & SAHRA.	Demarcation of sites prior to commencement of earthworks. Other mitigations throughout the construction phase.	Contractor	ESA, ECO and archaeologist.
Protection of hydrological resources (surface and underground).	As per the requirements of the EMPr.	Throughout the construction phase.	Contractor	ECO
Protection of all topsoil resources on site.	As per the requirements of the EMPr i.e. brush/straw packing and re-seeding	Throughout the construction phase.	Contractor	ECO
Construction of Cable Trenches	As per the requirements of this EMPr.	Throughout the construction phase	Contractor	ECO
Limiting damage caused by the installation of overhead lines.	As per the requirements of this EMPr.	Design phase and throughout the construction phase.	Design Team and Contractors	ECO and ER
Limiting Noise Impact	As per the requirements of the EMPr.	Design, throughout the construction and operation phase	Contractor, ER	ECO and ER
Reduction of dust generation as a result of construction activities.	As per the requirements of the EMPr.	Throughout the construction phase	Contractor	ECO and ER.
Providing for effective ecological corridors	Implementing the fencing requirements as defined by the ecological specialist	Design and construction phases.	ER and Contractor	ECO and ER.

Item	Management Action	Timing	Responsible Party	Monitoring
	and this EMPr.			
Limit environmental damage from blasting, drilling, jackhammering and trenching activities including that on existing boreholes.	Implementing the requirements for blasting detailed in this EMPr.	Throughout the construction phase.	Contractor	ECO and ER.
Preventing of Erosion and siltation of the wash / drainage lines.	Implementation of Stormwater Management and Erosion Control Measures detailed in this EMPr, as well as those made by the ecological specialists.	Design phase and throughout the construction phase	Design Team, Engineer and Contractors	ECO and ER.
Protection of protected plant species and on-going re-vegetation and rehabilitation.	Implementation of Plant Rescue, Re-vegetation and Rehabilitation Plan, as well as recommendation of ecological specialist.	Design phase and throughout the construction phase.	Design Team, Engineer and Contractors	ECO and ER.
Prevention of theft and other crime.	Development of a job site security plan.	Before commencement of construction.	Contractor	ER
On-going Environmental Education	As defined in the EMPr.	During construction.	EO and Contractor	Contractor to provide details to ECO. ECO to provide details in monthly reports.
Prevent pollution resulting from oil and fuel storage and handling.	Implement correct fuel and oil handling procedures. Implement emergency spill response plan.	Duration of the project lifespan.	EO and Contractor	ECO, ER and Contractor
Operation Phase				
Prevent pollution resulting from oil and fuel storage and handling.	Implement correct fuel and oil handling procedures. Implement emergency spill response plan.	Duration of the project lifespan	Facility operator	Facility manager and Environmental Authority.
Manage vegetation growth	Trimming of vegetation under panels to avoid overshadowing and fire risk.	Throughout operation	Operation and Maintenance staff.	Operation staff to report to Operator.
Prevent and manage erosion / obstruction of washes / drainage	Regular monitoring of wash to remove obstructions and repair	Throughout operation	Operation and Maintenance staff.	Operation staff to report to Operator.

Item	Management Action	Timing	Responsible Party	Monitoring
lines	erosion.			
Control of alien plants	Regular monitoring and removal of alien invasive plant species.	Throughout operation	Operation and Maintenance staff.	Operation staff to report to Operator.
On-going Environmental Education	As defined in the EMPr	During maintenance and operation.	Operation and Maintenance staff.	Operation staff to report to Operator.
Closure and Decommissioning Phase				
Items, management, responsibilities and monitoring as per construction phase, as above.				
Decommissioning of Solar facility.	Closure of facility in compliance with legislation and this EMPr.	After lifespan of project.	Facility operator and Kai!Garib Local Municipality.	Local, provincial and national Authorities
On-going Environmental Education	As defined in the EMPr	During decommissioning.	EO and Contractor	Contractor report to ECO. ECO to provide details in monthly reports.

13. NON-COMPLIANCE

Should any person commit an action of non-compliance he/she may be convicted of an offence, in terms of Sub-regulation (1) of the National Environmental Management Act, to imprisonment for a period not exceeding two years or to a fine not exceeding an amount prescribed in terms of the Adjustment of Fines Act, 1991 (Act No. 101 of 1991).

Apart from a fine resulting from any legal mechanism, the ECO may advise the ER to impose a penalty for non-compliance in terms of this Environmental Management Programme (EMPr). The procedure detailed below is for a spot fine in terms of this EMPr and does not detail the procedure for fining in terms of any other legal mechanism.

13.1 Procedures

The contractor must comply with the environmental specifications and requirements of this EMPr, the Environmental Authorisation (EA) and Section 28 of NEMA, on an on-going basis and any failure on his/her part to do so will entitle the ER to impose a penalty.

In the event of non-compliance the following recommended process shall be followed:

- The ECO shall issue a notice of non-compliance to the ER, stating the nature and magnitude of the contravention. A copy shall be provided to the Project Developer / Proponent.
- The ER will issue this notice to the Contractor.
- The Contractor shall act to correct the transgression within the period specified by the ER.
- The Contractor shall provide the ER with a written statement describing the actions to be taken to discontinue the non-compliance, the actions taken to mitigate its effects and the expected results of the actions. A copy shall be provided to the Project Developer / Proponent.
- In the case of the Contractor failing to remedy the situation within the predetermined time frame, the ER shall impose a monetary penalty (spot fine) based on the conditions of contract.
- Should the transgression be a blatant disregard of conditions of the EMPr or EA, the ER (on advice from the ECO) can at their discretion immediately issue a fine and require the remediation (without first giving the contractor a chance to remediate).
- In the case of non-compliance giving rise to physical environmental damage or destruction, the ER shall be entitled to undertake such remedial works as may be required to remedy such damage and to recover from the Contractor the full costs incurred in doing so.
- In the event of a dispute, difference of opinion, etc. between any parties in regard to or arising out of interpretation of the conditions of the EMPr, disagreement regarding the implementation or method of implementation of conditions of the EA any party shall be entitled to require that the issue be referred to specialists for determination.
- The ER on advice from the EO shall at all times have the right to stop work and/or certain activities on site in the case of non-compliance or failure to implement remediation measures.

The Director: Integrated Environmental authorisations and Director: Compliance Monitoring at the DEA must be notified in writing and within 48 (forty eight) hours, if any condition of the Environmental Authorisation cannot be or is not adhered to. Any notification in terms of this condition must be accompanied by the reasons for the non-compliance.

13.2 Offences and Penalties

Any avoidable non-compliance with the conditions of the EMPr shall be considered sufficient ground for the imposition of a penalty.

Possible offences, which should result in the issuing of a contractual penalty, include, but are not limited to:

- Unauthorised entrance into no-go areas;
- Catching and killing of wild animals, and removal or damage to conservation-worthy plant species;
- Open fires outside of the contractor site camp and insufficient fire control;
- Unauthorised damage to natural vegetation;
- Unauthorised camp establishment (including stockpiling, storage, etc.);
- Hydrocarbons / hazardous material: negligent spills / leaks and insufficient storage;
- Ablution facilities: non-use, insufficient facilities, insufficient maintenance;
- Insufficient solid waste management (including clean-up of litter, unauthorised dumping etc.);
- Erosion due to negligence / non-performance;
- Excessive cement / concrete spillage / contamination;
- Non-induction of staff.

14. REFERENCES

Almond, J. (March 2012). Recommended Exemption from further specialist paleontological studies or mitigation: Proposed 75MW Solar Facility on Farm 426 Skuitdrift, Kenhardt District, Northern Cape Province. Published as part of the Scoping & Environmental Impact Reporting process facilitated by *Cape EAPrac*.

Aylward, E. (2012 & 2013). Khoi-Sun Development: Layout Report. Published as part of the Scoping & Environmental Impact Reporting process facilitated by *Cape EAPrac*.

BVi Consulting (Sept.2012). Report on the proposed Road to the Khoi-Sun Development – Skuitdrift. Published as part of the Scoping & Environmental Impact Reporting process facilitated by *Cape EAPrac*.

DEA (2010). *National Climate Change Response Green Paper 2010.*

DEA (January 2008). *National Response to South Africa's Electricity Shortage*. Interventions to address electricity shortages.

DEADP (2003). Waste Minimisation *Guideline for Environmental Impact Assessment reviews.* NEMA EIA Regulations Guideline & Information Series, Department Environmental Affairs & Development Planning.

DEADP (2005). *Guideline for the review of specialist input in the EIA process*. NEMA EIA Regulations Guideline & Information Document Series, Department of Environmental Affairs & Development Planning.

DEADP (2005). *Guideline for involving biodiversity specialists in the EIA process*. NEMA EIA Regulations Guideline & Information Document Series, Department of Environmental Affairs & Development Planning.

DEADP (2005). *Guideline for environmental management plans*. NEMA EIA Regulations Guideline & Information Document Series, Department of Environmental Affairs & Development Planning.

DEAT (2006). *EIA Regulations* in terms of the National Environmental Management Act (Act No 107 of 1998) (Government Notice No R 385, R 386 and R 387 in Government Gazette No 28753 of 21 April 2006).

DEADP (2006). *Guideline on the Interpretation of the Listed Activities.* NEMA EIA Regulations Guidelines & Information Document Series, Department of Environmental Affairs & Development Planning.

DEADP (2007). *Guide on Alternatives,* NEMA EIA Regulations Guidelines & Information Document Series, Department of Environmental Affairs & Development Planning.

DEADP (2007). *Guideline on Appeals,* NEMA EIA Regulations Guidelines & Information Document Series, Department of Environmental Affairs & Development Planning.

DEADP (2007). *Guideline on Exemption Applications.* NEMA EIA Regulations Guidelines & Information Document Series, Department of Environmental Affairs & Development Planning.

DEADP (2007). *Guideline on Public Participation*. NEMA EIA Regulations Guidelines & Information Document Series, Department of Environmental Affairs & Development Planning.

DEADP (2009). *Guideline on Need & Desirability,* NEMA EIA Regulations Guideline and Information Document Series, Department Environmental Affairs & Development Planning.

DEADP (2009). *Guideline on Alternatives*, NEMA EIA Regulations Guideline and Information Document Series, Department Environmental Affairs & Development Planning.

DEADP (2009). *Guideline on Transitional Arrangements,* NEMA EIA Regulations Guideline and Information Document Series, Department Environmental Affairs & Development Planning.

DEADP (2009). *Guideline on Exemption Applications*. NEMA EIA Regulations Guideline and Information Document Series, Department Environmental Affairs & Development Planning.

DEADP (2009). *Guideline on Appeals*. NEMA EIA Regulations Guideline and Information Document Series, Department Environmental Affairs & Development Planning.

DEADP (2009). *Guideline on Public Participation*. NEMA EIA Regulations Guideline and Information Document Series, Department Environmental Affairs & Development Planning.

DEAT (2002). Integrated Environmental Management Information Series 3: *Stakeholder Engagement*. Department of Environmental Affairs and Tourism, Pretoria.

DEAT (2004). *Environmental management Plans*, Integrated Environmental management, Information Series 12, Department Environmental Affairs & Tourism.

De Kock, S. (March 2012). Phase One Integrated Heritage Impact Assessment compiled in terms of Section 38(8) of the National Heritage Resources Act, 1999 (Act 25 of 1999): Proposed Khoi-Sun Development (75MW): Portion (425ha) of the Farm Skuitdrift 426, Kenhardt District, Northern Cape Province. Published as part of the Scoping & Environmental Impact Reporting process facilitated by *Cape EAPrac*.

Department of Mineral & Energy (1998). *White Paper on Energy Policy of the Republic of South Africa***.**

Department of Mineral & Energy (2003). *The White Paper on Renewable Energy***.**

DWA (2001). *Generic public participation guideline*. Department of Water Affairs and Forestry.

Hsai-Yang, F (Ed)(2006). *Environmental Geotechnology Dictionary* (online version). University of North Caroline, Charlotte, USA.

Integrated Resource Plan for Electricity (Oct. 2010)**.** Revision 2, Version8.

International Finance Corporation – World Bank Group. (April 2007). *Environmental, Health and Safety Guidelines for Electric Power Transmission and Distribution.*

International Finance Corporation – World Bank Group. (April 2007). *General Environmental, Health and Safety Guidelines.*

Keatimilwe K & Ashton PJ 2005. *Guideline for the review of specialist input in EIA processes.* Department Environmental Affairs & Development Planning.

Lochner P (2005). *Guideline for Environmental Management Plans*. Department Environmental Affairs & Development Planning.

Mucina, L. & Rutherford, M.C. (eds.) 2006. *The Vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19.* South African National Biodiversity Institute, Pretoria.

National Energy Regulator of South Africa (NERSA) (Feb.2010). *Rules on selection criteria for renewable energy projects under the REFIT Programme.*

Oberholzer B (2005). *Guideline for involving visual & aesthetic specialists*. Department Environmental Affairs & Development Planning.

SANBI Biodiversity GIS (2007). South African National Biodiversity Institute, Cape Town, South Africa.

Smith, A. (March 2012). Archaeological Report: Proposed 75MW Solar Facility on Farm 426 Skuitdrift, Northern Cape Province. Published as part of the Scoping & Environmental Impact Reporting process facilitated by *Cape EAPrac.*

Todd, S. (2012 & 2013). Proposed Khoi-Sun Solar Facility: Fauna & Flora Specialist Report for Impact Assessment. Published as part of the Scoping & Environmental Impact Reporting process facilitated by *Cape EAPrac.*

Van der Merwe, E. (2012 & 2013). Khoi-Sun Development: EIA Engineering Report. Published as part of the Scoping & Environmental Impact Reporting process facilitated by *Cape EAPrac.*

Winter S & Beaumann N (2005). *Guideline for involving heritage specialists in EIA processes.* Department Environmental Affairs & Development Planning.

15. PHOTOGRAPHS, DESCRIPTIONS AND CO-ORDINATES OF PROTECTED PLANT SPECIES AT SKUITDRIFT 2 SOLAR PV ENERGY FACILITY SITE

Species of conservation concern are illustrated below. The list includes species listed as threatened under the South African Red Data List of Plants, as well as those species which are provincially protected and are either significant or suitable for search and rescue. Common species within protected genera are not illustrated, but will nevertheless need to be listed on the permit application to clear the site.

These photographs can be used for environmental education purposes during the construction phase of the project to ensure that all construction staff are made aware of the protected status of these species. This photographic record of protected plant species, particularly those suitable for rescue and translocation, will have to be updated after the pre-construction survey by the ecologist.

15.1 *Boscia Foetida*

Status	**Provincially Protected**
Suitable for search rescue	No, permit required for cut or destruction by the DENC
Abundance at site	Occasional
Description	Small tree, usually with white stems. Produces small green flowers and small round fruits.

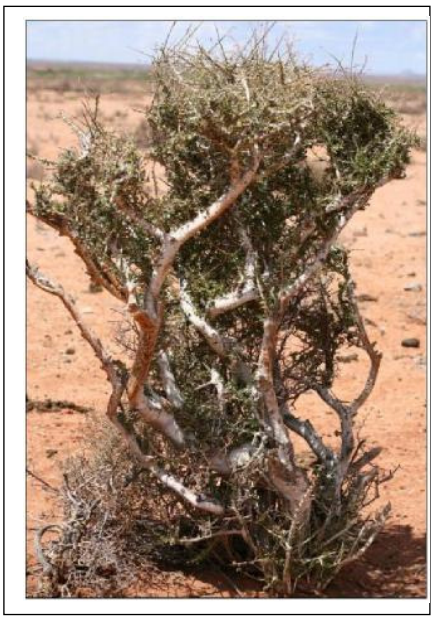


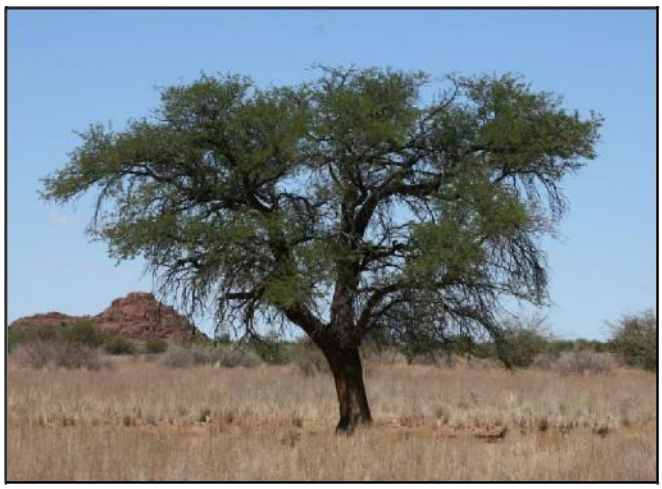
Figure 6: *Boscia Foetida*

15.2 *Hoodia gordonii*


Figures 7 and 8: *Hoodia gordonii*

Status	Nationally Protected
Suitable for search rescue	Yes
Abundance at site	Occasional
Description	Stem succulent up to 1m tall, but usually lower. Has spiny upright stems 5-10 cm wide. Produces large brownish flowers.

15.3 *Acacia Erioloba*




Figures 9 and 10: *Acacia erioloba*

Description:

- Medium-sized to large deciduous or semi-evergreen tree; crown usually flat-topped, dome shaped or rounded. Older branches often contorted.
- Bark thick, rough and deeply longitudinally fissured.
- Spines paired, straight, often swollen and fused at the base, white or reddish.
- Leaves bipinnately compound; leaflets prominently veined below.
- Flowers in globose heads, bright golden-yellow.

» Pods large, flat, thick and semi-woody, velvety grey, half moon-shaped, indehiscent.
» Usually on red Kalahari sands, often more abundant along drainage lines.

15.4 *Aloe Dichotoma*


Figures 11 and 12: *Aloe dichotoma*

Description

» Small succulent tree with a thickened trunk and dense rounded crown.
» Leaves succulent, in terminal rosettes, blue-green or yellowish green; margin with small yellowish-brown teeth.
» Inflorescence branched, borne terminally above a leaf rosette; flower spikes about 300 mm long, bright yellow.
» On rocky hills and sandy flats throughout most of the Northern Cape.

15.5 Co-ordinates of Protected Plant Species

Table of localities of protected species observed within Skuitdrift 2 Solar PV Energy Facility development area. The coordinates are in decimal degrees and based on the WGS84 datum. The table should be considered reasonably complete for *Acacia erioloba* as this species is conspicuous and can usually be easily seen, whoever, there may be additional individuals of *Aloe dichotoma* and Hoodia present as these species are less conspicuous and given the large extent of the site, it is not likely that all individuals present were observed. The final development footprint should therefore be searched for these species prior to construction. A permit obtainable from the Permit Office of the Northern Cape Department of Environment and Nature Conservation (DENC) for their translocation or removal during construction would be required. Contact person: Marietjie Smit msmit@half.ncape.gov.za

Table 4: Co-ordinate localities of protected species observed within the Skuitdrift 2 Solar PV Energy Facility area. Please note that only approximately 3 x *Acacia erioloba, 11* x *Hoodia gordonii,* 3 x *Aloe dichotoma* and 11 x *Boscia foetida* were noted within the layout.

Id	Species	Lat	Long
1	*Aloe dichotoma*	-28.6097	19.76708
2	*Hoodia gordonii*	-28.6105	19.76511
3	*Aloe dichotoma*	-28.611	19.76517
4	*Aloe dichotoma*	-28.6101	19.7675
5	*Hoodia gordonii*	-28.6087	19.76586
6	*Hoodia gordonii*	-28.6091	19.76681
7	*Hoodia gordonii*	-28.6094	19.76743
8	*Aloe dichotoma*	-28.6063	19.76586
9	*Acacia erioloba*	-28.6066	19.76521
10	*Hoodia gordonii*	-28.6096	19.76698
11	*Acacia erioloba*	-28.605	19.76705
12	*Hoodia gordonii*	-28.6096	19.76699
13	*Acacia erioloba*	-28.606	19.76895
14	*Hoodia gordonii*	-28.6147	19.76285
15	*Acacia erioloba*	-28.6065	19.76961
16	*Hoodia gordonii*	-28.6153	19.76341
17	*Acacia erioloba*	-28.6066	19.77073
18	*Acacia erioloba*	-28.6064	19.77102
19	*Acacia erioloba*	-28.6062	19.77132
20	*Acacia erioloba*	-28.606	19.77062
21	*Acacia erioloba*	-28.6054	19.76916
22	*Acacia erioloba*	-28.6044	19.76716
23	*Acacia erioloba*	-28.6044	19.76677
24	*Acacia erioloba*	-28.6041	19.76591
25	*Acacia erioloba*	-28.6034	19.7653
26	*Acacia erioloba*	-28.6024	19.76441
27	*Acacia erioloba*	-28.6024	19.76365
28	*Acacia erioloba*	-28.6049	19.76381
29	*Acacia erioloba*	-28.6051	19.76386
30	*Acacia erioloba*	-28.6061	19.76468
31	*Acacia erioloba*	-28.6077	19.77318
32	*Acacia erioloba*	-28.6078	19.77263
33	*Acacia erioloba*	-28.6088	19.77309
34	*Acacia erioloba*	-28.6107	19.77263
35	*Acacia erioloba*	-28.6119	19.76605
36	*Acacia erioloba*	-28.6118	19.76368
37	*Acacia erioloba*	-28.6086	19.76355
38	*Acacia erioloba*	-28.6058	19.75473
39	*Acacia erioloba*	-28.6099	19.76891
40	*Acacia erioloba*	-28.6036	19.75654

16. PHOTOS AND DESCRIPTION OF ALIEN PLANT SPECIES ON SITE

16.1 *Prosopis Glandulosa*

Category 1
Medium to large tree with pinnate leaves and usually thorny. Usually associated with drainage lines but may grow anywhere. Occasional at the site but can increase rapidly as a result of disturbance.

When cut down the tree resprouts, so herbicides are usually needed in combination with cutting. The appropriate techniques and herbicides can be obtained from the DAFF website.

Figure 13: *Prosopis glandulosa*

16.2 *Argemone Ochroleuca*

White – flowered Mexican poppy. Category 1.

Figure 14 and 15: *Argemone ochroleuca*

16.3 *Salsola Kali*

Tumbleweed, Tolbos. Not Listed.

Figures 16 and 17: *Salsola kali*

APPENDIX A:
CURRICULUM VITAE

savannah environmental

1st Floor, Block 2, 5 Woodlands Drive Office Park
Woodlands Drive, Woodmead
Johannesburg, South Africa

Email: joanne@savannahsa.com
Tel: +27 (11) 656 3237

CURRICULUM VITAE OF JO-ANNE THOMAS

Profession:	Environmental Management and Compliance Consultant; Environmental Assessment Practitioner
Specialisation:	Environmental Management; Strategic environmental advice; Environmental compliance advice & monitoring; Environmental Impact Assessments; Policy, strategy & guideline formulation; Project Management; General Ecology
Work experience:	Twenty one (21) years in the environmental field

VOCATIONAL EXPERIENCE

Provide technical input for projects in the environmental management field, specialising in Strategic Environmental Advice, Environmental Impact Assessment studies, environmental auditing and monitoring, environmental permitting, public participation, Environmental Management Plans and Programmes, environmental policy, strategy and guideline formulation, and integrated environmental management. Key focus on integration of the specialist environmental studies and findings into larger engineering-based projects, strategic assessment, and providing practical and achievable environmental management solutions and mitigation measures. Responsibilities for environmental studies include project management (including client and authority liaison and management of specialist teams); review and manipulation of data; identification and assessment of potential negative environmental impacts and benefits; review of specialist studies; and the identification of mitigation measures. Compilation of the reports for environmental studies is in accordance with all relevant environmental legislation.

Undertaking of numerous environmental management studies has resulted in a good working knowledge of environmental legislation and policy requirements. Recent projects have been undertaken for both the public- and private-sector, including compliance advice and monitoring, electricity generation and transmission projects, various types of linear developments (such as National Road, local roads and power lines), waste management projects (landfills), mining rights and permits, policy, strategy and guideline development, as well as general environmental planning, development and management.

SKILLS BASE AND CORE COMPETENCIES

- Project management for a range of projects
- Identification and assessment of potential negative environmental impacts and benefits through the review and manipulation of data and specialist studies
- Identification of practical and achievable mitigation and management measures and the development of appropriate management plans
- Compilation of environmental reports in accordance with relevant environmental legislative requirements
- External and peer review of environmental reports & compliance advice and monitoring
- Formulation of environmental policies, strategies and guidelines
- Strategic and regional assessments; pre-feasibility & site selection
- Public participation processes for a variety of projects
- Strategic environmental advice to a wide variety of clients both in the public and private sectors
- Working knowledge of environmental planning processes, policies, regulatory frameworks and legislation

EDUCATION AND PROFESSIONAL STATUS

Degrees:

- B.Sc Earth Sciences, University of the Witwatersrand, Johannesburg (1993)
- B.Sc Honours in Botany, University of the Witwatersrand, Johannesburg (1994)
- M.Sc in Botany, University of the Witwatersrand, Johannesburg (1996)

Short Courses:

- Environmental Impact Assessment, Potchefstroom University (1998)
- Environmental Law, Morgan University (2001)
- Environmental Legislation, IMBEWU (2017)
- Mining Legislation, Cameron Cross & Associates (2013)
- Environmental and Social Risk Management (ESRM), International Finance Corporation (2018)

Professional Society Affiliations:

- Registered with the South African Council for Natural Scientific Professions as a Professional Natural Scientist: Environmental Scientist (400024/00)
- Registered with the International Associated for Impact Assessment South Africa (IAIAsa): 5601
- Member of the South African Wind Energy Association (SAWEA)

EMPLOYMENT

Date	Company	Roles and Responsibilities
2006 - Current	Savannah Environmental (Pty) Ltd	Director Project manager Independent specialist environmental consultant, Environmental Assessment Practitioner (EAP) and advisor.
1997 – 2005	Bohlweki Environmental (Pty) Ltd	Senior Environmental Scientist at. Environmental Management and Project Management
January – July 1997	Sutherland High School, Pretoria	Junior Science Teacher

PROJECT EXPERIENCE

Project experience includes large infrastructure projects, providing technical input for projects in the environmental management field, specialising in Strategic Environmental Advice, Environmental Impact Assessment studies, environmental permitting, Public Participation, Environmental Management Plans (EMPs) and Programmes (EMPrs), environmental policy, strategy and guideline formulation, and integrated environmental management; with a key focus on strategic assessment, and providing practical and achievable environmental management solutions and mitigation measures.

RENEWABLE POWER GENERATION PROJECTS: PHOTOVOLTAIC SOLAR ENERGY FACILITIES

Environmental Compliance, Auditing and ECO

Project Name & Location	Client Name	Role
ECO and bi-monthly auditing for the construction of the Adams Solar PV Project Two South of Hotazel, Northern Cape	Enel Green Power	Project Manager
ECO for the construction of the Kathu PV Facility, Northern Cape	REISA	Project Manager
ECO and bi-monthly auditing for the construction of the Pulida PV Facility, Free State	Enel Green Power	Project Manager

Project Name & Location	Client Name	Role
ECO for the construction of the RustMo1 SEF, North West	Momentous Energy	Project Manager
ECO for the construction of the Sishen SEF, Northern Cape	Windfall 59 Properties	Project Manager
ECO for the construction of the Upington Airport PV Facility, Northern Cape	Sublanary Trading	Project Manager
Quarterly compliance monitoring of compliance with all environmental licenses for the operation activities at the Kathu PV facility, Northern Cape	REISA	Project Manager
ECO for the construction of the Konkoonsies II PV SEF and associated infrastructure, Northern Cape	BioTherm Energy	Project Manager
ECO for the construction of the Aggeneys PV SEF and associated infrastructure, Northern Cape	BioTherm Energy	Project Manager

Compliance Advice and ESAP Reporting

Project Name & Location	Client Name	Role
Aggeneys Solar Farm, Northern Cape	BioTherm Energy	Environmental Advisor
Airies II PV Facility SW of Kenhardt, Northern Cape	BioTherm Energy	Environmental Advisor
Kalahari SEF Phase II in Kathu, Northern Cape	Engie	Environmental Advisor
Kathu PV Facility, Northern Cape	Building Energy	Environmental Advisor
Kenhardt PV Facility, Northern Cape	BioTherm Energy	Environmental Advisor
Kleinbegin PV SEF West of Groblershoop, Northern Cape	MedEnergy	Environmental Advisor
Konkoonises II SEF near Pofadder, Northern Cape	BioTherm Energy	Environmental Advisor
Konkoonsies Solar Farm, Northern Cape	BioTherm Energy	Environmental Advisor
Lephalale SEF, Limpopo	Exxaro	Environmental Advisor
Pixley ka Seme PV Park, South-East of De Aar, Northern Cape	African Clean Energy Developments (ACED)	Environmental Advisor
RustMo1 PV Plant near Buffelspoort, North West	Momentous Energy	Environmental Advisor
Scuitdrift 1 SEF & Scuitdrift 2 SEF, Limpopo	Building Energy	Environmental Advisor
Sirius PV Plants, Northern Cape	Aurora Power Solutions	Environmental Advisor
Upington Airport PV Power Project, Northern Cape	Sublunary Trading	Environmental Advisor
Upington SEF, Northern Cape	Abengoa Solar	Environmental Advisor
Ofir-ZX PV SEF near Keimoes, Northern Cape	Networx S28 Energy	Environmental Advisor

Due Diligence Reporting

Project Name & Location	Client Name	Role
5 PV SEF projects in Lephalale, Limpopo	iNca Energy	Environmental Advisor
Prieska PV Plant, Northern Cape	SunEdison Energy India	Environmental Advisor
Sirius Phase One PV Facility near Upington, Northern Cape	Aurora Power Solutions	Environmental Advisor

RENEWABLE POWER GENERATION PROJECTS: CONCENTRATED SOLAR FACILITIES (CSP)

Environmental Compliance, Auditing and ECO

Project Name & Location	Client Name	Role
ECO for the construction of the !Khi CSP Facility, Northern Cape	Abengoa Solar	Project Manager
ECO for the construction of the Ilanga CSP 1 Facility near Upington, Northern Cape	Karoshoek Solar One	Project Manager

Project Name & Location	Client Name	Role
ECO for the construction of the folar Park, Northern Cape	Kathu Solar	Project Manager
ECO for the construction of the KaXu! CSP Facility, Northern Cape	Abengoa Solar	Project Manager
Internal audit of compliance with the conditions of the IWUL issued to the Karoshoek Solar One CSP Facility, Northern Cape	Karoshoek Solar One	Project Manager

Compliance Advice and ESAP reporting

Project Name & Location	Client Name	Role
Ilanga CSP Facility near Upington, Northern Cape	Ilangethu Energy	Environmental Advisor
Ilangalethu CSP 2, Northern Cape	FG Emvelo	Environmental Advisor
Kathu CSP Facility, Northern Cape	GDF Suez	Environmental Advisor
Lephalale SEF, Limpopo	Cennergi	Environmental Advisor
Solis I CSP Facility, Northern Cape	Brightsource	Environmental Advisor

RENEWABLE POWER GENERATION PROJECTS: WIND ENERGY FACILITIES

Environmental Compliance, Auditing and ECO

Project Name & Location	Client Name	Role
ECO for the construction of the West Coast One WEF, Western Cape	Aurora Wind Power	Project Manager
ECO for the construction of the Gouda WEF, Western Cape	Blue Falcon	Project Manager
EO for the Dassiesklip Wind Energy Facility, Western Cape	Group 5	Project Manager
Quarterly compliance monitoring of compliance with all environmental licenses for the operation activities at the Gouda Wind Energy facility near Gouda, Western Cape	Blue Falcon	Project Manager
Annual auditing of compliance with all environmental licenses for the operation activities at the West Coast One Wind Energy facility near Vredenburg, Western Cape	Aurora Wind Power	Project Manager
External environmental and social audit for the Amakhala Wind Farm, Eastern Cape	Cennergi	Project Manager
External environmental and social audit for the Tsitsikamma Wind Farm, Eastern Cape	Cennergi	Project Manager
ECO for the construction of the Excelsior Wind Farm and associated infrastructure, Northern Cape	BioTherm Energy	Project Manager
External compliance audit of the Dassiesklip Wind Energy Facility, Western Cape	BioTherm Energy	Project Manager

Compliance Advice

Project Name & Location	Client Name	Role
Amakhala Phase 1 WEF, Eastern Cape	Cennergi	Environmental Advisor
Dassiesfontein WEF within the Overberg area, Western Cape	BioTherm Energy	Environmental Advisor
Excelsior Wind Farm, Western Cape	BioTherm Energy	Environmental Advisor

Great Karoo Wind Farm, Northern Cape	African Clean Energy Developments (ACED)	Environmental Advisor
Hopefield Community WEF, Western Cape	African Clean Energy Developments (ACED)	Environmental Advisor
Rheboksfontein WEF, Western Cape	Moyeng Energy	Environmental Advisor
Tiqua WEF, Western Cape	Cennergi	Environmental Advisor
Tsitsikamma WEF, Eastern Cape	Cennergi	Environmental Advisor
West Coast One WEF, Western Cape	Moyeng Energy	Environmental Advisor

Due Diligence Reporting

Project Name & Location	Client Name	Role
Witteberg WEF, Western Cape	EDPR Renewables	Environmental Advisor
IPD Vredenburg WEF within the Saldanha Bay area, Western Cape	IL&FS Energy Development Company	Environmental Advisor

CONVENTIONAL POWER GENERATION PROJECTS (COAL)

Environmental Compliance, Auditing and ECO

Project Name & Location	Client Name	Role
ECO for the Camden Power Station, Mpumalanga	Eskom Holdings	Project Manager

Compliance Advice

Project Name & Location	Client Name	Role
Thabametsi IPP Coal-fired Power Station, near Lephalale, Limpopo	Axia	Environmental Advisor

GRID INFRASTRUCTURE PROJECTS

Environmental Compliance, Auditing and ECO

Project Name & Location	Client Name	Role
ECO for the construction of the Ferrum-Mookodi Transmission Line, Northern Cape and North West	Trans-Africa Projects on behalf of Eskom	Project Manager
EO for the construction of the Gamma-Kappa Section A Transmission Line, Western Cape	Trans-Africa Projects on behalf of Eskom	Project Manager
EO for the construction of the Gamma-Kappa Section B Transmission Line, Western Cape	Trans-Africa Projects on behalf of Eskom	Project Manager
EO for the construction of the Hydra IPP Integration project, Northern Cape	Trans-Africa Projects on behalf of Eskom	Project Manager
EO for the construction of the Kappa-Sterrekus Section C Transmission Line, Western Cape	Trans-Africa Projects on behalf of Eskom	Project Manager
EO for the construction of the Namaqualand Strengthening project in Port Nolloth, Western Cape	Trans-Africa Projects on behalf of Eskom	Project Manager
ECO for the construction of the Neptune Substation Soil Erosion Mitigation Project, Eastern Cape	Eskom	Project Manager
ECO for the construction of the Ilanga-Gordonia 132kV power line, Northern Cape	Karoshoek Solar One	Project Manager

MINING SECTOR PROJECTS

Environmental Compliance, Auditing and ECO

Project Name & Location	Client Name	Role
ECO for the construction of the Duhva Mine Water Recovery Project, Mpumalanga	Eskom Holdings SoC Limited	Project Manager
External compliance audit of Palesa Coal Mine's Integrated Water Use License (IWUL), near KwaMhlanga, Mpumalanga	HCI Coal	Project Manager
External compliance audit of Palesa Coal Mine's Waste Management License (WML) and EMP, near KwaMhlanga, Mpumalanga	HCI Coal	Project Manager
External compliance audit of Mbali Coal Mine's Integrated Water Use License (IWUL), near Ogies, Mpumalanga	HCI Coal	Project Manager
Independent External Compliance Audit of Water Use License (WUL) for the Tronox Namakwa Sands (TNS) Mining Operations (Brand se Baai), Western Cape	Tronox Namakwa Sands	Project Manager
Independent External Compliance Audit of Water Use License (WUL) for the Tronox Namakwa Sands (TNS) Mineral Separation Plant (MSP), Western Cape	Tronox Namakwa Sands	Project Manager
Independent External Compliance Audit of Water Use License (WUL) for the Tronox Namakwa Sands (TNS) Smelter Operations (Saldanha), Western Cape	Tronox Namakwa Sands	Project Manager
Compliance Auditing of the Waste Management Licence for the PetroSA Landfill Site at the GTL Refinery, Western Cape	PetroSA	Project Manager

INFRASTRUCTURE DEVELOPMENT PROJECTS (BRIDGES, PIPELINES, ROADS, WATER RESOURCES, STORAGE, ETC)

Environmental Compliance, Auditing and ECO

Project Name & Location	Client Name	Role
ECO and bi-monthly auditing for the construction of the Olifants River Water Resources Development Project (ORWRDP) Phase 2A: De Hoop Dam, R555 realignment and housing infrastructure	Department of Water and Sanitation	Project Manager Auditor
ECO for the Rehabilitation of the Blaaupan & Storm Water Channel, Gauteng	Airports Company of South Africa (ACSA)	Project Manager
Due Diligence reporting for the Better Fuel Pyrolysis Facility, Gauteng	Better Fuels	Project Manager
ECO for the Construction of the Water Pipeline from Kendal Power Station to Kendal Pump Station, Mpumalanga	Transnet	Project Manager
ECO for the Replacement of Low-Level Bridge, Demolition and Removal of Artificial Pong, and Reinforcement the Banks of the Crocodile River at the Construction at Walter Sisulu National Botanical Gardens, Gauteng Province	South African National Biodiversity Institute (SANBI)	Project Manager
External Compliance Audit of the Air Emission Licence (AEL) for a depot in Bloemfontein, Free State Province and in Tzaneen, Mpumalanga Province	PetroSA	Project Manager

HOUSING AND URBAN PROJECTS

Compliance Advice and reporting

Project Name & Location	Client Name	Role
Kampi ya Thude at the Olifants West Game Reserve, Limpopo	Nick Elliot	Environmental Advisor
External Compliance Audit of WUL for the Johannesburg Country Club, Gauteng	Johannesburg Country Club	Project Manager

Environmental Compliance, Auditing and ECO

Project Name & Location	Client Name	Role
Due Diligence Audit for the Due Diligence Audit Report, Gauteng	Delta BEC (on behalf of Johannesburg Development Agency (JDA))	Project Manager

1st Floor, Block 2, 5 Woodlands Drive Office Park
Woodlands Drive, Woodmead
Johannesburg, South Africa

Email: lisa.o@savannahsa.com
Tel: +27 (11) 656 3237

CURRICULUM VITAE OF LISA OPPERMAN

Profession : Environmental Assessment Practitioner and GIS Consultant

Specialisation: Environmental Impact Assessments, Basic Assessments, Site Screening and Site Selection reporting, compilation of maps through the use of ArcGIS

Work Experience: 3 years of experience in the environmental management and GIS field

VOCATIONAL EXPERIENCE

Lisa Opperman has three years of experience in the environmental field. She has worked on a variety of EIA processes including renewable energy projects, as well as industrial developments. She has also been involved in the undertaking of public participation for projects located in South Africa which has included the undertaking of public meetings, focus group meetings and key stakeholder meetings in both Afrikaans and English. She also has experience in working with ArcGIS 10 for the compilation of maps, the manipulation of data and screening for environmental sensitivities within areas with the potential for development.

SKILLS BASE AND CORE COMPETENCIES

- GIS Mapping
- EIA Report Writing
- Conducting of public involvement processes
- Administrative tasks
- Analysis and manipulation of geographical information and technical experience with the use of ArcGIS

EDUCATION AND PROFESSIONAL STATUS

Degrees:

- B.Sc. (Hons) Environmental Management (2014), North-West University, Potchefstroom
- B.A Psychology, Geography and Environmental Studies (2013), North-West University, Potchefstroom

Courses:

- Environmental Legal Compliance and Auditing (2017), Janice Tooley at the Protea Hotel OR Thambo, Johannesburg

EMPLOYMENT

Date	Company	Roles and Responsibilities
February 2015 – current	Savannah Environmental (Pty) Ltd	Environmental Assessment Practitioner and GIS Consultant *Tasks include: Compilation of Environmental Scoping Reports, Plan of Study, Environmental Impact Assessment Reports, Basic Assessments and Environmental management programmes; Environmental Screening Reports; Specialist management; project proposals and tenders; Client liaison and Marketing; Process EIA Applications, GIS Mapping and data analysis and manipulation*

PROJECT EXPERIENCE

Renewable Power Generation Projects: Solar Energy Facilities

Screening Studies

Project Name & Location	*Client Name*	*Role*
Pre-feasibility Desktop Screening and Fatal Flaw Scan for a Solar PV Project near Lichtenburg, North West Province	*ABO Wind AG*	*EAP and GIS Consultant*

Environmental Impact Assessments and Environmental Management Programmes

Project Name & Location	*Client Name*	*Role*
Buffels PV 1 & Buffels PV 2 Solar Energy Facilities near Orkney, North West	*Kabi Solar*	*EAP and GIS Consultant*
Woodhouse Solar 1 & Woodhouse Solar 2 PV Facilities near Vryburg, North West	*Genesis Eco-Energy Developments*	*EAP and GIS Consultant*
Orkney Solar Farm, North West	*Genesis Eco-Energy Developments*	*EAP and GIS Consultant*
Tewa Isitha Solar 1 & Tewa Isitha Solar 2 PV facilities near Upington, Northern Cape	*AfriCoast Energy*	*EAP and GIS Consultant*

Basic Assessments

Project Name & Location	*Client Name*	*Role*
Harmony Gold 3x PV Facilities, Welkom, Free State	*BBEntropie*	*EAP and GIS Consultant*

Renewable power generation projects: Wind Energy Facilities

Screening Studies

Project Name & Location	*Client Name*	*Role*
Juno Wind Farm Screening Assessment Report near Lamberts Bay, Western Cape Province	*AMDA Developments*	*EAP and GIS Consultant*

Lamberts Bay Wind Farm Screening Assessment Report near Lamberts Bay, Western Cape Province	*Windy World*	*EAP and GIS Consultant*
Pre-feasibility Desktop Screening and Fatal Flaw Scan for the Kudusberg and Rondekop Wind Energy Facilities, Northern Cape and Western Cape Provinces	*ABO Wind AG*	*EAP and GIS Consultant*

Environmental Impact Assessments and Environmental Management Programmes

Project Name & Location	***Client Name***	***Role***
Boulders Wind Farm, Western Cape Province	*Vredenburg Windfarm*	*EAP and GIS Consultant*
Namas Wind Farm, Northern Cape Province	*Genesis Namas Wind (Pty) Ltd*	*EAP and GIS Consultant*
Zonnequa Wind Farm, Northern Cape Province	*Genesis Zonnequa Wind (Pty) Ltd*	*EAP and GIS Consultant*

Grid Infrastructure Projects

Basic Assessments

Project Name & Location	***Client Name***	***Role***
132/11kV Olifantshoek Substation and Power Line, Northern Cape	*Eskom*	*EAP and GIS Consultant*

Gas Projects

Environmental Impact Assessments and Environmental Management Programmes

Project Name & Location	***Client Name***	***Role***
Richards Bay Combined Cycle Power Plant (CCPP) power plant, KwaZulu-Natal	*Eskom*	*EAP and GIS Consultant*

Basic Assessments

Project Name & Location	***Client Name***	***Role***
Neopak Combined Heat and Power (CHP) Plant, Rosslyn, Gauteng	*Neopak*	*EAP, Public Participation and GIS Consultant*

Screening Studies

Project Name & Location	***Client Name***	***Role***
Richards Bay Combined Cycle Power Plant (CCPP) power plant, near Richards Bay, KwaZulu-Natal	*Eskom*	*EAP and GIS Consultant*

Infrastructure Development Projects (bridges, pipelines, roads, etc)

Basic Assessments

Project Name & Location	***Client Name***	***Role***
Water Treatment Plant at the Neopak Facility, Rosslyn, Gauteng	*Neopak*	*EAP, Public Participation and GIS Consultant*

Housing and Urban Projects

Environmental Impact Assessments and Environmental Management Programmes

Project Name & Location	***Client Name***	***Role***

Metals Industrial Cluster near Kuruman, Northern Cape	*Northern Cape Department of Economic Development and Tourism*	*EAP and GIS Consultant*

Environmental Management Tools

Environmental Management Programmes

Project Name & Location	***Client Name***	***Role***
Environmental Management Programme (EMPr) for the Nxuba Wind Farm, Eastern Cape	*ACED*	*EAP*
Operation Environmental Management Programme (EMPr) for Phase 1 of the Amakhala Emoyeni Wind Energy Facility, Eastern Cape	*Cennergi*	*EAP*
Operation Environmental Management Programme (EMPr) for the Tsitsikamma Community Wind Energy Facility, Eastern Cape Province	*Cennergi*	*EAP*
Environmental Management Programme (EMPr) for the Skuitdrift 1 Solar PV Energy Facility near Augrabies, Northern Cape Province	*Building Energy South Africa*	*EAP and GIS Consultant*
Environmental Management Programme (EMPr) for the Skuitdrift 2 Solar PV Energy Facility near Augrabies, Northern Cape Province	*Building Energy South Africa*	*EAP and GIS Consultant*

APPENDIX B:
ECOLOGICAL WALK-THROUGH REPORT

Application for a permit for the removal of Protected Trees from the Skuitdrift 2 Solar PV Energy Facility, situated on farm Skuitdrif 426, near Augrabies, Northern Cape, South Africa.

Prepared by

Leigh-Ann de Wet

(M.Sc., Pri. Sci. Nat)

For

Savannah Environmental
(on behalf of Khoi-Sun Development (Pty) Ltd)

August 2017

LD Biodiversity Consulting

Biodiversity Assessments, Baseline surveys and Impact Assessments and Integrated Biodiversity Management Solutions.

leighann.dewet@gmail.com
083 352 1936

This report should be cited as:
L. de Wet (2017). Application for a permit for the removal of Protected Trees from the Skuitdrift 2 Solar PV Energy Facility, Northern Cape, South Africa. LD Biodiversity Consulting upon appointment by Savannah Environmental.

Appointment of Specialist
Leigh-Ann de Wet (LD Biodiversity Consulting) was commissioned by Savannah Environmental, on behalf of Khoi-Sun Development (Pty) Ltd, to undertake a site walk through to identify any Protected Trees occurring within the development footprint and to provide the required information for the permitting process.

Details of Specialist
Leigh-Ann de Wet
LD Biodiversity Consulting

Telephone: 083 352 1936
e-mail: leighann.dewet@gmail.com

Expertise of the specialist (see Appendix 1 for CV)

- M.Sc. in Botany from Rhodes University.
- Registered Professional Natural Scientist with the South African Council for Natural Scientific Professionals (Ecological Science).
- Registered with RSPO as a certified High Conservation Value Assessor (Plants), since 2011.
- Founded LD Biodiversity Consulting in 2014.
- Ecological Consultant since 2009.
- Conducted, or have been involved in over 100 Ecological Impact Assessments, Baseline surveys, Biodiversity Action Plans and Offset Plans throughout Africa.
- Published four scientific papers, two popular articles and have three scientific papers in preparation.
- Presented 7 international conference presentations, and at two Botanical Society meetings.
- Lectured methods for specialist assessment for the Rhodes University short course on EIA.

Independence
Leigh-Ann de Wet and LD Biodiversity Consulting have no connection with Khoi-Sun Development (Pty) Ltd, and LD Biodiversity Consulting is not a subsidiary of any kind of Khoi-Sun Development. The remuneration for services by Savannah Environmental in relation to this report and associated studies is unrelated to approval by decision-making authorities responsible for authorization of any Khoi-Sun Development (Pty) Ltd activity. LD Biodiversity Consulting has no interest in secondary developments as a result of this project.

Table of Contents

List of Figures

List of Tables

1 Introduction

1.1 Development description

Khoi-Sun Development (Pty) Ltd is developing a solar energy facility on the farm Skuitdrif 426 in the Northern Cape Province, approximately 50km north west of Augrabies and 68km north east of Pofadder. The development footprint is approximately 20ha in extent, and infrastructure including access roads, a substation and a transmission line is also planned. An Environmental Impact Assessment process was conducted on 2013 and the development was approved.

1.2 Site description

The vegetation of the site was determined by Todd (2013: Ecological Specialist Report) as comprising four plant communities. These plant communities include:

- Drainage lines and washes
- Rocky outcrops
- Sandy plains
- Rocky plains

A detailed description of each community type is given in the specialist report. In the footprint of the development surveyed as part of the permitting process, three of these community types were observed, namely; drainage lines and washes, rocky plains and sandy plains. Importantly, trees are located primarily within the drainage lines and washes and include the species *Acacia erioloba, Boscia foetida* and *Acacia mellifera*.

Site sensitivity was primarily medium, with the washes forming areas of high sensitivity and rocky outcrops forming very high sensitivity zones. Should the areas of high sensitivity be avoided, the destruction of *Acacia erioloba* individuals can be avoided. Sensitivity of the full site area is indicated in Figure 1.1.

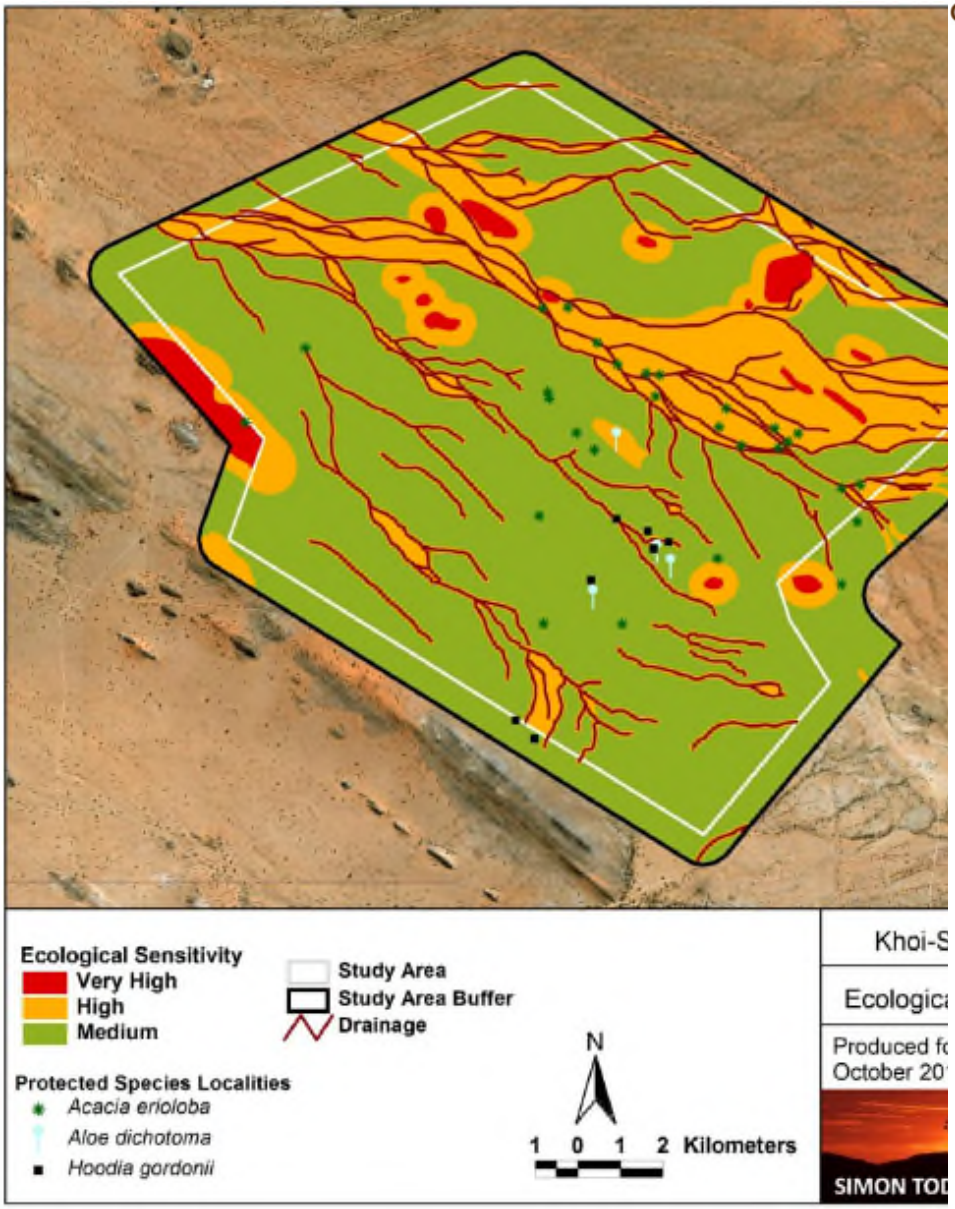


Figure 1.1: Sensitivity map of the Skuitdrift 2 Solar PV Energy Facility, as determined by the Ecological Specialist Report (Todd, 2016).

1.3 Flora Species Occurring on Site

Dominant species include trees in the washes (*Acacia erioloba, Acacia mellifera* and *Boscia foetida* along with *Phaeoptilum spinosum*), with dominant species in the sandy plains being *Stipagrostis uniplumis*, *S. ciliata*, *Schmidtia kalahariensis*, *Rhigozum trichotomum, Phaeoptilum spinosum* and *Lyciium pumilum*. Rocky plains serve as host to *Microlema incanum, Hermannia spinescens, Asparagus deudatus, Hoodia gordonii* and *Aloe dichotoma*.

One Protected Tree species was found on site: *Acacia erioloba* (Camel Thorn).

Two other species (not Protected Trees, but protected under other legislation). protected under legislation were located on site and included *Aloe dichotoma* (Quiver Tree) and *Hoodia gordonii* (Bokhorings), listed on Schedule 1 (Specially Protected Species) on the Northern Cape Nature Conservation Act no. 9 of 2009. *Hoodia gordonii* is also listed as a Protected Species on the National Environmental Management: Biodiversity Act (Act 10 of 2004) under the Threatened or Protected Species (TOPS) regulations.

A full species list is presented in Appendix 2.

1.4 Information sources

- The information included in this report as to location and descriptions of *Acacia erioloba* individuals at the Skuitdrift 2 Solar PV Energy Facility is taken from the Ecological Specialist Report with field work conducted on the 29th February 2012 (Todd, 2013) in addition to a site walk through conducted by Leigh-Ann de Wet on the 8th of August 2017.

2 Methodology

The site is flat and open, which makes it relatively easy to locate tall trees. In order to locate all *Acacia erioloba* individuals, the site was traversed on foot in transects 100 metres apart. Rocky plains were particularly well covered; when these were encountered smaller transects of 5m were walked. GPS locations for each tree were recorded. *Acacia erioloba* trees located close to the footprint were also recorded.

3 Results

There are few *Acacia erioloba* trees on site, all of which are located within washes. These wash areas have been given a high sensitivity in the Ecological Specialist Report (Todd, 2013). All the *Acacia erioloba* trees encountered (three) are relatively small, three (3) metres or less in height with a narrow crown. Encountered trees were otherwise healthy. All GPS points are listed in Table 3.1. Figure 3.1 indicates the position of each of the trees on site.

Table 3.1: GPS locations of each *Acacia erioloba* located on the Skuitdrift 2 Solar PV Energy Facility

Number	Lat	Long
1	-28.611900°	19.766050°
2	-28.611800°	19.763680°
3	-28.608600°	19.763550°

Figure 3.1: Location of all *Acacia erioloba* trees on the Skuitdrift 2 Solar PV Energy Facility in relation to the development footprint.

4 APPENDIX 1: Specialist CV

6 Beach Road	**Leigh-Ann de Wet**	leigh-
Noordhoek	**MSc | Pri. Sci. Nat.**	ann@ldbiodiversity.co.za
Cape Town	**Biodiversity Specialist**	083 352 1936

Profile

A biodiversity specialist with a history in botanical research, biodiversity assessments and associated planning in developing countries. Possesses experience in classification of ecosystems and development of management and monitoring plans for a variety of ecosystems from the spiny thicket of Madagascar to the Rainforests of West and Central Africa. Experience also includes Biodiversity Assessments (comprising classification and mapping of ecosystems and habitats) of ecosystems and vegetation types throughout Southern Africa including grasslands, forests, thicket, bushveld and fynbos with associated conservation and management recommendations.

Key Expertise

Ecological research methodology development	Report and paper writing
Ecological research	Synthesis of specialist work into integrated assessments
Habitat and vegetation mapping	Ecological statistics
Habitat and vegetation classification	Environmental Management and Monitoring

Education

2005 - 2007	**MSc** in Botany – Rhodes University
2005	**BSc Honours** in Botany (with Distinction) – Rhodes University
2001 - 2004	**BSc** (Botany and Entomology) – Rhodes University

Courses

2013	Wetland Management: Introduction to Law – University of the Free State
2013	Wetland Management: Introduction and Delineation Short Course – University of the Free State
2011	Land Degradation Short Course – Rhodes University
2009	EIA Short Course – Rhodes University and Coastal and Environmental Services

Membership

2012 – Present	Professional Natural Scientist with SACNASP: Ecological Science (No. 400233/12)
2012 – Present	High Conservation Value Assessor (plants) with the Round Table of Sustainable Biofuels.
2013 – Present	South African Association of Botanists

2013 – Present Botanical Society of South Africa
2013 – Present Wildlife and Environment Society of South Africa
2013 Grasslands Society of Southern Africa

Professional experience

2014 - Current Owner of LD Biodiversity Consulting – Biodiversity Specialist
Started own company (Sole Proprietor) to focus on Ecological Assessments including baseline assessments (habitat and ecosystem classification) as well as Management and Monitoring for large projects. Responsibilities include:

- Ecological Surveys including Baseline Assessments, Biodiversity Management and Monitoring Plans and Spatial Planning for biodiversity goals to meet international standards
- Offset design
- Strategic Environmental Planning
- Mapping (QGIS)
- Research
- Financial Management

2012 - 2014 Digby Wells Environmental – Unity Manager: Biophysical
Management of the Biophysical Department, specifically Flora and Fauna although included the overseeing and review of both Freshwater Ecology and Wetlands as well.
Responsibilities included:

- Conducting and management of Ecological Baseline and Impact Assessments to meet international standards
- Biodiversity Management and Monitoring Plans
- Management of a team of between four and seven colleagues and specialists

2009 – 2012 Coastal and Environmental Services – Senior Environmental Consultant and Ecological Specialist
Ecological specialist responsible for conducting ecological assessments including baseline and impact assessments for Fauna and Flora. Later in this time for overseeing junior ecologists and training. Key responsibilities included:

- Conducting Ecological Baseline and Impact Assessments to international standards
- Strategic environmental planning
- Managing teams of specialists
- Mapping (Arc)
- Research

2007 - 2009 Rhodes University (South Africa) and Sheffield University (England) – NERC Research Assistant
Design and conducting of a large common or garden experiment looking at the effects of global climate change on grassland composition. Key responsibilities included:

- Experimental design

- Experiment implementation
- Data analyses

Awards

2005	Best Young Botanist second prize for a presentation entitled: "Population biology and effects of harvesting on *Pelargonoium reniforme* (Geraniaceae) in Grahamstown and surrounding areas" at the SAAB conference. Dean's list, Academic Colours, Masters Scholarship.
2004	Putterill Prize for conservation in the Eastern Cape, Dean's list, Academic Half Colours, Honours Scholarship.
2001 - 2003	Dean's List

Publications

de Wet, L., Downsborough, L., Reimers, B., and Weah, C. (in prep). Traditional ecological knowledge and social survey as a proxy for large mammal scientific survey in Liberia.

de Wet, L., Downsborough, L., Reimers, B., and Weah, C (in prep). Traditional ecological knowledge and presence of large mammals in Liberia: a case study.

de Wet, L., and Downsborough, L. (in prep). A case for using traditional knowledge for community managed multiple use conservation areas in Liberia.

Taylor, S, Ripley, B, Martin, T, **de Wet, L,** Woodward, I and Osborne, C (2014.) Physiological advantages of C4 grasses in the field: a comparative experiment demonstrating the importance of drought. Global Change Biology – in Press.

Ripley BS, **de Wet, L** and Hill MP (2008). Herbivory-induced reduction in photosynthetic productivity of water hyacinth, *Eichhornia crassipes* (Martius) Solms-Laubach (Pontederiaceae), is not directly related to reduction in photosynthetic leaf area. African Entomology 16(1): 140-142.

de Wet LR, Barker NP and Peter CI (2008). The long and the short of gene flow and reproductive isolation: Inter-Simple Sequence Repeat (ISSR) markers support the recognition of two floral forms in *Pelargonium reniforme* (Geraniaceae). Biochemical Systematics and Ecology 36: 684-690.

de Wet L, NP Barker and CI Peter (2006). Beetles and Bobartia: an interesting herbivore-plant relationship. Veld & flora. September: 150 – 151.

de Wet LR and Botha CEJ (2007). Resistance or tolerance: An examination of aphid (*Sitobion yakini*) phloem feeding on Betta and Betta-Dn wheat (*Triticum aestivum* L.). South African Journal of Botany 73(1): 35-39.

de Wet L (2005). Is *Pelargonium reniforme* in danger? The effects of harvesting on

Pelargonium reniforme. Veld & Flora. December: 182-184.

Presentations

2013 **LR de Wet** – Biodiversity Actions Plans for existing mines: Making them Work for Grassland Conservation - Grassland Society of Southern Africa Congress, Limpopo

2011 **LR de Wet** - Finding Ecological Benefits of Windfarms – Thicket Forum, Grahamstown

2010 Lubke, RA, N Davenport, **LR de Wet** and C Fordham – The ecology and distribution of endorheic pans in the subtropical thicket vegetation near Port Elizabeth, Eastern Cape, South Africa – International Association for Vegetation Science, 53rd Annual Symposium, Ensenada, Mexico.

2006 **LR de Wet,** Barker, N and Peter, C – Pollinator-mediated selection in *Pelargonium reniforme* as described by Inter Simple Sequence Repeat markers. – South African Association of Botanists (SAAB) conference.

2006 **LR de Wet**, Barker, N and Peter, C– Pollinator-mediated selection of *Pelargonium reniforme* and two floral morphs described by inter simple sequence repeat markers – Southern African Society for Systematic Biology (SASSB) conference.

2005 **LR de Wet** and Vetter, S – Population biology and effects of harvesting on *Pelargonium reniforme* (Geraniaceae) in Grahamstown and surrounding areas, Eastern Cape, South Africa – South African Association of Botanists (SAAB) conference.

2005 **LR de Wet** and Vetter, S – Harvesting of *Pelargonium reniforme* in Grahamstown; what are the implications for populations of the plant? – Thicket Forum

2005 **LR de Wet** – Harvesting of *Pelargonium reniforme* in Grahamstown; what are the implications for populations of the plant? – Annual general meeting. Botanical Society of South Africa, Albany Branch.

2004 **LR de Wet** – Population biology of *Pelargonium reniforme* – Annual general meeting. Botanical Society of South Africa, Albany Branch.

5 APPENDIX 2: Species List for the site

This species list has been generated from the Ecological Specialist Report (Todd, 2013) for the site and includes all species recorded from the study site.

Acacia erioloba
Acacia mellifera
Aloe dichotoma
Asparagus denudatus
Boscia foetida
Chascanum garipense
Coccinia rehmannii
Commiphora gracilifrondosa
Commiphora namaensis
Cucumis africanus
Enneapogon scaber
Hermannia minutiflora
Hermannia spinescens
Hermannia stricta
Hibiscus elliottiae
Hibiscus engleri
Hoodia gordonii
Kissenia capensis
Leucophyrys mesocoma
Lycium pumilum
Microloma incanum
Monechma spartioides
Parkinsonia africana
Pergularia daemia
Petalidium lucens
Phaeoptilum spinosum
Rhigozum trichotomum
Rogeria longiflora
Salsola rabieana
Schmidtia kalahariensis
Sisyndite spartea
Stipagrostis anomala
Stipagrostis brevifolia
Stipagrostis ciliata
Stipagrostis namaquensis
Stipagrostis uniplumis
Trichodesma africanum
Tricholaena capensis subsp *arenaria*
Zygophyllum rigidum

Application for a permit for the removal of two Schedule 1: Specially Protected Species and one Schedule 2: Protected Species from the Skuitdrift 2 Solar PV Energy Facility, situated on farm Skuitdrif 426, near Augrabies, Northern Cape, South Africa.

Prepared by

Leigh-Ann de Wet

(M.Sc., Pri. Sci. Nat)

For

Savannah Environmental

January 2018

LD Biodiversity Consulting

Biodiversity Assessments, Baseline surveys and Impact Assessments and Integrated Biodiversity Management Solutions.

leighann.dewet@gmail.com
083 352 1936

This report should be cited as:
L. de Wet (2017). Application for a permit for the removal of two Schedule 1: Specially Protected Species and one Schedule 2: Protected Species from the Skuitdrift 2 Solar PV Energy Facility, situated on farm Skuitdrif 426, near Augrabies, Northern Cape, South Africa. LD Biodiversity Consulting upon appointment by Savannah Environmental.

Appointment of Specialist
Leigh-Ann de Wet (LD Biodiversity Consulting) was commissioned by Savannah Environmental, on behalf of Khoi-Sun Development (Pty) Ltd, to undertake a site walk through to identify any Protected Species occurring within the development footprint and to provide the required information for the permitting process.

Details of Specialist
Leigh-Ann de Wet
LD Biodiversity Consulting

Telephone: 083 352 1936
e-mail: leighann.dewet@gmail.com

Expertise of the specialist (see Appendix 1 for CV)

- M.Sc. in Botany from Rhodes University.
- Registered Professional Natural Scientist with the South African Council for Natural Scientific Professionals (Ecological Science).
- Registered with RSPO as a certified High Conservation Value Assessor (Plants), since 2011.
- Founded LD Biodiversity Consulting in 2014.
- Ecological Consultant since 2009.
- Conducted, or have been involved in over 100 Ecological Impact Assessments, Baseline surveys, Biodiversity Action Plans and Offset Plans throughout Africa.
- Published four scientific papers, two popular articles and have three scientific papers in preparation.
- Presented 7 international conference presentations, and at two Botanical Society meetings.
- Lectured methods for specialist assessment for the Rhodes University short course on EIA.

Independence
Leigh-Ann de Wet and LD Biodiversity Consulting have no connection with Khoi-Sun Development (Pty) Ltd, and LD Biodiversity Consulting is not a subsidiary of any kind of Khoi-Sun Development (Pty) Ltd. The remuneration for services by Savannah Environmental in relation to this report and associated studies is unrelated to approval by decision-making authorities responsible for authorisation of any Khoi-Sun Development (Pty) Ltd activity. LD Biodiversity Consulting has no interest in secondary developments as a result of this project.

Table of Contents

List of Figures

List of Tables

1 Introduction

1.1 Development description

Khoi-Sun Development (Pty) Ltd is developing a solar energy facility on the farm Skuitdrif 426 in the Northern Cape Province, approximately 50km north west of Augrabies and 68km north east of Pofadder. The development footprint is approximately 20ha in extent, and infrastructure including a transmission line is also planned. An Environmental Impact Assessment was conducted in 2013 and the development was approved.

1.2 Site description

The vegetation of the site was determined by Todd (2013: Ecological Specialist Report) as comprising four plant communities. These plant communities include:

- Drainage lines and washes
- Rocky outcrops
- Sandy plains
- Rocky plains

A detailed description of each community type is given in the specialist report. In the footprint of the development surveyed as part of the permitting process, three of these community types were observed, namely; drainage lines and washes, rocky plains and sandy plains. Importantly, trees are located primarily within the drainage lines and washes and include the species *Acacia erioloba, Boscia foetida* and *Acacia mellifera*.

Site sensitivity was primarily medium, with the washes forming areas of high sensitivity and rocky outcrops forming very high sensitivity zones (Todd, 2013).

1.3 Flora Species Occurring on Site

Dominant species include trees in the washes (*Acacia erioloba, Acacia mellifera* and *Boscia foetida* along with *Phaeoptilum spinosum*), with dominant species in the sandy plains being *Stipagrostis uniplumis*, *S. ciliata*, *Schmidtia kalahariensis*, *Rhigozum trichotomum, Phaeoptilum spinosum* and *Lyciium pumilum*. Rocky plains serve as host to *Microlema incanum, Hermannia spinescens, Asparagus deudatus, Hoodia gordonii* and *Aloe dichotoma*.

One Protected Tree species was found on site: *Acacia erioloba* (Camel Thorn) for which a permit for destruction has been issued by DAFF. Three other species protected under legislation were located on site and included:

1. *Aloe dichotoma* (Quiver Tree) listed on Schedule 1 (Specially Protected Species) on the Northern Cape Nature Conservation Act no. 9 of 2009.

2. *Hoodia gordonii* (Bokhorings), listed on Schedule 1 (Specially Protected Species) on the Northern Cape Nature Conservation Act no. 9 of 2009. And listed as a Protected Species on the National Environmental Management: Biodiversity Act (Act 10 of 2004) under the Threatened or Protected Species (TOPS) regulations.

3. *Boscia foetida* (Shepperd's tree), listed on Schedule 2 (Protected Species) on the Northern Cape Nature Conservation Act no. 9 of 2009.

4. A full list of species found on site is presented in Appendix 2.

All individuals of both *Aloe dichotoma* and *Hoodia gordonii* will be translocated to an area outside of the development footprint (within 500m). *Boscia foetida* individuals are difficult to transplant successfully and will thus be destroyed during the construction of the development where they cannot be avoided.

1.4 Assumptions and limitations

- The information included in this report as to the location and descriptions of *Aloe dichotoma*, *Hoodia gordonii* and *Boscia foetida* individuals at the Skuitdrift 2 Solar PV Energy Facility is taken from the Ecological Specialist Report with field work conducted on the 29th February 2012 (Todd, 2013) in addition to a site walk through conducted by Leigh-Ann de Wet on the 8th of August 2017.

2 Methodology

In order to locate all *Aloe dichotoma* individuals, the site was traversed on foot in transects 100 metres apart. Rocky plains encountered smaller transects of 5m were walked to identify *Hoodia gordonii* individuals. GPS locations for each plant were recorded. *Aloe dichotoma* and *Hoodia gordonii* individuals located within 10m of the footprint were also recorded.

To locate all *Boscia foetida* individuals, the site was traversed on foot in transects 100 metres apart. GPS locations for each plant were recorded. *Boscia foetida* individuals located within 10m of the footprint were also recorded. It is likely that additional *Boscia foetida* species will be found on site as the transects may not have allowed for the recording of every single plant.

Discussions regarding the permitting of the Skuitdrift 2 Solar PV Energy Facility site were held via email. Correspondence in Appendix 3 refers.

It should be noted that when protected species are removed, each should be photographed by the ECO.

3 Results

3.1 Aloe dichotoma

There are three (3) *Aloe dichotoma* trees on site. Of these three (3) trees, two (2) are dead. The one (1) living tree is relatively small, being 1.5 metres tall with one trunk and no branches. All GPS points are listed in Table 3.1. Figure 3.1 indicates the position of each of the *Aloe dichotoma* trees on site.

Table 3.1: GPS locations of each *Aloe dichotoma* located on the Skuitdrift 2 Solar PV Energy Facility site:

Number	Lat	Long	Status
1	-28.607164°	19.761717°	Dead
2	-28.609728°	19.766420°	Dead
3	-28.610994°	19.765108°	Living

Figure 3.1: Location of all *Aloe dichotoma* trees on the Skuitdrift 2 Solar PV Energy Facility site in relation to the development footprint.

3.2 *Hoodia gordonii*

Eleven (11) *Hoodia gordonii* individuals were recorded on site and close to the site and related infrastructure. Of the eleven (11) individuals recorded, two (2) were dead. Figure 3.2 shows a living and dead *Hoodia gordonii* on the Skuitdrift 2 Solar PV Energy Facility site. All GPS points are listed in Table 3.2. Figure 3.3 indicates the position of each of the *Hoodia gordonii* on site.

Figure 3.2: A living and a dead *Hoodia gordonii* on the Skuitdrift 2 Solar PV Energy Facility site.

Table 3.2: GPS locations of each *Hoodia gordonii* located on the Skuitdrift 2 Solar PV Energy Facility site.

Number	Lat	Long	Status
1	-28.610674°	19.765734°	Dead
2	-28.610718°	19.765404°	Living
3	-28.610489°	19.765047°	Living
4	-28.609705°	19.766620°	Living
5	-28.608448°	19.762192°	Dead
6	-28.612028°	19.771004°	Living
7	-28.612204°	19.771790°	Living
8	-28.612282°	19.771690°	Living
9	-28.612307°	19.771845°	Living
10	-28.612230°	19.771955°	Living
11	-28.612230°	19.771955°	Living

Figure 3.3: Location of all *Hoodia gordonii* plants on the Skuitdrift 2 Solar PV Energy Facility site in relation to the development footprint.

3.3 *Boscia foetida*

There are eleven (11) *Boscia foetida* (Figure 3.4) on site, some *Boscia albitrunca* was found, but not within the development footprint. The individuals found were healthy. All GPS points are listed in Table 3.3. Figure 3.5 indicates the position of each of the *Boscia foetida* on site.

Figure 3.4: *Boscia foetida* found on the Skuitdrift 2 Solar PV Energy Facility site.

Table 3.3: GPS locations of each *Boscia foetida* located on the Skuitdrift 2 Solar PV Energy Facility site.

Number	Lat	Long	Status
1	-28.611512°	19.766983°	Living
2	-28.610464°	19.765930°	Living
3	-28.610620°	19.765240°	Living
4	-28.611039°	19.764811°	Living
5	-28.610799°	19.763515°	Living
6	-28.609973°	19.762689°	Living
7	-28.608451°	19.762148°	Living
8	-28.607675°	19.763281°	Living
9	-28.608809°	19.763762°	Living
10	-28.609244°	19.764527°	Living
11	-28.610585°	19.767176°	Living

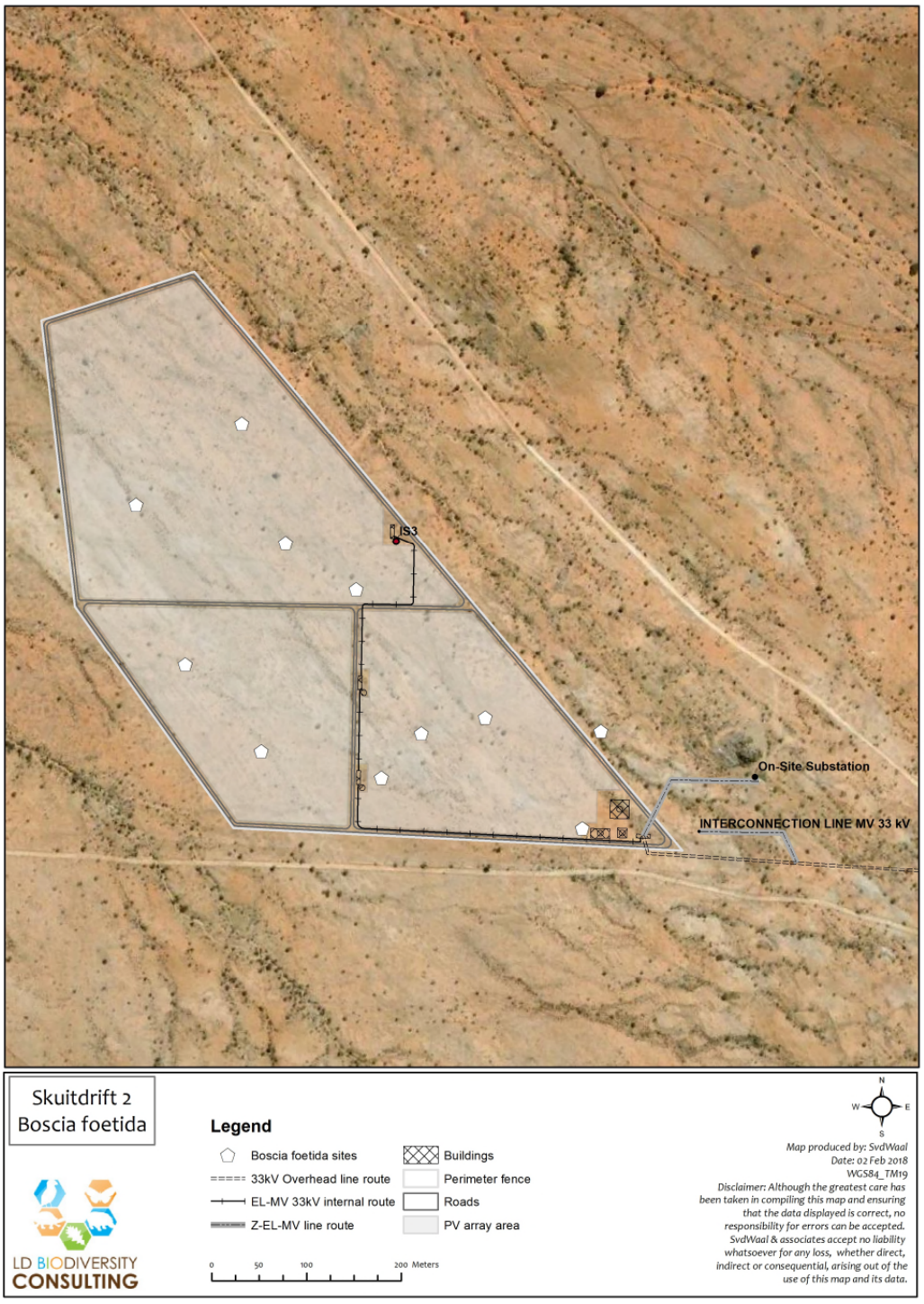


Figure 3.5: Location of all *Boscia foetida* trees on the Skuitdrift 2 Solar PV Energy Facility site in relation to the development footprint.

4 APPENDIX 1: Specialist CV

6 Beach Road
Noordhoek
Cape Town

Leigh-Ann de Wet
MSc | Pri. Sci. Nat.
Biodiversity Specialist

leighann.dewet@gmail.com
083 352 1936

Profile

A biodiversity specialist with a history in botanical research, biodiversity assessments and associated planning in developing countries. Possesses experience in classification of ecosystems and development of management and monitoring plans for a variety of ecosystems from the spiny thicket of Madagascar to the Rainforests of West and Central Africa. Experience also includes Biodiversity Assessments (comprising classification and mapping of ecosystems and habitats) of ecosystems and vegetation types throughout Southern Africa including grasslands, forests, thicket, bushveld and fynbos with associated conservation and management recommendations.

Key Expertise

Ecological research methodology development	Report and paper writing
Ecological research	Synthesis of specialist work into integrated assessments
Habitat and vegetation mapping	Ecological statistics
Habitat and vegetation classification	Environmental Management and Monitoring

Education

2005 - 2007	**MSc** in Botany – Rhodes University
2005	**BSc Honours** in Botany (with Distinction) – Rhodes University
2001 - 2004	**BSc** (Botany and Entomology) – Rhodes University

Courses

2013	Wetland Management: Introduction to Law – University of the Free State
2013	Wetland Management: Introduction and Delineation Short Course – University of the Free State
2011	Land Degradation Short Course – Rhodes University
2009	EIA Short Course – Rhodes University and Coastal and Environmental Services

Membership

2012 – Present	Professional Natural Scientist with SACNASP: Ecological Science (No. 400233/12)
2012 – Present	High Conservation Value Assessor (plants) with the Round Table of Sustainable Biofuels.

2013 – Present	South African Association of Botanists
2013 – Present	Botanical Society of South Africa
2013 – Present	Wildlife and Environment Society of South Africa
2013	Grasslands Society of Southern Africa

Professional experience

2014 - Current Owner of LD Biodiversity Consulting – Biodiversity Specialist

Started own company (Sole Proprietor) to focus on Ecological Assessments including baseline assessments (habitat and ecosystem classification) as well as Management and Monitoring for large projects. Responsibilities include:

- Ecological Surveys including Baseline Assessments, Biodiversity Management and Monitoring Plans and Spatial Planning for biodiversity goals to meet international standards
- Offset design
- Strategic Environmental Planning
- Mapping (QGIS)
- Research
- Financial Management

2012 - 2014 Digby Wells Environmental – Unity Manager: Biophysical

Management of the Biophysical Department, specifically Flora and Fauna although included the overseeing and review of both Freshwater Ecology and Wetlands as well. Responsibilities included:

- Conducting and management of Ecological Baseline and Impact Assessments to meet international standards
- Biodiversity Management and Monitoring Plans
- Management of a team of between four and seven colleagues and specialists

2009 – 2012 Coastal and Environmental Services – Senior Environmental Consultant and Ecological Specialist

Ecological specialist responsible for conducting ecological assessments including baseline and impact assessments for Fauna and Flora. Later in this time for overseeing junior ecologists and training. Key responsibilities included:

- Conducting Ecological Baseline and Impact Assessments to international standards
- Strategic environmental planning
- Managing teams of specialists
- Mapping (Arc)
- Research

2007 - 2009	Rhodes University (South Africa) and Sheffield University (England) – NERC Research Assistant

Design and conducting of a large common or garden experiment looking at the effects of global climate change on grassland composition. Key responsibilities included:

- Experimental design
- Experiment implementation
- Data analyses

Awards

2005	Best Young Botanist second prize for a presentation entitled: "Population biology and effects of harvesting on *Pelargonium reniforme* (Geraniaceae) in Grahamstown and surrounding areas" at the SAAB conference. Dean's list, Academic Colours, Masters Scholarship.
2004	Putterill Prize for conservation in the Eastern Cape, Dean's list, Academic Half Colours, Honours Scholarship.
2001 - 2003	Dean's List

Publications

de Wet, L., Downsborough, L., Reimers, B., and Weah, C. (in prep). Traditional ecological knowledge and social survey as a proxy for large mammal scientific survey in Liberia.

de Wet, L., Downsborough, L., Reimers, B., and Weah, C (in prep). Traditional ecological knowledge and presence of large mammals in Liberia: a case study.

de Wet, L., and Downsborough, L. (in prep). A case for using traditional knowledge for community managed multiple use conservation areas in Liberia.

Taylor, S, Ripley, B, Martin, T, **de Wet, L,** Woodward, I and Osborne, C (2014.) Physiological advantages of C4 grasses in the field: a comparative experiment demonstrating the importance of drought. Global Change Biology – in Press.

Ripley BS, **de Wet, L** and Hill MP (2008). Herbivory-induced reduction in photosynthetic productivity of water hyacinth, *Eichhornia crassipes* (Martius) Solms-Laubach (Pontederiaceae), is not directly related to reduction in photosynthetic leaf area. African Entomology 16(1): 140-142.

de Wet LR, Barker NP and Peter CI (2008). The long and the short of gene flow and reproductive isolation: Inter-Simple Sequence Repeat (ISSR) markers support the recognition of two floral forms in *Pelargonium reniforme* (Geraniaceae). Biochemical Systematics and Ecology 36: 684-690.

de Wet L, NP Barker and CI Peter (2006). Beetles and Bobartia: an interesting herbivore-plant relationship. Veld & flora. September: 150 – 151.

de Wet LR and Botha CEJ (2007). Resistance or tolerance: An examination of aphid (*Sitobion yakini*) phloem feeding on Betta and Betta-Dn wheat (*Triticum aestivum* L.). South African Journal of Botany 73(1): 35-39.

de Wet L (2005). Is *Pelargonium reniforme* in danger? The effects of harvesting on *Pelargonium reniforme*. Veld & Flora. December: 182-184.

Presentations

2013	**LR de Wet** – Biodiversity Actions Plans for existing mines: Making them Work for Grassland Conservation - Grassland Society of Southern Africa Congress, Limpopo
2011	**LR de Wet** - Finding Ecological Benefits of Windfarms – Thicket Forum, Grahamstown
2010	Lubke, RA, N Davenport, **LR de Wet** and C Fordham – The ecology and distribution of endorheic pans in the subtropical thicket vegetation near Port Elizabeth, Eastern Cape, South Africa – International Association for Vegetation Science, 53rd Annual Symposium, Ensenada, Mexico.
2006	**LR de Wet,** Barker, N and Peter, C – Pollinator-mediated selection in *Pelargonium reniforme* as described by Inter Simple Sequence Repeat markers. – South African Association of Botanists (SAAB) conference.
2006	**LR de Wet**, Barker, N and Peter, C– Pollinator-mediated selection of *Pelargonium reniforme* and two floral morphs described by inter simple sequence repeat markers – Southern African Society for Systematic Biology (SASSB) conference.
2005	**LR de Wet** and Vetter, S – Population biology and effects of harvesting on *Pelargonium reniforme* (Geraniaceae) in Grahamstown and surrounding areas, Eastern Cape, South Africa – South African Association of Botanists (SAAB) conference.
2005	**LR de Wet** and Vetter, S – Harvesting of *Pelargonium reniforme* in Grahamstown; what are the implications for populations of the plant? – Thicket Forum
2005	**LR de Wet** – Harvesting of *Pelargonium reniforme* in Grahamstown; what are the implications for populations of the plant? – Annual general meeting. Botanical Society of South Africa, Albany Branch.
2004	**LR de Wet** – Population biology of *Pelargonium reniforme* – Annual general meeting. Botanical Society of South Africa, Albany Branch.

5 APPENDIX 2: Species List for the site

This species list has been generated from the Ecological Specialist Report (Todd, 2013) and includes all species mentioned as recorded on site.

Acacia erioloba
Acacia mellifera
Aloe dichotoma
Asparagus denudatus
Boscia foetida
Chascanum garipense
Coccinia rehmannii
Commiphora gracilifrondosa
Commiphora namaensis
Cucumis africanus
Enneapogon scaber
Hermannia minutiflora
Hermannia spinescens
Hermannia stricta
Hibiscus elliottiae
Hibiscus engleri
Hoodia gordonii
Kissenia capensis
Leucophyrys mesocoma
Lycium pumilum
Microloma incanum
Monechma spartioides
Parkinsonia africana
Pergularia daemia
Petalidium lucens
Phaeoptilum spinosum
Rhigozum trichotomum
Rogeria longiflora
Salsola rabieana
Schmidtia kalahariensis
Sisyndite spartea
Stipagrostis anomala
Stipagrostis brevifolia
Stipagrostis ciliata
Stipagrostis namaquensis
Stipagrostis uniplumis
Trichodesma africanum
Tricholaena capensis subsp *arenaria*
Zygophyllum rigidum

6 APPENDIX 3: Correspondence regarding permitting: Skuitdrift 2 Solar PV Energy Facility

Leigh-Ann de Wet <leighann.dewet@gmail.com>

RE: Sluitdrift sites 1 and 2 - Botanical specialist

JacolineMa <JacolineMa@daff.gov.za> Thu, Dec 14, 2017 at 4:35 PM
To: Leigh-Ann de Wet <leighann.dewet@gmail.com>

Dear Leigh-Ann

It might be more appropriate if you ask these questions to Natalie Uys (nuys.denc@gmail.com) or Peter Cloete (peter.denc87@gmail.com) at DENC. The questions relates more to the DENC Flora Permit than the DAFF Forest Act License. Both DAFF and DENC usually requires an **accurate estimation** of the affected numbers of trees or plants per species, because the quantities are specified in the Permit and/or License and it help us quantify cumulative development impacts on different vegetation types in the province. We are not unreasonable in expecting each and every individual plant to be counted or mapped on large-scale developments, but the estimation should be as accurate as possible. Different people use different methods and there is no specific prescribed methodology, as long as the result gives a true reflection of the species density on site which can then be extrapolated to cover the whole footprint. Woody vegetation is sparse at the proposed development sites, therefore 100 m wide transects should easily enable you to count most of the affected *B. foetida* on site, because it is open and one can easily spot them.

What is of concern is the number of juvenile Quiver trees encountered on site, because there is a moratorium in place in the Northern Cape Province, prohibiting the removal of the species from the wild as Natalie has pointed out in the attached e-mail. Again, you should ask the DENC about this. In reality, DENC should not issue any permits for removal of Quiver trees due to the Moratorium. If the DENC agrees to issue a Flora Permit for removal of the Quiver trees on site, it should definitely be relocated to a similar habitat nearby. Ideally, the area where I found the 3 dead Quiver tree close to each other (of which you have mapped one) and where most of the young Quiver trees are growing, should have been highlighted as a very sensitive area during the EIA process and excluded from the authorisation. It is not too late to exclude this from the development footprint, since 75 MW over 210 ha was authorised and only 5 WM over 20 ha footprint will be constructed. Therefore, I would suggest the area (flat rocky outcrop where most Quiver trees were encountered) should be excluded from development and demarcated as a no-go zone. Leave the Quiver trees where they are!

As for the bird nest, birds migrate. It is quite possible the nest was not there when you visited the site, but to remove the active nest in the Quiver tree, the developer may need a Fauna Permit from DENC.

Regards,

Jacoline Mans

Designation: Chief Forester (NFARegulation)

Directorate: Forestry Management (Other Regions) Northern Cape

Department of Agriculture, Forestry and Fisheries

Tel: 054 338 5909

Fax: 054 334 0030

Web: www.daff.gov.za

E-mail: JacolineMa@daff.gov.za

From: Leigh-Ann de Wet [mailto:leighann.dewet@gmail.com]
Sent: 14 December 2017 02:58 PM
To: JacolineMa
Subject: Sluitdrift sites 1 and 2 - Botanical specialist

Hi Jacoline,

Thank you so much for your site visit to the Skuitdrift sites the other day and for your feedback.

I would like to confirm with you in person exactly what is required for the updates to the permitting applications.

As I have said to Lisa of Savannah, I made a mistake in not including the *Boscia* and of course need to rectify that error!

Was my methodology (100m) transects incorrect? I have used this in Limpopo, Mpumalanga and the Eastern Cape for protected species with no issues. It if course does not pick up each individual but does register each species (with very rare exceptions, especially in the Eastern Cape with small succulent species).

Please advise on how I should go forward?

Is it required that I return to site and comprehensive mapping of each individual plant? Or is the requirement met if I add the *Boscias* to at the application (I did see them , but unfortunately had not double checked the Provincial list)?

As for the nests, I did not see any when I was there and was specifically checking - so I need to add this now that you have done your assessment and there is a new nest?

Your help would be greatly appreciated! I need to rectify this as soon as possible of course!

Yours sincerely,

Leigh-Ann de Wet

Leigh-Ann de Wet <leighann.dewet@gmail.com>

Re: Skuitdrift 1 & 2 Solar project

Peter Cloete <peter.denc87@gmail.com> Mon, Jan 8, 2018 at 8:32 AM
To: Leigh-Ann de Wet <leighann.dewet@gmail.com>

Good morning Leigh-Ann
Normally we request a full species list of the development footprint, how ever given the situation, it would be recommended that protected species found on site that was not list in the application may also be removed or preserve at a nursery. Your suggestion with regards the bird nest removal is supported.
With regards the photographic records of the plants to be removed/cut or damage is important for record keeping purposes. It is recommended that the ECO carries that responsibility.

For any enquiries
Feel free to contact me

Best regards
Peter Cloete

On Mon, Jan 8, 2018 at 8:18 AM, Leigh-Ann de Wet <leighann.dewet@gmail.com> wrote:
Hi Peter,

I am not sure if you got my last email, I would like to give my client (Savannah Environmental) a way forward and would appreciate your response.

Yours sincerely,
Leigh-Ann

On Thu, Dec 21, 2017 at 11:39 AM, Leigh-Ann de Wet <leighann.dewet@gmail.com> wrote:
Hi Peter,

Thank you so much for the reply and information.

I am happy to amend the applications to reflect the presence of *Boscia foetida* as mentioned previously.

Please confirm what you mean by “a detailed flora species is required and included in the permit application”. Does this entail me going to site and doing a full species list? Ordinarily this is done during the EIA phase, unfortunately the specialist assessment did not include a full species list and I pulled what I could from each report (these lists were attached as appendices).

As for a photographic record of those plants that are destroyed, does this require the presence of someone on site when the construction commences to record each individual removed?

And the bird's nest. I understand fully that this will require a permit. However, considering it was not there when I did my site visit, and due to the transient nature of birds, perhaps it is prudent to wait until construction commences to confirm the presence of an active nest and apply for a permit then?

Thanks again for your reply and I hope you can provide clarification on the above-mentioned issues.

Yours sincerely,
Leigh-Ann de Wet

On 20 Dec 2017, at 10:28 AM, Peter Cloete <peter.denc87@gmail.com> wrote:

Dear Leigh-Ann
According to the Northern Cape Nature Conservation Act, *Boschia foetida* listed as Schedule 2 (Protected) species, therefore the developer must apply for an amendment to the existing flora application permit already submitted to include the above mentioned specie. Based on the information provided from the Department of Agriculture, Forestry and Fisheries (site visit conducted), it became apparent that a detailed flora species is required and included in the permit application.
With regards the methodology, a 100m transects are normally recommended especially in arid environments like the Northern Cape. Advisably a photographic record must be provided of the individuals destroyed and those recorded. It is recommended that no bird species or nest may be removed without the necessary permits from DENC.

Feel free to contact me for any enquiries.

Kind regards
Peter Cloete

On Wed, Dec 20, 2017 at 9:01 AM, Elsabe Swart <elsabe.dtec@gmail.com> wrote:
Peter,

Het jy al reageer op die klient se navraag?
Onthou asb om te antwoord.

Dankie

---------- Forwarded message ----------
From: **Natalie Uys** <nuys.denc@gmail.com>
Date: Fri, Dec 15, 2017 at 9:12 AM
Subject: Fwd: Skuitdrift 1 & 2 Solar project
To: Peter Cloete <peter.denc87@gmail.com>
Cc: Elsabe Swart <elsabe.dtec@gmail.com>

Dear Peter

Please see the email below that requires an urgent response from you.

Best regards

Natalie Uys *Pr.Sci.Nat.*
Production Scientist Grade B: Botanist
Northern Cape Department of Environment and Nature Conservation (DENC), Private Bag X6102, Kimberley, 8300. Tel nr: 053 807 7300/7472. Fax: 053 - 831 3530 ; Email: nuys.denc@gmail.com
Website: http://denc.ncpg.gov.za/ Permit office contact information: Email: dencpermits@gmail.com OR dencpermits@ncpg.gov.za (2MB Size restriction per email); Fax: 086 5151 769 (For submitting new applications) Courier address: 90 Long Street / Longstraat 90, Kimberley.

---------- Forwarded message ----------
From: **Leigh-Ann de Wet** <leighann.dewet@gmail.com>
Date: 15 December 2017 at 08:32
Subject: Skuitdrift 1 & 2 Solar project
To: nuys.denc@gmail.com, peter.denc87@gmail.com

Hi Natalie and Peter,

I got your contact details from Jacoline Mans of DAFF. I have some questions regarding the permitting applications that I did for the two Skuitdrift sites and was hoping you could help me rectify them.

I would like to confirm with you in person exactly what is required for the updates to the permitting applications.

As I have said to Lisa of Savannah, I made a mistake in not including the *Boscia* and of course need to rectify that error!

Was my methodology (100m) transects incorrect? I have used this in Limpopo, Mpumalanga and the Eastern Cape for protected species with no issues. It if course does not pick up each individual but does register each species (with very rare exceptions, especially in the Eastern Cape with small succulent species).

Please advise on how I should go forward?

Is it required that I return to site and comprehensive mapping of each individual plant? Or is the requirement met if I add the *Boscias* to at the application (I did see them , but unfortunately had not double checked the Provincial list)?

As for the nests, I did not see any when I was there and was specifically checking - so I need to add this now that you have done your assessment and there is a new nest?

Please see the email sent to me by Jacoline below:

Dear Leigh-Ann

It might be more appropriate if you ask these questions to Natalie Uys (nuys.denc@gmail.com) or Peter Cloete (peter.denc87@gmail.com) at DENC. The questions relates more to the DENC Flora Permit than the DAFF Forest Act License. Both DAFF and DENC usually requires an **accurate estimation** of the affected numbers of trees or plants per species, because the quantities are specified in the Permit and/or License and it help us quantify cumulative development impacts on different vegetation types in the province. We are not unreasonable in expecting each and every individual plant to be counted or mapped on large-scale developments, but the estimation should be as accurate as possible. Different people use different methods and there is no specific prescribed methodology, as long as the result gives a true reflection of the species density on site which can then be extrapolated to cover the whole footprint. Woody vegetation is sparse at the proposed development sites, therefore 100 m wide transects should easily enable you to count most of the affected *B. foetida* on site, because it is open and one can easily spot them.

What is of concern is the number of juvenile Quiver trees encountered on site, because there is a moratorium in place in the Northern Cape Province, prohibiting the removal of the species from the wild as Natalie has pointed out in the attached e-mail. Again, you should ask the DENC about this. In reality, DENC should not issue any permits for removal of Quiver trees due to the Moratorium. If the DENC agrees to issue a Flora Permit for removal of the Quiver trees on site, it should definitely be relocated to a similar habitat nearby. Ideally, the area where I found the 3 dead Quiver tree close to each other (of which you have mapped one) and where most of the young Quiver trees are growing, should have been highlighted as a very sensitive area during the EIA process and excluded from the authorisation. It is not too late to exclude this from the development footprint, since 75 MW over 210 ha was authorised and only 5 WM over 20 ha footprint will be constructed. Therefore, I would suggest the area (flat rocky outcrop where most Quiver trees were encountered) should be excluded from development and demarcated as a no-go zone. Leave the Quiver trees where they are!

As for the bird nest, birds migrate. It is quite possible the nest was not there when you visited the site, but to remove the active nest in the Quiver tree, the developer may need a Fauna Permit from DENC.

Regards,

Jacoline Mans

Designation: Chief Forester (NFARegulation)

Your help would be greatly appreciated! I need to rectify this as soon as possible of course!

I look forward to your response,

Yours sincerely,

Leigh-Ann de Wet

--
Regards
Elsabe

E SWART
SCIENTIFIC MANAGER GR B: RESEARCH AND DEVELOPMENT SUPPORT
Pr.Sci.Nat.

Department of Environment and Nature Conservation
Private Bag X6102
Kimberley
8300
Tel. 053 - 807 7481
Fax 053 - 831 3530
Mobile 082 4582954
elsabe.dtec@gmail.com

--
Mr. Peter Cloete
Candidate Scientist: District Ecologists
Research and Development Support Section
Northern Cape Department of Environment and Nature Conservation
C/O Voortrekker and Magasyn Street
Springbok
8240
Tel: (027) 718 8800
Fax: (027) 718 8814
E-mail: peter.denc87@gmail.com

--
Mr. Peter Cloete
Candidate Scientist: District Ecologists
Research and Development Support Section
Northern Cape Department of Environment and Nature Conservation
C/O Voortrekker and Magasyn Street
Springbok
8240
Tel: (027) 718 8800
Fax: (027) 718 8814
E-mail: peter.denc87@gmail.com

APPENDIX C:
HERITAGE WALK-THROUGH REPORT

McGregor Museum
Department of Archaeology

SKUITDRIFT 2 SOLAR PV ENERGY FACILITY

(KHOI-SUN DEVELOPMENT (PTY) LTD)

NEAR POFADDER, NORTHERN CAPE

ARCHAEOLOGY SPECIALIST
WALK-THROUGH SURVEY

David Morris
October 2017

SKUITDRIFT 2 SOLAR PV ENERGY FACILITY
ON THE FARM SKUITDRIF 426
NEAR POFADDER, NORTHERN CAPE

ARCHAEOLOGY SPECIALIST WALK-THROUGH SURVEY

David Morris, McGregor Museum, Kimberley & Sol Plaatje University, Kimberley
P.O. Box 316 Kimberley 8300
Tel 082 2224777 email dmorriskby@gmail.com
October 2017

1. Introduction and Background

The McGregor Museum was approached by Savannah Environmental (Ref SE1784) to carry out a heritage walk-through survey for the solar PV energy facility proposed by Khoi-Sun Development (Pty) Ltd, to be situated on the farm Skuitdrif 426 near Pofadder in the Northern Cape. This report provides an archaeology specialist walk-through survey of the footprint for the proposed construction of a 5 MW photovoltaic solar facility. Previously, Phase 1 Impact Assessments had been provided for Archaeology (Smith 2012) and Palaeontology (Almond 2012), together with an integrated Heritage Impact Assessment (De Kock 2012). Final Comment supporting the archaeology and palaeontology report recommendations was signed off by SAHRA on 11 July 2012 (SAHRIS), and Environmental Authorisation was granted on 26 June 2013.

The PV facility is proposed to make use of solar photovoltaic (PV) technology and include the following infrastructure: Arrays of solar photovoltaic (PV) panels; appropriate tracking/mounting structures; cabling between the project components, to be lain underground where practical; fencing around the facility; security and ablution facilities; two 10kL rainwater tanks; internal and external access roads; laydown area; site office, store room and control room buildings; inverter stations; onsite substation and transformers; and 33kV overhead power line to evacuate the power from the facility into the Eskom grid at the nearby existing Eskom Schuitdrift Substation. Existing roads will be upgraded and used for the facility where possible, however internal access roads will have to be constructed.

2. Specialist

The author of this report is an archaeologist accredited as a Principal Investigator by the Association of Southern African Professional Archaeologists, employed at Head of Archaeology at the McGregor Museum in Kimberley and an Extraordinary Professor in the School of Humanities, Sol Plaatje University, Kimberley. Work has previously been carried by the author in the region of the proposed activity (Morris 1999a-b, 2000a-c, 2001, 2010, 2012, 2014).

The author works independently of the organisation commissioning specialist input, and provides these walk-trough survey observations within the framework of the National Heritage Resources Act (No 25 of 1999).

The National Heritage Resources Act no. 25 of 1999 (NHRA) protects heritage resources which include archaeological and palaeontological objects/sites older than 100 years, graves older than 60 years, structures older than 60 years, as well as intangible values attached to places. The Act requires that anyone intending to disturb, destroy or damage such sites, objects and/or structures may not do so without a permit from the relevant heritage resources authority. This is the context for this walk-through survey and specialist report, required by the relevant heritage resources authority/ies to assess whether there are any sensitive heritage resources located within the site and whether authorisation may be granted for the disturbance or alteration, or destruction of the identified heritage resources.

3. Description of the receiving environment and potential impacts

The environment is arid, comprising a barren, almost featureless, gently sloping drainage plain situated about 12 km south of the Orange River north east of Pofadder. The landscape being sparsely vegetated, surface archaeological traces are likely to be highly visible.

Figure 1. Google Earth image of the terrain indicating the locality of the site some 12 km south of the Orange River.

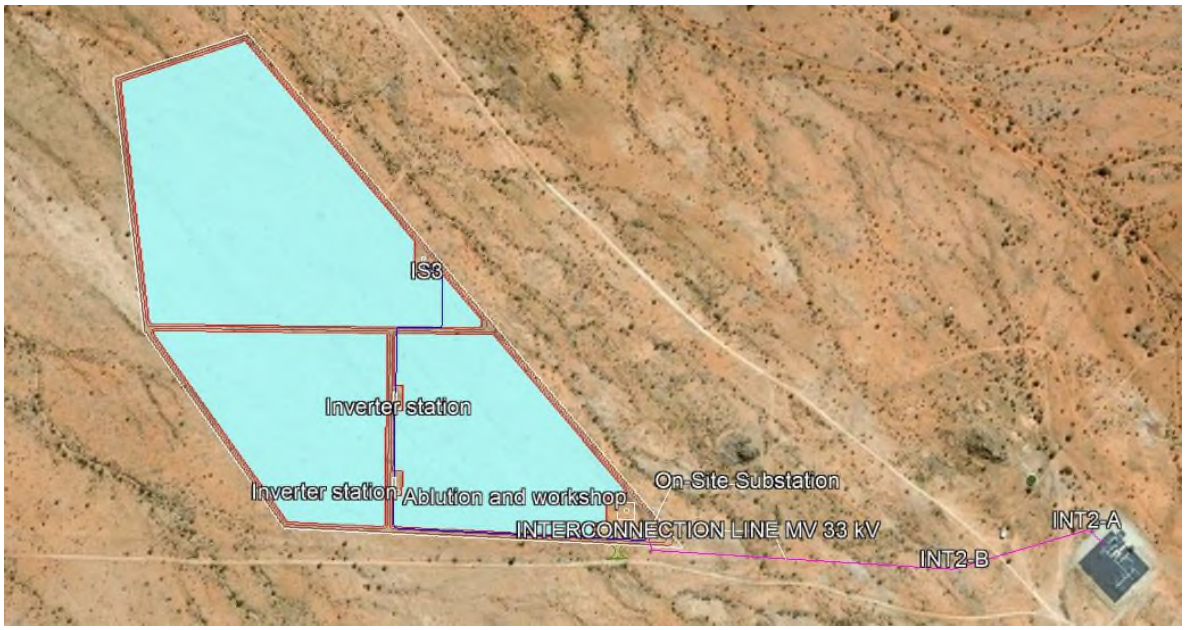


Figure 2. Google Earth image showing the proposed Skuitdrift 2 Solar PV Energy Facility footprint, with existing roads, and proposed facility infrastructure and transmission line to the exiting Eskom substation.

4. Heritage features of the region

Background information on heritage features known or expected in the region is the same, in its essential outline, to that noted in previous reports for similar landscapes nearer to Pofadder (e.g. Morris 2014). The Phase 1 Archaeological Impact Assessment report by Smith (2012; cf. De Kock 2012) produced findings in accord with this expectation.

Colonial frontier

The eighteenth- and nineteenth-century records for this region (Penn 2005) include the travelogues of George Thompson (1827) and E.J. Dunn (1931, Robinson 1978), who visited the region in 1824 and 1872 respectively. Place names were becoming fixed in this colonial frontier period (in a cadastral sense, on maps and in farm names), many such names having Khoekhoegowab origins encapsulating vestiges of precolonial/indigenous social geography. Genocide against the indigenous people is documented in this area (Anthing 1863; de Prada Samper 2012), with certain mountainous areas (like Gamsberg near Aggeneys and Namies) being the likely settings of massacre sites, referred to by Dunn in 1872 (Robinson 1978) and, more obliquely, by Anthing (1863; Jose Manuel de Prada-Samper pers. comm. 2009). Dunn refers to conflict at Zwart Modder, a farm south of Skuitdrift, where he recorded an isolated grave of a member of the Northern Border Police (which has yet to be relocated).

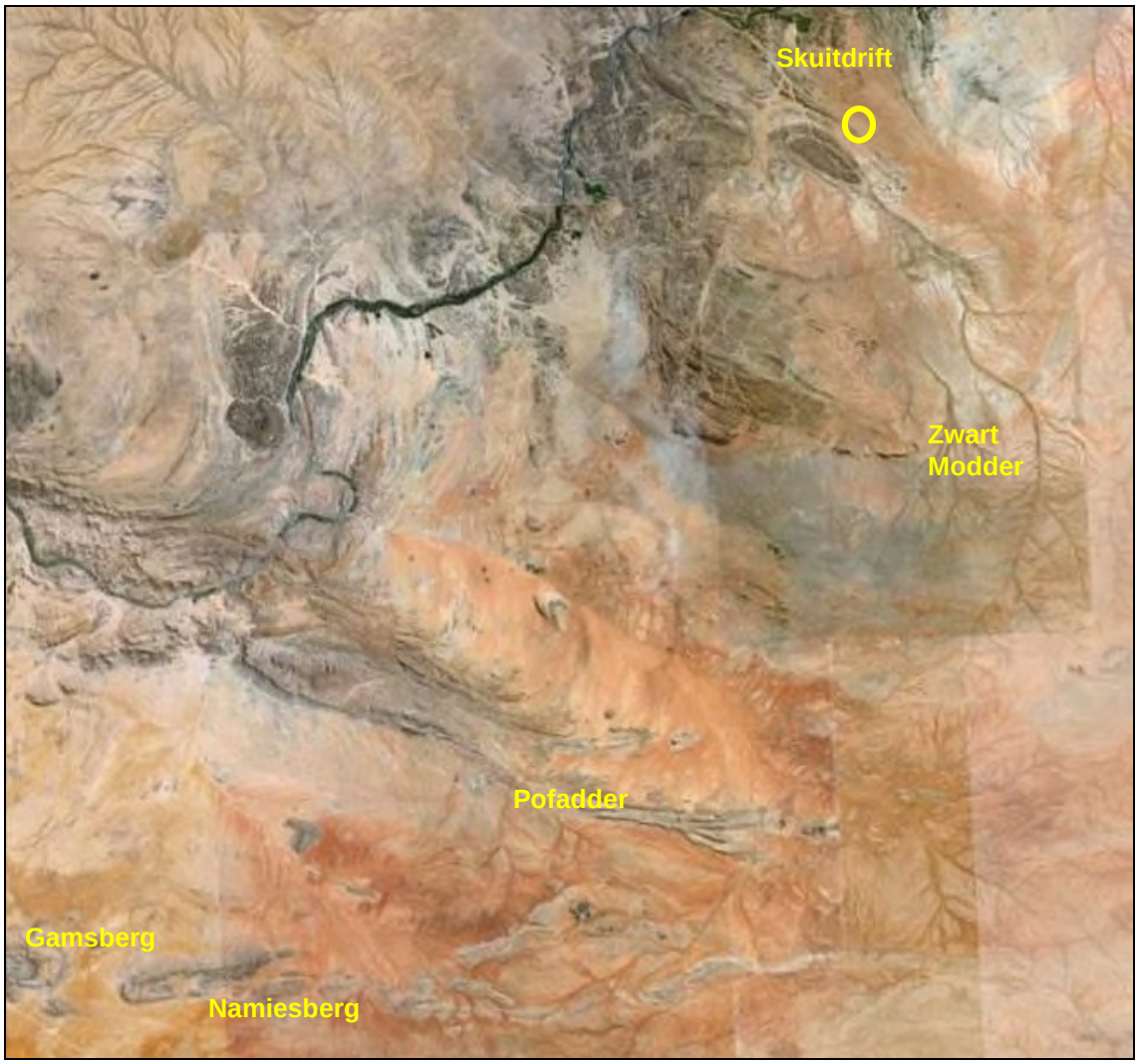


Figure 3. Regional focus: the study area relative to Skuitdrift, Pofadder and some other places mentioned.

Later Stone Age

Late Holocene Later Stone Age (LSA) sites are the predominant archaeological trace noted in surveys in the Aggeneys-Pofadder region (Morris 1999a-b, 2000a-c, 2001, 2010). Beaumont *et al*. (1995) have shown, with reference to the LSA, that "virtually all the Bushmanland sites so far located appear to be ephemeral occupations by small groups in the hinterland on both sides of the [Orange] river" (1995:263). This was in sharp contrast to the substantial herder encampments along the Orange River floodplain itself (Morris & Beaumont 1990), which reflected the "much higher productivity and carrying capacity of these bottom lands." "Given choice, the optimal exploitation zone for foragers would have been the Orange River." The appearance of herders in the Orange River Basin, Beaumont *et al*. argued, led to competition over resources and ultimately to marginalisation of hunter-gatherers, some of whom then occupied Bushmanland, probably mainly in the last millennium, and focused their hunting and gathering activities around the limited number of water sources in the region. Surveys have located signs of

human occupation mainly in the shelter of granite inselbergs (as indeed found here by Smith 2012), on red dunes which provided clean sand for sleeping, or around the seasonal pans (Beaumont *el al*. 1995:264). Possibly following good rains, herders moved into the Orange River hinterland, as attested archaeologically at sites with ample pottery near Aggeneys and, east of Pofadder, at Schuitdrift South – Morris 1999a). However, Thompson (1824) refers to herder groups settled at the stronger springs such as Pella dispersing during periods of drought to smaller springs in the region, which could equally well account for the traces referred to here. Dunn, in 1872, refers to a place at Schuit Klip where water accumulated following rains and was still available after a year of no rain in the vicinity (Robinson 1978:60-61). At such times competition between groups over resources and stress within an already marginalised hunter-gatherer society, must have intensified.

Pleistocene: Middle and Earlier Stone Age

Beaumont *et al*. (1995:240-1) have noted a widespread low density stone artefact scatter of Pleistocene age across areas of Bushmanland to the south where raw materials, mainly quartzite cobbles, were derived from extensive surface spreads of Dwyka tillite. Systematic collections of this material made at Olyvenkolk, south west of Kenhardt and Maans Pannen, and east of Gamoep, could be separated out by abrasion state into a fresh component of Middle Stone Age (MSA) with prepared cores, blades and points, and a large aggregate of moderately to heavily weathered Earlier Stone Age (ESA).

Beaumont *et al*. have shown that "substantial MSA sites are uncommon in Bushmanland" (1995:241) and those that have been documented thus far have generally yielded only small samples (Morris & Beaumont 1991; Smith 1995).

The ESA included Victoria West cores on dolerite, long blades, and a very low incidence of handaxes and cleavers. The Middle (and perhaps in some instances Lower) Pleistocene occupation of the region that these artefacts reflect must have occurred at times when the environment was more hospitable than today. This is suggested by the known greater reliance of people in Acheulean times on quite restricted ecological ranges, with proximity to water being a recurrent factor in the distribution of sites.

5. Description and evaluation of environmental issues and potential impacts

Heritage resources including archaeological sites are in each instance unique and non-renewable resources. Area and linear developments such as those envisaged can have a permanent destructive impact on these resources. The original heritage impact assessments (Smith 2012, Almond 2012, De Kock 2012) evaluated the sensitivity and significance of such resources where present with a view to recommending no-go areas and/or measures to mitigate or manage the said impacts.

The walk-through survey follows authorisation of the proposed facility and addresses the appropriateness of the layout relative to heritage resources and sensitivities.

6. Potential areas of sensitivity

Based on previous experience in the area (including Smith 2012), it is estimated that any terrain close to hills or rocky features, particularly sandy spots near sheltering rocks, may tend to have traces of precolonial Stone Age occupation/activity.

No such features occur on the actual footprint of the proposed development.

While places in the open plains have been found to have sparsely scattered artefacts (such as at Konkoonsies near the Paulputs Substation site – Morris 1999a), these areas are expected to be less significant. An exception to this is where rocky outcrops at the surface on the plains provide places where water pools exist after rains. Such places often attracted people in the past with traces of this including artificial grinding grooves in the bedrock and ample evidence of stone artefacts and pottery. A very good example of this is at Schuitdrift South about 3 km east of the development at 28º36'46" S 19º48'46" E. It is in fact described in some detail by Dunn (Robinson 1978:60-61): "Two holes occur in the gneiss at the crest of a ridge … when heavy thunder rains sweep over this arid country the water runs into and sometimes fills these most useful reservoirs, in which it is stored up and lasts many months."

Once again, there are no indications of such features on the footprint of the proposed development.

Colonial era sites or features within the study area include farm infrastructure, and a grave site beyond the footprint that was noted by De Kock (2012).

The objective of the walk-through survey is to assess the authorised layout relative to the above potential areas or sensitivities, given that disturbance of surfaces in the development area could have a destructive impact on heritage resources. In the event that such resources are found, they are likely to be of a nature that potential impacts could be mitigated by documentation and/or salvage following approval and permitting by the South African Heritage Resources Agency and, in the case of any built environment features, the Northern Cape Heritage Resources Authority. Should exceptional heritage features be found (not considered likely), some could require preservation *in situ* and hence modification of the intended placement of development components may be required.

Disturbance of any surface includes any construction: of a road, a pipeline, erection of a pylon, or preparation of a site for a substation, or plant, or building, or any other *clearance* of, or *excavation* into, a land surface. In the event of archaeological materials being present such activity would alter or destroy their context (even if the artefacts themselves are not destroyed, which is also possible). Without context, archaeological traces are of much reduced significance. It is the contexts as much as the individual items that are protected by the heritage legislation.

7. Criteria to assess significance where archaeological resources are found

In addition to guidelines provided by the National Heritage Resources Act (Act No. 25 of 1999), a set of criteria based on Deacon (nd) and Whitelaw (1997) for assessing archaeological significance has been developed for Northern Cape settings (Morris 2000a). These criteria include estimation of landform potential (in terms of its capacity to contain archaeological traces) and assessing the value to any archaeological traces (in terms of their attributes or their capacity to be construed as evidence, given that evidence is not given but constructed by the investigator).

Estimating site potential

Table 1 (below) is a classification of landforms and visible archaeological traces used for estimating the potential of archaeological sites (after J. Deacon nd, National Monuments Council). Type 3 sites tend to be those with higher archaeological potential, but there are notable exceptions to this rule, for example the renowned rock engravings site Driekopseiland near Kimberley which is on landform L1 Type 1 – normally a setting of lowest expected potential. It should also be noted that, generally, the older a site the poorer the preservation, so that sometimes *any* trace, even of only Type 1 quality, can be of exceptional significance. In light of this, estimation of potential will always be a matter for archaeological observation and interpretation.

Assessing site value by attribute

Table 2 (below) is adapted from Whitelaw (1997), who developed an approach for selecting sites meriting heritage recognition status in KwaZulu-Natal. It is a means of judging a site's archaeological value by ranking the relative strengths of a range of attributes (given in the second column of the table). While aspects of this matrix remain qualitative, attribute assessment is a good indicator of the general archaeological significance of a site, with Type 3 attributes being those of highest significance.

Table 1. Classification of landforms and visible archaeological traces for estimating the potential for archaeological sites (after J. Deacon, National Monuments Council).

Class	Landform	Type 1	Type 2	Type 3
L1	Rocky surface	Bedrock exposed	Some soil patches	Sandy/grassy patches
L2	Ploughed land	Far from water	In floodplain	On old river terrace
L3	Sandy ground, inland	Far from water	In floodplain or near feature such as hill	On old river terrace
L4	Sandy ground, Coastal	>1 km from sea	Inland of dune cordon	Near rocky shore
L5	Water-logged deposit	Heavily vegetated	Running water	Sedimentary basin
L6	Developed urban	Heavily built-up with no known record of early settlement	Known early settlement, but buildings have basements	Buildings without extensive basements over known historical sites
L7	Lime/dolomite	>5 myrs	<5000 yrs	Between 5000 yrs and 5

Class	Landform	Type 1	Type 2	Type 3
				myrs
L8	Rock shelter	Rocky floor	Sloping floor or small area	Flat floor, high ceiling
Class	**Archaeo-logical traces**	**Type 1**	**Type 2**	**Type 3**
A1	Area previously excavated	Little deposit remaining	More than half deposit remaining	High profile site
A2	Shell or bones visible	Dispersed scatter	Deposit <0.5 m thick	Deposit >0.5 m thick; shell and bone dense
A3	Stone artefacts or stone walling or other feature visible	Dispersed scatter	Deposit <0.5 m thick	Deposit >0.5 m thick

Table 2. Site attributes and value assessment (adapted from Whitelaw 1997)

Class	Attribute	Type 1	Type 2	Type 3
1	Length of sequence/context	No sequence Poor context Dispersed distribution	Limited sequence	Long sequence Favourable context High density of arte/ecofacts
2	Presence of exceptional items (incl regional rarity)	Absent	Present	Major element
3	Organic preservation	Absent	Present	Major element
4	Potential for future archaeological investigation	Low	Medium	High
5	Potential for public display	Low	Medium	High
6	Aesthetic appeal	Low	Medium	High
7	Potential for implementation of a long-term management plan	Low	Medium	High

8. Methodology & Limitations

The area being relatively small, our team of three scanned across the full extent of (and beyond) the footprint during the walk-through survey (Fig. 4 indicates the track taken by one of the three and all of the heritage resources located).

An assumption made in this study is that, by and large in this landscape, some sense of the archaeological traces to be found in the area would be apparent from surface observations (including assessment of places of erosion or past excavations that expose erstwhile below-surface features). There remains the possibility that during construction sites or features of significance could be encountered in the sub-surface (this could include an unmarked burial, or a high density of stone tools, for instance), in which case specified steps are necessary (cease work and report to heritage authority).

Nineteenth- and twentieth-century cultural history and intangible heritage values attached to places are difficult to recover owing to the sparse population.

The manner in which archaeological traces might be affected by the proposed development has been indicated above, but can be summed up in the following terms: it would be any act or activity that would result immediately or in the future in the destruction, damage, excavation, alteration, removal or collection from its original position, any archaeological material or object (as indicated in the National Heritage Resources Act (No 25 of 1999)). The most obvious impact in this case would be land surface disturbance associated with infrastructure construction.

9. Findings: walk-through survey observations

The study area was visited on 4 October 2017 by an archaeology team from the McGregor Museum including the author (D. Morris) and assistants (A. Henderson and J. Louw), to carry out a walk-through survey of the proposed development footprint of the Skuitdrift 2 Solar PV Energy Facility site.

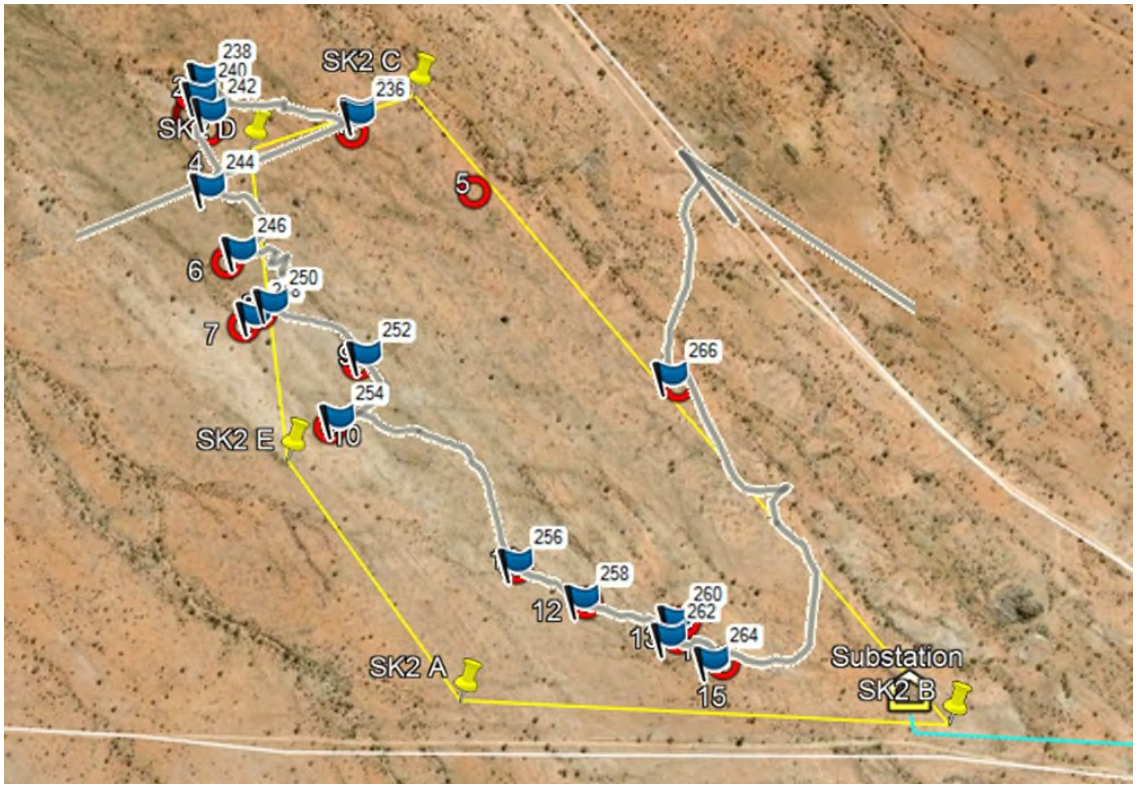


Figure 4. The track followed by one of the team members.

The lack of topographical features such as rocky outcrops, major watercourses, or dunes, suggested on the basis of prior experience of the archaeology of the region that the development footprint was not likely to be rich in archaeological traces of major significance.

This prediction was proven to be correct in terms of the very sparse observations tabulated below.

The sandy plain with rocky exposures across which the proposed facility is to be developed, was found to have extremely low density occurrences of Stone Age material, which occurs as isolated stone tool flakes, seemingly mainly of Middle and Later Stone Age character. This finding is consistent with that of Smith (2012) who found that higher density sites occur against the hills north east of the layout. Unconsolidated sand in places may mask higher numbers of artefacts below the surface, but much of the specific locale is eroded down, with artefacts resting directly on rocky or more or less consolidated substrate.

Observation No	Lattitude	Longitude	Description	Sensitivity
2017/1	28°36’’23.6”	19°45’43.7”	Jaspilite flake	LOW
2017/2	28°36’27.4”	19°45’43.9”	Quartzite flake	LOW
2017/3	28°36’33.0”	19°45’47.8”	Jaspilite flake and nearby flaked river-rolled pebble	LOW
2017/4	28°36’25.5”	19°45’43.5”	Quartz flake	LOW
2017/5	28°36’25.5”	19°45’48.1”	Two quartz flakes	LOW
2017/6	28°36’27.7”	19°45’41.2”	Flaked river-rolled pebble	LOW
2017/7	28°36’29.7”	19°45’39.8”	Flaked river-rolled pebble	LOW
2017/8	28°36’29.3”	19°45’40.4”	Jaspilite flake	LOW
2017/9	28°36’30.9”	19°45’43.9”	Quartzite flake	LOW
2017/10	28°36’32.9”	19°45’42.9”	Quartzite flake	LOW
2017/11	28°36’37.3”	19°45’49.6”	Jaspilite flake	LOW
2017/12	28°36’38.4”	19°45’52.1”	Quartzite flake broken	LOW
2017/13	28°36’39.0”	19°45’55.6”	Jaspilite manuport with edge damage and one flake removal	LOW
2017/14	28°36’39.5”	19°45’55.4”	Jaspilite flake	LOW
2017/15	28°36’40.3”	19°45’57.0”	Quartzite flake	LOW
2017/16	28°36’31.6”	19°45’55.4”	Quartz flake	LOW

Notable is the variety of raw materials present in comparison with the very few artefacts seen at the land adjacent to the site (east). The quartzite and jaspilite raw materials are exitic to the local environment, the quartzite probably derived from Dwyka tillite sources to the south, while jaspilite occurs in the river gravels of the Orange River to the north. The presence of river-rolled pebbles would appear to confirm derivation from the Orange River gravels.

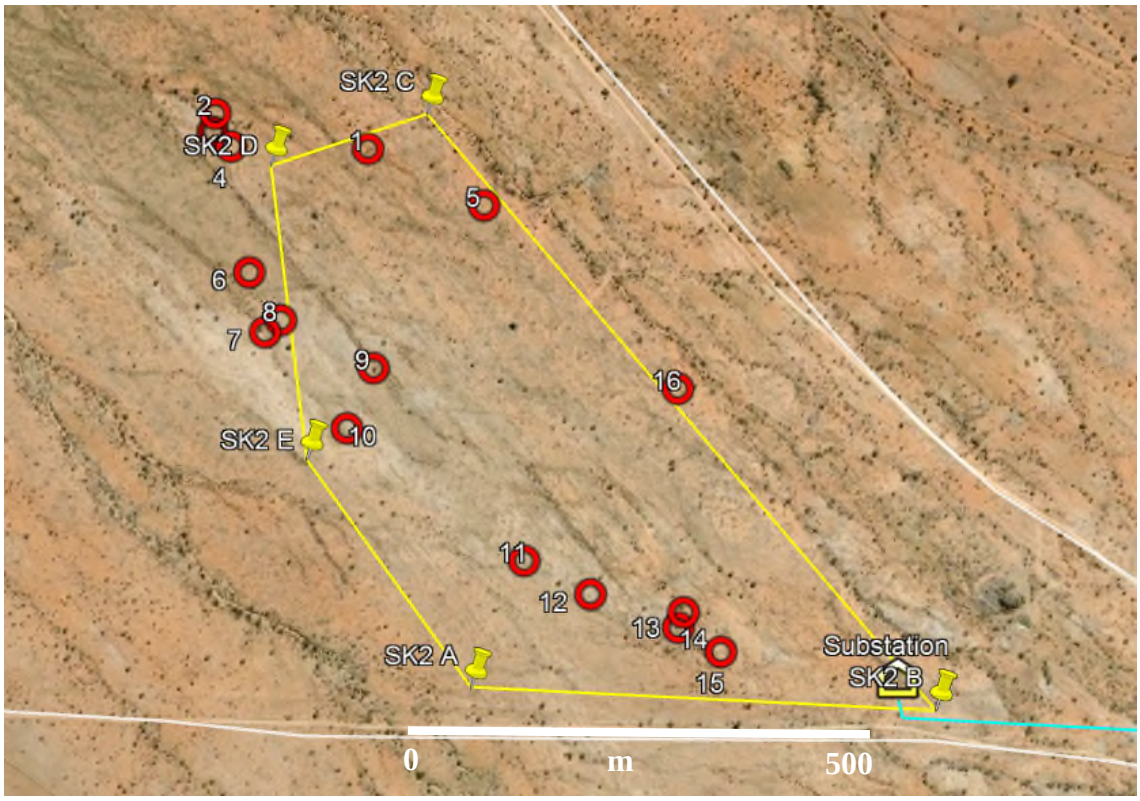


Figure 5. Observations 1-16 are within or at/just beyond the edge of the footprint of the proposed solar energy facility. This distribution of essentially isolated finds reflects an extremely low incidence of archaeological traces within the footprint.

Figure 6. A view north westwards across the proposed facility footprint from a nearby hill.

Figure 7. View southwards across the site.

Figure 8. View across the site showing sparse vegetation and wind-eroded surface, making for high archaeological visibility.

Figure 9. A view north westwards across the proposed facility footprint.


Figures 10 a, b & c. Flakes on a) jaspilite (river rolled pebble), b) jaspilite and on c) quartz.


Figure 11 a & b. Flakes on quartzite and on jaspilite.

10. Conclusion

The walk-through survey has found that the footprint of the proposed Skuitdrift 2 Solar PV Energy Facility has very low densities of isolated stone artefacts relating to the Middle and Later Stone Ages. The significance of impact is concluded to be LOW. Criteria applied (Tables 1 and 2) indicate Landform 3 Type 1 (Low significance), Archaeological trace Class 3 Type 1 (Low significance) and Type 1 for all of the Site Attribute classes (Low significance).

In terms of secondary or cumulative impacts (unlikely as they would apply only outside of the layout of the facility), the higher density artefact scatters against the nearby hills to the north east, noted by Smith (2012), must be avoided; while the existence of a sensitive high-density Later Stone Age site at Schuitdrift South, situated at 28º36'46" S 19º48'46" E, about 3 km to the east of the proposed development, is also noted. These higher/high-density sites in the wider landscape serve to further benchmark the low significance of archaeological materials found on the facility footprint during this walk-through survey.

Acknowledgements

The author thanks Savannah Environmental for assistance with information after commissioning the McGregor Museum to carry out this walk-through survey; farmer Mr Stephanus Nel who granted access to the land; and field assistants Abenicia Henderson and Jani Louw who helped walk the layout.

References

Almond, J. 2012. Proposed 75 MW Solar Facility on farm Skuitdrift 426, Kenhardt District, Northern Cape. "Draft version not for submission" retrieved from SAHRIS, October 2017.

Anthing, L. 1863. Letter to the Cape Parliament. Cape Blue Book.

Beaumont, P. B., Smith, A.B., & Vogel, J.C. 1995. Before the Einiqua: the archaeology of the frontier zone. In A. B. Smith (ed.). Einiqualand: studies of the Orange River frontier, Cape Town: UCT Press.

Deacon, J. nd. Archaeological Impact Assessment - specialist input to planning and design. Unpublished notes compiled for the National Monuments Council.

De Kock, S. 2012. Phase 1 Integrated Heritage Impact Assessment – proposed 10 MW Solar Facility: Portion (45ha) of the farm Skuitdrift 426, Kenhardt District, Northern Cape. "Draft version not for submission" retrieved from SAHRIS, October 2017.

De Prada Samper, J.M. 2012. The forgotten killing fields: 'San' genocide and Louis Anthing's mission to Bushmanland, 1862-1863. *Historia* 57(1):172-187.

Dunn, E. J. 1931. The Bushmen. London: Charles Griffin & Co.

Morris, D. 1999a. Archaeological impact assessment, 'Southern Option', powerline 'Schuitdrift' to 'Paulputs', Pofadder District, Northern Cape. Unpublished Report to Eskom.

Morris, D. 1999b. Archaeological impact assessment, Skuitklipkop Microwave Tower, Kenhardt District, Northern Cape. Unpublished Report to Eskom.

Morris, D. 2000a. Gamsberg Zinc Project environmental impact assessment specialist report: archaeology.

Morris, D. 2000b. Archaeological impact assessment, Black Mountain Mine, Aggeneys, Northern Cape. Unpublished report to Walmsley Environmental Consultants.

Morris, D. 2000c. Archaeological specialist report: desktop assessment of possible archaeological resources along the proposed route, Helios to Aggeneis, Northern Cape. Appendix G in Eyethu Engineers CC: Scoping report: environmental impact assessment for the proposed Aggeneis to Helios 400 kV transmission line. Eskom Transmission Group.

Morris, D. 2001. Gamsberg Zinc: supplementary report on archaeological resources at Gamsberg. Unpublished report for Gamsberg Zinc Project.

Morris, D. 2010. Cultural Heritage Assessment: Gamsberg. Supplementary observations to a previous specialist report on archaeological resources. Unpublished report to SRK Consulting.

Morris, D. 2012. Pofadder Solar Thermal Facility KaXu Solar One: specialist input for the Environmental Impact Assessment Phase and Environmental Management Plan: Archaeology.

Morris, D. 2014. Xina Solar Thermal Facility: specialist input for the Environmental Impact Assessment Phase and Environmental Management Plan for the proposed Xina Solar Thermal Facility, Pofadder, Northern Cape Province: Archaeology.

Morris, D. & Beaumont, P.B. 1991. !Nawabdanas: archaeological sites at Renosterkop, Kakamas District, Northern Cape. South African Archaeological Bulletin 46:115-124.

Penn, N. 2005. The Forgotten Frontier: Colonist and Khoisan on the Cape's Northern Frontier in the 18th Century. Athens, Ohio and Cape Town: Ohio University Press and Double Storey Books.

Prinsloo, H.P. 1998. Argeologiese omgewingsverslag: Pofadder en Aggeneys omgewing. For Klopfer Environmental Consultants.

Robinson, A.M.L. (ed) 1978. Selected articles from the Cape Monthly Magazine NS, 1870-1876. Cape Town: Van Riebeeck Series Second Series No 9.

Sampson, C. G. 1974. The Stone Age archaeology of South Africa. New York: Academic Press.

Smith, A.B. 1995. Archaeological observations along the Orange River and its hinterland. In A. B. Smith (ed.). Einiqualand: studies of the Orange River frontier, Cape Town: UCT Press.

Smith, A.B. 2012. Archaeological report: Proposed 75MW Solar Facility on Farm 426 Skuitdrift, Northern Cape Province. "Draft version not for submission" accessed on SAHRIS, October 2017.

Thompson, G. 1827. Travels and adventures in Southern Africa. Reprint, Cape Town: Africana Connoisseurs Press, 1962.

Whitelaw, G. 1997. Archaeological monuments in KwaZulu-Natal: a procedure for the identification of value. Natal Museum Journal of Humanities. 9:99-109.

APPENDIX D:
ENGINEERING REPORT

Khoi-Sun Development

January 21

2013

Engineering overview and summary pertaining to environmental aspects of the Khoi-Sun Development. Compiled by Solek (Renewable Energy Engineers)

EIA Engineering Report

Contents

List of Figures

Abbreviations and Acronyms

- DAFF Department of Agriculture, Forestry and Fisheries
- DEA National Department of Environmental Affairs
- DWA Department of Water Affairs
- EAP Environmental Assessment Practitioner
- EIA Environmental Impact Assessment
- EMP Environmental Management Plan
- IPP Independent Power Producer
- IPPPP Independent Power Producer Procurement Program
- PPA Power Purchase Agreement
- NEMA National Environmental Management Act
- NERSA National Energy Regulator of South Africa
- PV Photo Voltaic
- ROD Record of Decision
- SID Strategically Important Development
- SANRAL South African National Roads Agency Limited
- UNFCCC United Nations Framework Convention on Climate Change

1. Introduction

Khoi-Sun Development (Pty) Ltd) as an Independent Power Producer (IPP) is proposing the establishment of a commercial solar energy facility on a site within the Northern Cape to be known as Khoi-Sun Development, with a power production capacity of 75MW. The Northern Cape is generally known to be one of the preferred areas for the generation of solar energy in South Africa and even in the world due to abundant solar radiation. The purpose of this facility is to generate electricity from a renewable energy source (i.e. solar radiation) to provide power to the national electricity grid. The proposed development site is located within the Khai-Garib Municipality district approximately 100km North West of Kakamas, in the Northern Cape Province.

The purpose of this engineering report is to describe the various sections of the facility and provide a transparent view on facility operation and the possible effects on the environment. Solek, a renewable energy engineering company, is primarily responsible for the compilation of this section of the report, and a complete company profile is attached in the appendix for the readers convenience.

The report gives background on the energy market in South Africa and the opportunity for solar energy in the Northern Cape. The overall project and proposed facility is also described in more detail by investigating:

- The basic understanding of solar PV plants
- The description of the proposed solar facility
- The different steps in the construction phase of the proposed facility
- The project operation and maintenance phase
- Financial implications and financial overview (Cost Implications)
- Planned project timelines
- Overall conclusion

1.1. Background of the energy market in South Africa

The development of renewable energy in South Africa is gaining momentum at a significant pace, due to the incentives allocated towards approved projects by the South African government. Eskom's shortfall in its energy providing capability resulted in the development and construction of Medupi and Kusile coal power stations. Development of these power stations relied heavily on World Bank financial assistance. The loan requirements forced South Africa into the development of a renewable energy program, hence bringing to life the Independent Power Producer Procurement Program (IPPPP).

According to the Integrated Resource Plan 2010 (IRP 2010), South Africa will require 42 500 MW of additional energy over the following 20 years in order to meet the requirements created by the growing economy. Approximately 20% of this additional energy is projected to be supplied by solar power.

In order to stimulate the demand in solar power, the South African government has made 1450 MW of solar photovoltaic capacity available, which can be applied for by means of the Independent Power Producer Procurement Programme. The Department of Energy (DoE) has set a number of dates apart for the submission of bid documents for private companies to apply for a license to generate electricity. The deadlines for the first three stages are as follows:

- 1st Bid Submission: 4 November 2011

- 2nd Bid Submission: 5 March 2012
- 3rd Bid Submission: 19 August 2013 (previously 7 May 2013)

Another market arising is that of green builders and corporate organisations which are to invest in green electricity and carbon emission reduction. This means that green electricity suppliers such as biogas or solar, will be bought at a premium price from private power producers and obtain a green status according to the United Nations Framework Convention on Climate Change (UNFCCC).

Large international companies seek opportunities in the local market. However, they lack experience with local authorities, procedures and political environment. This local 'know how' is favourable for South African companies and presents many more partnering opportunities with international companies.

1.2. Opportunity for solar energy in the Northern Cape

When considering South Africa's irradiation distribution, the Northern Cape Province is known to be one of the best preferred areas for the generation of solar energy in South Africa and even in the world. This can be ascribed to the advantageous sun radiation specifications and the vast flat planes that the province has to offer, which is not intensively used with the exception of farming. The global irradiation in the specific area is between 2400 and 2600 kWh/m^2. Furthermore, specific parts of the Northern Cape can be used for the generation of power without compromising on food security due to the area's low food produce capacity per hectare of usable land. Below is a map which gives an overview of this power producing potential.

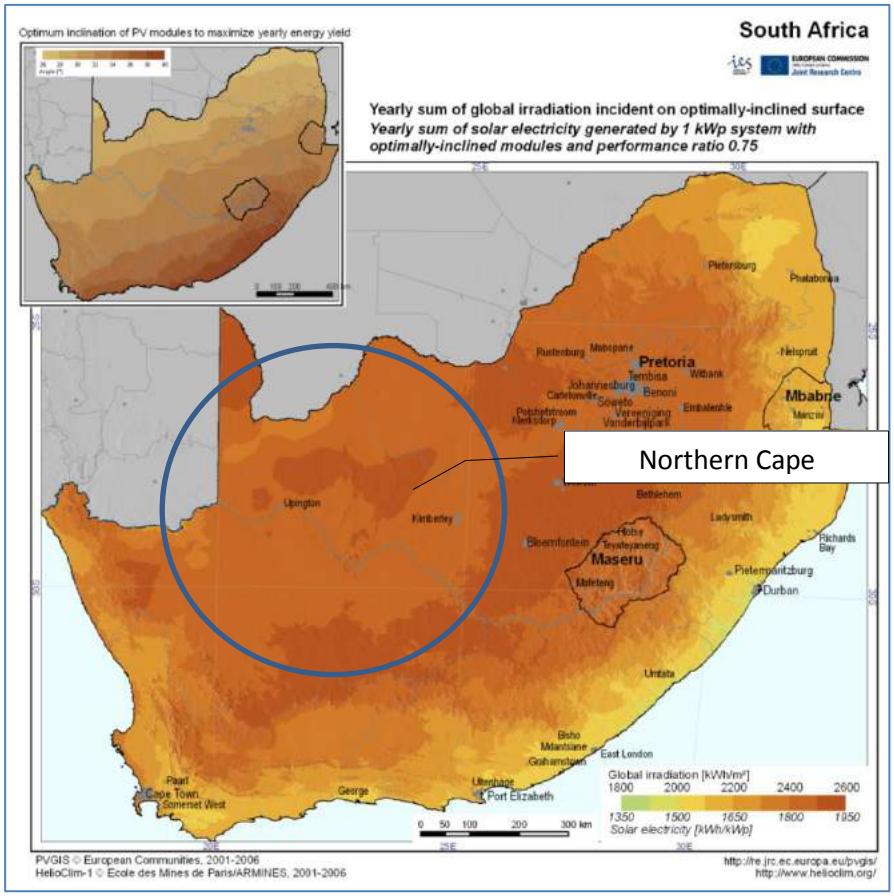


Figure 1: South African solar irradiation distribution

The benefits that the production of energy from the sun holds within the broader South African context outweighs most potential negative impacts the development may have on the bio-physical environment of the property. The contribution and agricultural value of the specific farm should be compared to the impact the national energy crisis could have. This crisis effects job creation, skills development, manufacturing, mining and economic growth potential of the renewable industry.

On the economic front, the proposed project has the potential of making a significantly positive contribution to the local economy. The Northern Cape was well-known for the large number of copper and zinc mines in the area, but since the early 1990's, many of these mines have closed down, leaving a devastating trail of unemployment behind. The local economy, mainly supported by farming, simply isn't enough to accommodate the high level of unemployment. In addition, poverty imposed social problems pose a problem in the surrounding area. The proposed development has the opportunity to create a significant amount of career opportunities over its entire lifespan of 20-30 years.

1.3. Overview of the proposed project

The applicant is proposing the establishment of a commercial solar energy facility, known as the Khoi-Sun Development and will be operated under the licensed of a company baring the same name, Khoi-Sun Development (Pty) Ltd. The proposed development site is located on Farm 426, Skuitdrift, approximately 100km northwest of the town Kakamas which is situated within the jurisdiction of the Khai-Garib Local Municipality in the Northern Cape Province. The purpose of the facility is to assist the government in providing much needed electricity by generating energy from a renewable energy source – the sun.

The proposed facility is to be designed for the generation of approximately 75MW of electricity, which will be fed into the national electricity grid. The proposed development site covers an area of around 250 hectares. The identified development site is located on the farm which covers 9800ha area in total. The area is located directly adjacent to the west of the existing Schuitdrift 132/33kV Eskom substation, which is situated on the same farm.

2. Solar energy as a power generation technology

2.1. Basic understanding of solar PV plants

Photovoltaic (PV) panels convert the energy delivered by the sun to direct current (DC) electric energy. The array of panels is connected to an inverter by means of a network of cables. The grid-tie-inverter, inverts the DC power to alternating current (AC) power which can be transferred to the national electricity network (grid). The voltage at which power is generated is stepped up to the required voltage and frequency of the national grid, by using transformers and specified inverters. The electricity is distributed from the onsite transformers via distribution lines to the adjacent Eskom Substation. From the Eskom substation, the electricity is fed into the national electricity network (grid).

The proposed Solar PV tracking technology is known as horizontal trackers. Horizontal trackers are ground-mounted and follow the sun's path with the use of typically single-axis technology in order to maximise the amount of direct sunlight on the Solar PV panels.

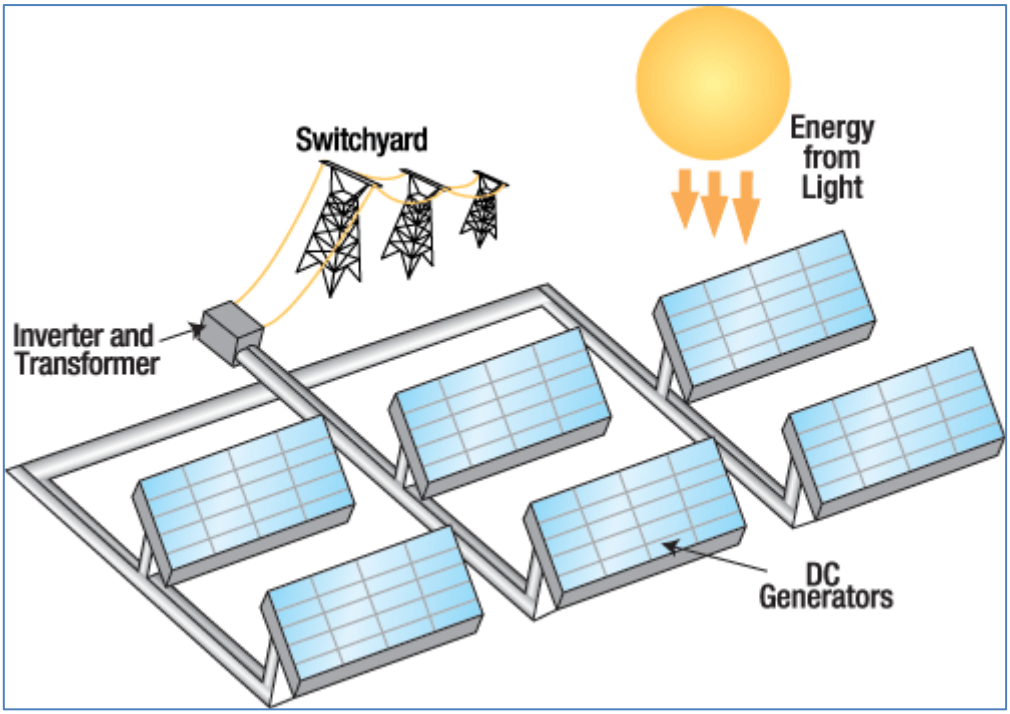


Figure 2: Typical Solar PV Plant diagram

The infrastructure of the facility includes the ground-mounted panels, cables, access roads, auxiliary roads, an onsite substation and a distribution line to the adjacent sub-station.

The primary input of the system is sunlight, which is converted to electricity. The facility also utilises auxiliary electricity from the Eskom grid to power tracker motors in order to optimise the amount of direct sunlight on the solar PV infrastructure.

2.2 Project related benefits

The single largest benefit of the generation of solar energy is the fact that the electricity is generated by means of a renewable source, the sun. This means that the project is sustainable and environmentally friendly and in essence the energy source cannot become depleted like fossil fuels, i.e. coal or oil. This type of energy production does not pollute the environment, it is renewable, reliable and it does not consume anything close to the amount of natural resources when compared to conventional power generation (e.g. coal power plants). Its long term environmental benefits are perhaps the most notable of any electricity source and holds much promise for reducing environmental impacts from electricity production from coal power plants – which is the most technology used in South Africa.

The production of 75MW's alternative energy is a welcomed supplement to South Africa's electricity supply and aligns with the government's targets of reducing reliance on fossil fuel based electricity. The renewable energy projects are treated as "Strategically Important Developments" (SID's) under the IPP Procurement Programmes, since these projects have the potential to make a significant contribution to the national and local economy.

Not only will the project contribute to the existing electricity Eskom grid in the area, but also in achieving the 40% share of new power generation being derived from IPP's nationally.

Long term benefits, particularly related to the local community and society, can be realised through the project, mainly in terms of much needed employment and skills development. Such a project is a very good stimulus for the local and national economy, positively contributing especially to the surrounding community. In addition, the general requirements provided for by government stipulate strong local procurements and local investments into the surrounding communities.

3. Description of the proposed solar facility

The proposed infrastructure, planned to be constructed includes a series of Solar PV arrays with inverters, internal electrical reticulation and an internal road network. It will also be necessary to construct an onsite substation which will typically include a transformer to allow the generated power to be connected to Eskom's electricity grid. Auxiliary buildings, including ablution, workshops and storage areas, are planned to be erected and a distribution line will also be required to distribute the generated electricity from the site to the existing Schuitdrift Eskom substation.

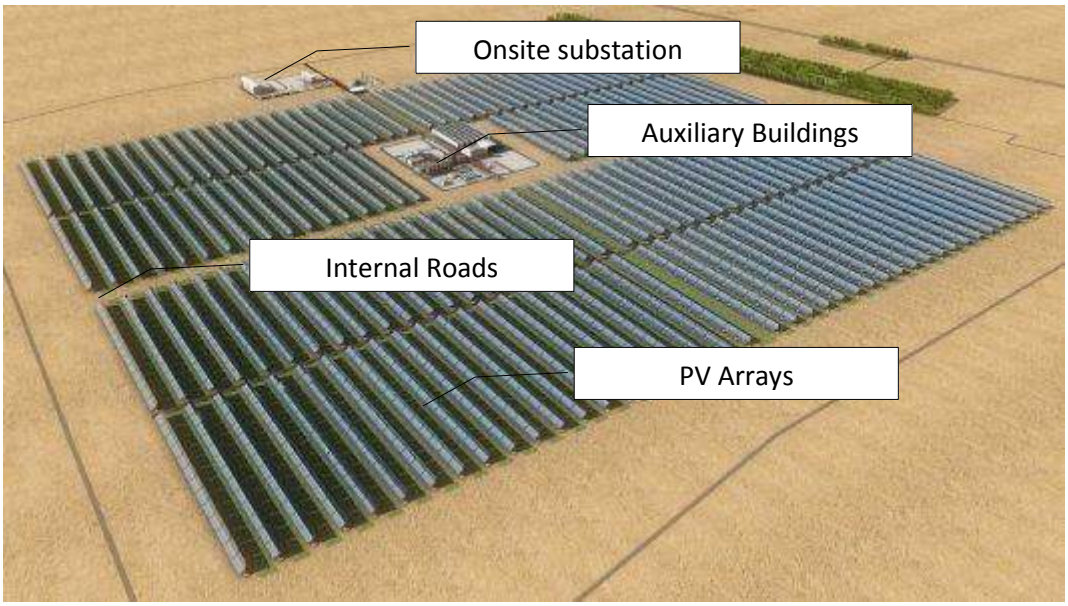


Figure 3: A typical layout of a Solar PV plant

The estimated portion of land each component will typically occupy is summarised in the table below:

Component	Estimate extent of the 75MW plant	Percentage of selected area (less than 250ha)	Percentage of whole farm (±9800ha)
PV Arrays	230 ha (2 km^2)	90%	less than 2.5%
Internal Roads	12 ha (0.12 km^2)	6%	less than 0.2%
Auxiliary Building Area	1 ha (0.01 km^2)	0.5%	less than 0.02%

3.1. Site development components

The final design will consist of different components. A typical description of the components and their assumed impact are listed below:

1. *Position of solar facilities*

The exact position of the solar PV array layout will be determined by the recommendations from the environmental specialists' reports to avoid all sensitive areas in the positioning of the facility. In addition the final layout will be influenced by the final detail design of the project once a tender has been awarded. The layout will be located on around 250ha of the proposed site (Farm 426).

Figure 4: Typical layout of solar arrays

2. *Foundation footprint*

The physical footprint of the PV panels on the ground is formed by a network of vertical poles (typically 100mm in diameter), on which the PV panels are to be mounted (see examples below).

Figure 5: Foundation footprint

Basic drilling or hammering techniques using special tools is used known as ramming. Removal of such foundations is possible upon de-commissioning of the project. The use of concrete for stabilisation is to be avoided as far as possible.

3. *Construction period laydown area*

The laydown area will typically be used for assembly of the PV panels and as a general placement/storage section for construction equipment. The laydown area for the construction period will be approximately 1ha and will be determined by the recommendations from the environmental specialists' reports to avoid all sensitive areas in the positioning of the facility.

4. *Internal roads indication width*

Gravelled internal roads and un-surfaced access tracks are to be provided for. Such access tracks (<4m width and limited to the construction site) will form part of the development footprint. Pathways (<4m width) between the PV panel layout will typically also be provided for cleaning and maintenance of the panels. Existing roads and tracks will be used as far as possible.

5. *Onsite substations and transformers*

The step-up substation and its associated infrastructure and internal roads should have a footprint of approximately 0.04 ha (20mx20m). Note that the 0.04 ha is included in the entire building footprint of <1ha.

Figure 7: Typical onsite substation footprint

6. *Cable routes and trench dimensions*

Shallow trenches for electric cables will be required to connect the PV Panels to the onsite substation (such electric cables are planned along internal roads and/or along pathways between the PV panels).

Figure 8: Cable trenches

7. *Connection routes to the distribution/ transmission network*

Electricity will be transmitted from the onsite step-up substation via new overhead power lines to the existing Eskom substation which is located adjacent and West of the proposed site.

8. *Cut and fill areas*

As far as possible, any cut and fill activity along the access roads will be avoided. The existing roads are currently being used by construction vehicles and should not need any alternation.

9. *Borrow pits*

As far as possible, the creation of borrow pits will also be avoided. Where possible, road surfacing material required (e.g. gravel/base course or stone) will be trucked in to the site from licensed outside sources if required. Currently no borrow pits is planned for this construction site.

10. *Soil heaps*

As far as possible, the creation of permanent soil heaps will be avoided. All topsoil removed for the purpose of digging foundations are to be separately stockpiled within the boundaries of the specified development footprint, for later rehabilitation. It is unlikely that major soil heaps will be required for this construction site.

11. *Auxiliary buildings*

The Auxiliary buildings area will typically include:

- A Workshop
- A Storeroom
- A Change and ablution room
- An administrative and security building
- 10x 10kL water tanks

Figure 9: Foundation of a typical onsite building

The infrastructure boundaries for the auxiliary buildings should occupy approximately 1ha. The workshop will be used for general maintenance of parts, etc. and will typically be 20mx20m. The storeroom will be used for storage of small equipment and parts and will typically be 10mx10m. The change and ablution facilities will be very basic and include toilets, basins and a change area. The administrative and security building will be used as an onsite office and will have a footprint of typically 20mx10m.

The final detailed design and exact coordinated layout of the facility will be designed and finalised should the facility be approved and awarded a tender as an IPP. The component list above is typical to such projects and may deviate due to engineering requirements, new technologies and regulatory changes from the government's tender process. This will be done should the project be approved and the environmental specialists recommendations have been made.

3.2.Project alternatives

In order to propose the best possible design in terms of economic aspects, several alternatives have been considered. The various alternatives considered in terms of site, layout, technology and distribution lines are discussed in the following sections.

3.2.1. Layout Alternatives

The actual location of the different facility components on the less than 250ha development site may vary. Determining the optimal / detailed layout is a costly process which would normally take place once an IPP tender has been awarded to the bidder. Several Solar PV array layout alternatives have however been considered (see Layout Report) and a preferred layout has been identified taking into account the site constraints identified and recommendations made by the various EIA specialists. With the actual construction, the preferred plant layout will stay the same in terms of footprint and size, but the exact location may change within the 250ha boundary.

3.2.2. Technology Alternatives

Photovoltaic (PV) solar power technology has been identified as the preferred technology to generate electricity in this project. There are however, several alternate options in terms of the specific Solar PV technology to be used. These alternatives can be grouped in terms of mounting and film alternatives but should not trigger any major difference in the impact of the project as explained in this report.

Mounting Alternatives

There are two major alternatives in terms of Solar PV mounting, namely fixed-tilt and tracker mounting technology.

When fixed-tilt solar mounting technology is considered, the Solar PV modules are fixed to the ground and do not contain any moving parts. These modules are fixed at a specific north facing angle. This type of technology is less expensive option than tracker technology, but it has a lower energy yield due to the limited exposure to sun radiation.

The preferred technology type is known as horizontal tracker technology. This single-axis technology is designed to follow the path of the sun across the sky. By using to this technology, the modules are exposed to typically 25% more radiation than fixed systems. The design is extremely robust and contains only a few moving parts still having more or less the same footprint and infrastructure requirements than that of fixed-tilt designs.

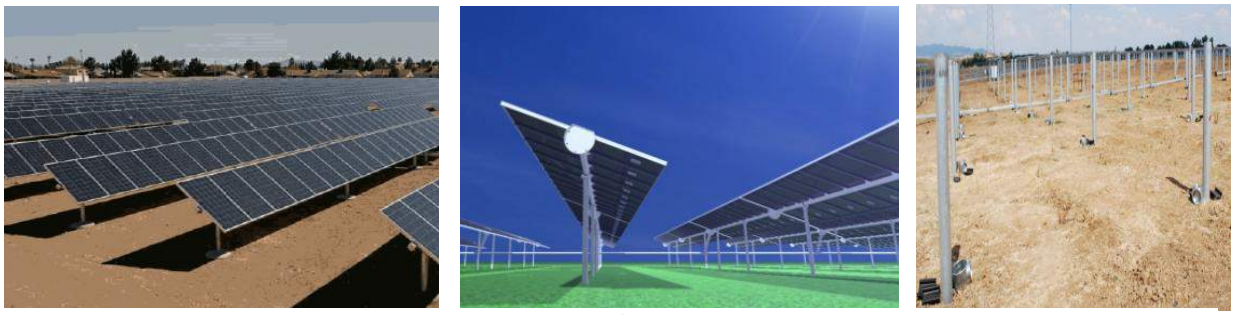


Figure 10: PV tracker mountings

The foundation of mountings can either be laid in concrete, driven piers or screws. Driven piers and screws are recommended in order to minimise the environmental impact of the facility. This

technology imposes a lower cost over the lifetime of the project and offers higher equity returns for investors. The operational risks are limited due to the proven performance and track record.

The tracker requires approximately 1.8 to 2.3 hectares per megawatt. The tracking design is based on a simple design and makes use of a well proven off-the-shelve technology which is readily available. The maximum height of the trackers is typically less than 2m.

Film Alternatives

There are a multitude of different film technologies available today. The best solution, according to research conducted are currently either thin film (amorphous silicon or cadmium telluride) or multi-crystalline cells depending on the space and irradiance conditions, with the electricity yield and application being the deciding factor.

Multi-crystalline cells are the preferred technology type in South Africa, since the output of this technology is higher and it performs better under higher temperatures than the thin film technology. Furthermore, thin film technology is not yet feasible for South African large scale projects due to its higher price.

As mentioned earlier, the film type do not affect the layout and impact from an environmental perspective and would not affect the environmental impact of the proposed project.

3.2.3. The "do-nothing" Alternative

Farm 426 Skuitdrift is currently used for limited stock grazing, limited by water availability and arid weather conditions. The exclusion of 250ha from the 9800ha property for the purposes of the solar facility will not have a significant effect on these farming activities, and minimal impact on the agricultural resources (soil and water). Should the do-nothing alternative be considered, the positive impacts associated with the solar facility (increased revenue for the farmer, local employment and generation of electricity from a renewable resource) will not be realised.

Cape EAPrac, the project's environmental assessment practitioners will report on a full investigation on what environmental impact the option of not developing the proposed facility will have.

4. Construction of the proposed facility

The construction phase of the solar facility should be between 16-18 months. The construction phase of the facility will create roughly 40-50 employment opportunities (during construction) of which most will ideally be local employments. The construction material and sourcing of required goods would most probably be from the local community and surrounding towns.

Should the project be approved, and all required approvals and licenses are obtained from the DEA, NERSA and a Power Purchase Agreement (PPA) is secured with Eskom (Single Buyer's Office, in collaboration with Department of Energy, under IPPPP), the construction is envisioned to begin in the second half of 2014. A series of activities would need to be undertaken, to construct the proposed facility and associated infrastructure.

The facility will be established in different phases namely: the pre-construction, construction, operation and decommissioning phases.

The **preconstruction phase** includes:

1. Conducting of surveys;
2. Transporting of the required construction components and equipment to site.
3. Pre-site preparation (establishment of temporary services for construction such as lavatories, water, health & safety requirements, site office etc.)

The **construction phase** includes:

1. Transportation of solar components and equipment to site,
2. Establishment of internal access roads,
3. Undertaking site preparation (i.e. including clearance of vegetation; and stripping of topsoil where necessary),
4. Erecting of solar PV frames and panels,
5. Constructing the onsite substation,
6. Establishment of additional infrastructure (workshop and maintenance buildings),
7. Establishing the underground connections between PV panels and onsite substation
8. Connection of onsite substation to power grid
9. Undertaking site remediation

The activities that will be undertaken on site, fall under different specialist fields, and include:

- **Civil works:** Site Preparation, Site grading, Drainage, Roads, Foundations, Stormwater & Anti-erosion Management
- **Mechanical works :** Piers Installations, Mechanical Assembly including trackers, Mounting of Panels
- **Electrical works :** Installation from low to high voltage including substation

For the purpose of the engineering report, the stages of the construction phase that have engineering implications will be discussed.

4.1.Transportation of solar components and equipment to site

All solar plant components and equipment are to be transported to the planned site by road. Construction should stretch over a period of approximately 18 months. During this period the majority of the solar PV panels and construction components will be transported by utilising 2x40ft container trucks.

Less than 30 containers will be required per megawatt installed. This will typically include all solar PV components and additional construction equipment. Over the period of 18 months, 2250 containers will therefore be transported to the proposed site. Roughly estimated this amounts to two 2x40ft container trucks per day. Normal construction traffic will also need to be taken into account. The usual civil engineering construction equipment will need to be transported to the site (e.g. excavators, trucks, graders, compaction equipment, cement trucks, etc.) as well as components required for the establishment of the onsite substation power line. Some of this power station equipment may be defined as abnormal loads in terms of the Road Traffic Act (Act No.29 of 1989). Input and approval are to be sought from the relevant road authorities for this purpose.

Transport to the site will be along appropriate national, provincial and local roads. The access roads to the site will be from Pofadder or Kakamas, along the N14. This is a tarred national road and no alterations should be necessary to handle construction traffic and traffic involved in the operation phase. The access road to the Khoi-Sun Development solar facility from the N14 has been confirmed as two divisional roads, the R359 and DR3256 which falls under the Siyanda District Municipality. After a very extensive process it has been clarified that this should not pose any constraints to the projects. According to SANRAL (the South African National Road Agency Limited) these roads fall under Department of Transport, Northern Cape, and no private farm owners consent is necessary.

In some instances, the smaller farm roads may require some alterations (e.g. widening of corners etc.), due to the dimensional requirements of the loads to be transported during the construction phase (i.e. transformers of the onsite substation). Permission from the local authorities can be obtained in this regard if required.

4.2.Establishment of internal access roads on the farm

Internal maintenance roads on the farm and proposed construction site are to be constructed. Where necessary, gravel may be used to service sections of the existing road on the farm itself.

The construction of the access road would normally consist of compacted rock-fill with a layer of higher quality surfacing stone on top. The proposed internal farm access roads will either be comprised of gravel tracks or of compacted rock-fill with layer of higher quality surface stone on top. The preferred alternative is still to be confirmed. If compacted rock-fill is used, a geotechnical survey is planned to be completed to assess the strength and durability properties of the rock strata at the site. It might be necessary to strip off some of the existing vegetation and level the exposed ground surface, in order to form an access track surface. Such access tracks (less than 4m width) will form part of the less than 20ha development footprint. The layout and alignment of these internal roads will be informed by recommendations made by the botanical specialist, as well as the topographical survey. Pathways (less than 4m width) between the Solar PV panels are to be provided for ease of maintenance and cleaning of the panels.

4.3.Site preparation

Cleaning of the surface areas is necessary in order to construct the solar PV plant. This will include clearance of vegetation at the footprint of the solar PV panels, the digging of the onsite substation and workshop area foundations and the establishment of the internal access roads and laydown areas. Where possible, vegetation will be trimmed and not removed. Where stripping of the topsoil is required, the soil is planned to either be stockpiled, backfilled and or spread on site.

Figure 11: Illustration of a typical site after preparation

To reduce the risk of open ground erosion, the site preparation will typically be undertaken in a systematic manner. Where any floral species of concern or sites of cultural / heritage value are involved, measures are to be put in place to attend to the preservation or restoration of these elements.

4.4.Erecting of solar PV panels

Figure 12: Onsite construction of the PV arrays

Once the site preparation has been done, and all necessary equipment has been transported to the site, the Solar PV panels and structures are assembled on site. Each Solar PV module consist of 60 monocrystalline silicon cells , forming a single panel. Each module is capable of generating typically 230W of DC electrical power. The solar PV modules are assembled in long rows across the Solar PV array, with the rows approximately 5m apart. The exact amount of modules in each Solar PV array is subject to the final facility design and is still to be confirmed. Foundation holes for the Solar PV panels are to be mechanically quarried to a depth of approximately 30-50cm. Driven piers and screws are recommended in order to minimise the environmental impact of the facility, hence reduced reliance on concrete foundations.

4.5.Construct onsite substation

An onsite substation will be necessary to enable the connection between the solar energy plant and the National Eskom electricity grid. The generated voltage is planned to be stepped up to 132kV by means of such an onsite substation in order to be fed into the Eskom grid via the Schuitdrift Eskom substation, shown below.

Figure 13: Schuitdrift Eskom substation

The onsite substation is constructed in a few sequential steps. First, a site is determined by the recommendations from the environmental specialist's reports to avoid the most sensitive areas in the positioning of the substation. Once the site is approved, the site clearing and levelling is to be done, after which the access roads to the substation are constructed. Next the substation foundation is laid. Once the foundation is constructed, the assembly, erection and installation of all equipment including the transformers are to be completed. The final step is the connection of the conductors to the equipment. The post-construction phase includes the rehabilitation of disturbed areas and protection of erosion sensitive areas. Below is typical onsite substation that connects to the existing Eskom substation.

Figure 14 : Typical onsite substation

4.6.Establishment of additional infrastructure

To minimise the potential ecological impact of a project of this scope, a decision was made to limit all activities and storage of equipment to one nominated area. A dedicated construction equipment camp and laydown area is planned to be established, which will later form part of the auxiliary building area. This area will typically be used for the assembly of the solar PV panels and the generation placement / storage of construction equipment. A temporary facility is planned to be used to secure the storage of fuel for the on-site construction vehicles. Necessary control measures will be put in place for correct transfer and use of fuel.

The auxiliary building area will typically consisit of the following:

- A Workshop
- A Storeroom
- A Change and Ablution room
- An Administrative and security building
- 10x 10kL water tanks

4.7.Connect onsite substation to power grid

In order to evacuate the power generated by the proposed facility and feed it into the Eskom grid, a distribution line would have to be constructed between the proposed onsitesubstation and the existing Eskom substation. The proposed onsite substation is approximately 200m from the excisting Eskom substation.

The Schuitdrift Eskom substation is currently fitted with a 10MVA 132/33kV step-down transformer and is fed from Paulputs with a 132kV line. From here the power is distributed via a 132kV line to Blouputs and 33kV lines towards Southern Farms, Raap&Skraap and Pofadder.

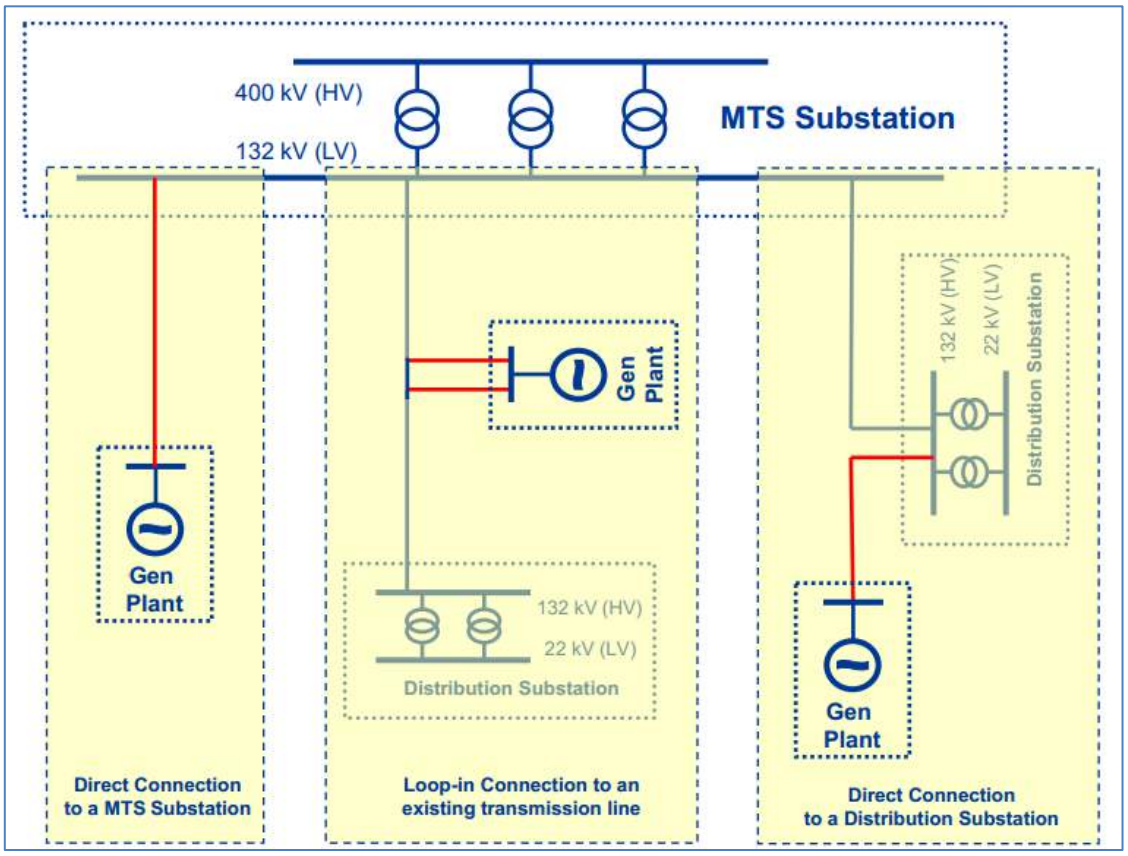


Figure 15: The different connection alternatives

There is currently an excess capacity of 75MW available at the Schuitdrift Eskom substation when connecting to the 132kV busbar or 10MW when connecting to the 33kV busbar without any alterations of the substation's existing infrastructure necessary. It is proposed to construct a 132kV distribution line between the site and the excisting Eskom substation. This line will be constructed by the developers, but would be handed over to Eskom for operation and maintenance.

Scuitdrift is supplied from Paulputs substation, which is equipped with a 125MVA 220/132kV transformer. Currently 110MW has been allocated to the IPPPP phase 1 preferred bidders. Depending on the allocation of preferred bidders in IPPPP phase 2, Paulputs might require strengthening to accommodate additional generation which might require a second transformer being installed.

The single largest risk involved in terms of grid connection is the timelines involved in the upgrading of the Eskom substation if necessary. If the capacity of the substation is allocated to other preferred bidders after IPPPP phase 3, the substation should be upgraded, which could influence the timelines of the project significantly. The upgrade of the substation will also impose significant financial implications.

Feedback from Eskom on the Draft Engineering Report and Draft Scoping Report provides guidance with regard to the planned development, which has been considered during the layout planning.

Eskom also provided generic requirements for works at or near Eskom infrastructure. Eskom's recommendations will be taken into account and a declaration letter explaining the process followed has been attached.

4.8. Undertake site remediation

Once construction is completed and once all construction equipment is removed, the site is to be rehabilitated where practical and reasonable. In the occurrence where access routes to the site were used which will not be used during operation, the access points are to be closed and rehabilitated.

5. Establishment of water sources

It is estimated that approximately 11 200 kl of water in total should be required during the 18 month construction phase (with is an average of 24kl per day when construction is calculated at 6 days a week). In addition, 10 - 18kl of water per day should be required for the cleaning of solar panels and for other operational phase requirements. Note that in terms of cooling of the electricity transformers, dry cooling is to be implemented by means of resin cast transformers.

Weather conditions, traffic and general dustiness of the site play a role in the exact amount of ground water required to wash the Solar PV panels. At present it is assumed that each panel should be washed twice a month.

To further reduce the use of water at the solar facility, the use of alternative panel cleaning methods is also being investigated. The most feasible technology under consideration uses compressed air to blow off any debris from the panel's surface. At this stage the technology is being tested and needs refinement before it would be commercially viable.

5.1. Water sources

1. Boreholes:

The preferred water sources are the existing nearby boreholes on the proposed farm. Three bore-holes are situated near the proposed site, and are seen as water options for the facility. The small volumes of water required for washing of the Solar PV panels and for general operational purposes (maximum of 18kl per day or 500kl per month) can be sourced from these boreholes. According to the initial drilling test records, the boreholes are all strong enough and the water it supplies is drinking water quality. The boreholes at the proposed site can currently supply over 130kl per day compared to the 18kl required. The borehole statistics is attached for the reader's convenience.

2. Southern Farms (alternative supply)

Another option is to get water from Southern Farms, which is situated 7km directly north of the proposed site. Southern Farms acquires water from the Orange River. Negotiations regarding this agreement are being done with the Southern Farms Management. In principle Southern Farms does not have any objections supplying the water, as long as the requirements from the DWA are adhered to. A formal letter confirming the consent has been received. In the instance of the onsite bore-holes not being approved as a liable water source, a pipeline would then be aligned from the proposed site to the Southern Farms facilities, along an existing road. The screening of this road has been included in the specialists' studies. If this option is taken, the water use license application will become an

integrated water use license application where Section 21 C and I will also be included as required by the DWA.

3. Rainwater

As an additional measure, PVC rainwater tanks could also be placed alongside the onsite buildings to collect the rainwater runoff from the roof. These PVC tanks will then form part of the water storing tanks. If necessary, measures can also be put in place to capture the rainwater runoff from the PV panels.

5.2.Water buffer

Water storing infrastructure is to be provided as part of the auxiliary building footprint area. A week's storing capacity are planned to be provided for. This will add up to 10 x 10 kl water tanks.

Figure 16: Typical water storage tank

5.3.Water-use permission

The quantity of water required usually qualifies for a general authorisation, but the specific quaternary area in which the development site is situated does not allow for general authorisation. Thus, a formal water use license would have to be applied for. However, after various discussions with the DWA, it was confirmed that a full assessment of the water use license application will only be undertaken by the DWA, once DEA and DAFF have issued the ROD and the proposed project has been appointed as a preferred bidder by the Department of Energy (DOE). The EIA application can therefore be submitted without a water licence, as long as there is enough confirmation that there are sufficient water available. Feedback from the DWA on the Draft Engineering Report and Draft Scoping Report provides guidance on the requirements for the Water Use Licence and associated water use monitoring. The recommendations made by the DWA will be taken into account. A water declaration letter explaining the process followed has been attached.

5.4.Erosion and storm water control

Due to the extremely low annual rainfall the risk of water erosion is low. The ground condition in the Skuitdrift area is such that any surface water is very quickly absorbed into the soil which avoids water build up on the surface and quickly reducing any water flow which might cause water erosion.

On large structures or buildings appropriate guttering would be used around the building to avoid water erosion where roof water would be flowing off the roof. Wherever practically possible rainfall run-off from the roofs/ gutters will be captured and stored in rainwater tanks. If this water cannot be captured, it will be channelled into energy dissipating structures to spread the water and slowing it down to reduce the risk of erosion. Such structures could be moulded from precast concrete, loosely packed rock or perforated bags filled with stone.

Any rainfall on the solar panels would be welcomed due to its cleaning effect on the solar panels, but as mentioned before, the annual predicted rainfall is very low. The solar panel surfaces are installed at a relatively large incline with gaps between panels. This does not allow significant water build up on the panels while also reducing the energy in falling droplets. Considering that the panels are on a tracking system, this also means that droplets leaving the solar panel surface would not drop onto the same ground areas all this time.

The construction area would cross over a number of seasonal washes. To avoid erosion in these washes recognised building practices will be followed to keep the natural flow of water within its natural borders. It is in the interest of the solar operator to keep the area clean and free of erosion to avoid any damage to the equipment. The solar panels would be installed on frames, allowing for natural water flow underneath the structure.

During the construction phase of the project there might be a risk of wind erosion where natural vegetation is removed. This might increase the risk of damaging sensitive equipment with a sandblasting effect and all parties involved will be vigilant to avoiding this from happening. Once the construction phase is complete the cleared areas will be re-vegetated with locally-collected seed of indigenous species and left for vegetation to return to the area naturally. Bare areas will also be packed with brush removed from other parts of the site to encourage natural vegetation regeneration and limit erosion. Any water being used in the cleaning process would speed up this natural vegetation rehabilitation process. Further it will also have a bonding effect on the sandy soil, avoiding the loose sand blowing away causing wind erosion.

Figure 17: Illustration of current vegetation on the farm

Access roads and internal roads would also be designed and built using recognised erosion and storm water management systems. During the construction phase of the solar PV facility temporary solutions would be implemented to ensure that the environment is preserved in a sustainable way by avoiding erosion. The following figures shows a typical temporary solution that would be implemented during the construction phase, basically consisting of an inlet, channel and outlet. During outflow of the water energy is dissipated allowing any particles to sink to the ground which also avoids fast flowing water to sweep particles up from the ground avoiding erosion, by flowing though packed stones acting as a filter.

Figure 18: Installed concrete pipes and culverts

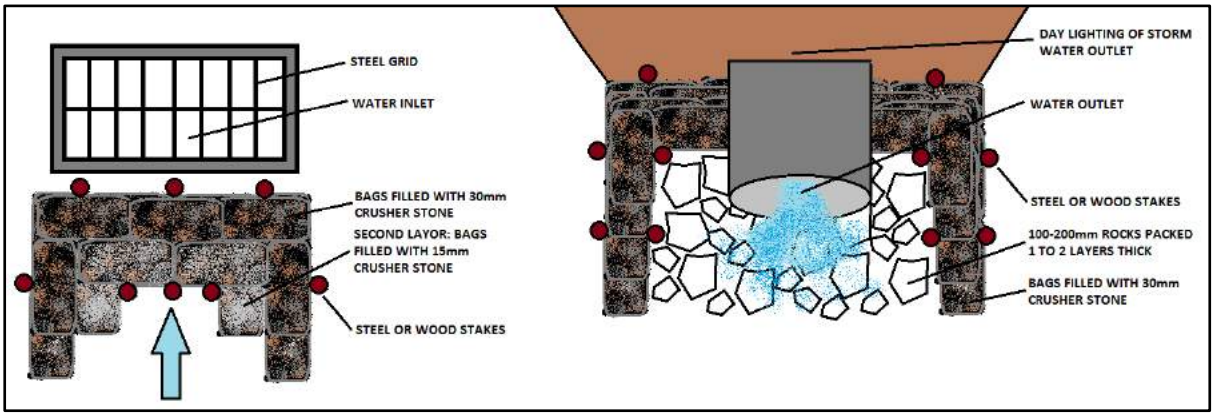


Figure 19: Temporary culvert inlet and outlet

More permanent solutions would be designed to keep storm water under control in a sustainable way. These structures would be built to be aesthetically pleasing by using fixtures such as stones packed in wire mesh to stay in a position or locking retaining walls at the inflow and outflow of the culverts also acting as scour protection. Depending on the situation, which is influenced by the type of water control required, the use of Low Level Stream Crossings (in this particular case it would be a dry water wash for most of the year) or culverts for water runoff management, either portal culverts with bases or reinforced precast concrete pipes would be used as the channelling.

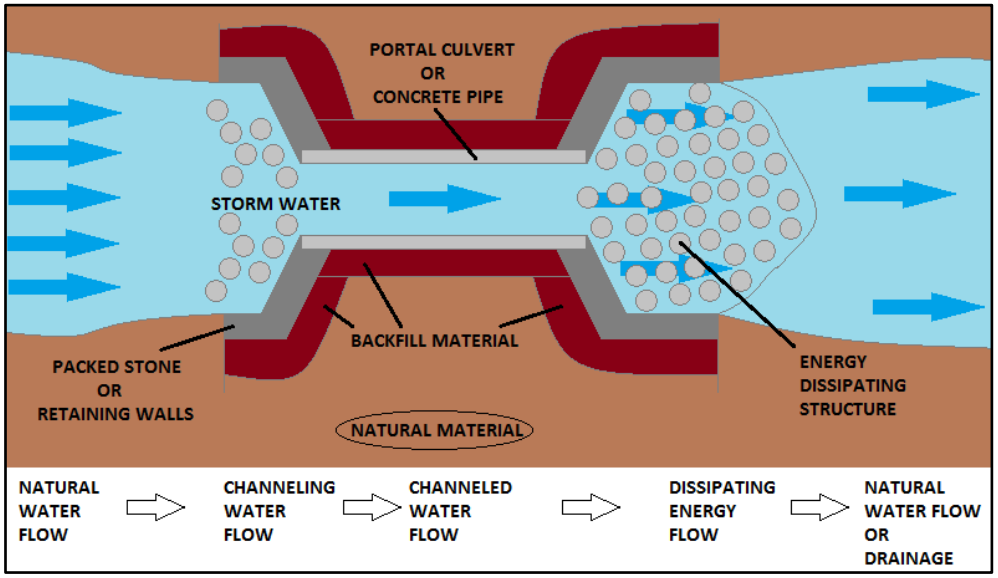


Figure 20: Storm water flow

An alternative to culverts considering drainage line crossings, Low-level River Crossings (LLRC) can be used. A LLRC is a structure that is designed in such a way to provide a bridge when water flow is low, while under high flow conditions water runs over the roadway, without causing damage.

Two types of LLRC can be used depending of the particular situation. A "Causeway" contains openings underneath the surface, which allows passing water through where a "Drift" does not.

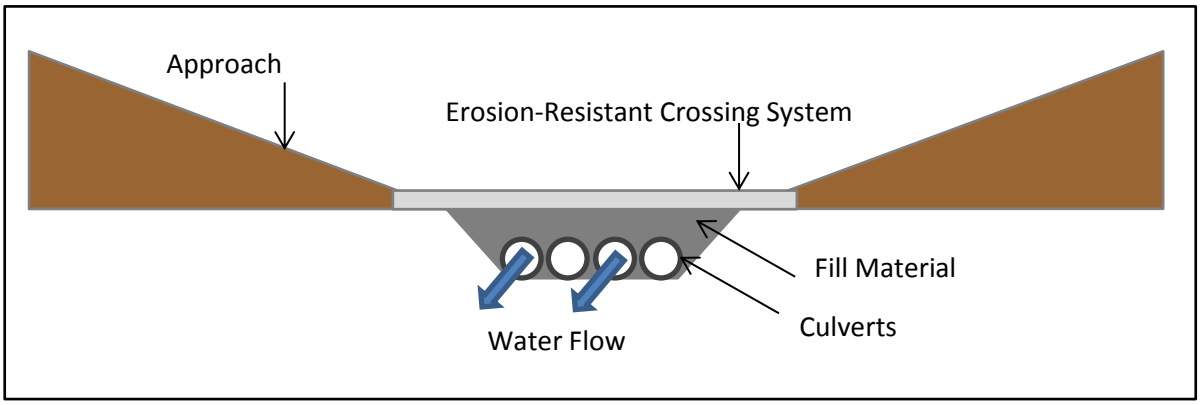


Figure 221: Causeway (Low Level River Crossing)

The same type of erosion control methods discussed with the culverts is taken into account when designing a LLRC. Because a LLRC is designed for water to flow over it, erosion protection is very important. Rock filled baskets, loosely packed rock or perforated bags filled with stone are some of the methods usually considered with LLRC.

6. Project operation and maintenance phase

The aim is to generate at full capacity by 2016. The facility should be operational during daylight hours, except during maintenance, poor weather conditions or breakdowns. Regular maintenance will typically include periodic cleaning, greasing of bearings and inspection. The panels are to be cleaned with water or compressed air, while any waste products are to be disposed of in accordance with relevant waste management legislation.

An estimated total of six full time staff members will typically be required during the operation phase of the project, which includes permanent technicians, maintenance and security personnel. Approximately three unskilled labourers will be needed for maintenance purposes and two security personnel will be deployed on a shift basis. One skilled staff member will be needed to manage and oversee the operations. Staff can be transported around the site using utility vehicles and a typical mini bus to transport staff from nearby towns of Kakamas and surrounding community. From time to time additional contract staff may be required for ad hoc ground cleaning or special panel cleaning.

7. Project decommission phase

The proposed solar energy facility is expected to have a lifespan of approximately 30 years if the specified periodic maintenance is performed. Once the facility has reached the end of its economic life, the infrastructure is to be decommissioned. The decommissioning of the facility would entail the disassembly and replacement of components with other appropriate technologies. However, if not

deemed so, then the facility would be completely decommissioned which would include the following decommissioning activities.

Site decommissioning preparation activities should include confirming the integrity of access to the site. Site access should be able to accommodate the required equipment (e.g. lay down areas, construction platform) and the mobilisation of decommissioning equipment.

The components would be disassembled, reused and recycled where possible, or disposed of in accordance with regulatory requirements. Functional components are planned to be donated to and installed at local schools and clinics for the benefit of the community.

8. Project output

8.1. Waste effluent, emission and noise management

Solid waste management

During the construction phase an estimated amount of less than 5m^3 non-hazardous solid construction waste are to be produced per month, for the expected 6 month construction period. All construction waste should be safely stored, and should be removed from site on an ad hoc basis by the appointed construction contractor where and when deemed necessary. The construction waste, where applicable, are to be disposed at an appropriately licenced Municipal landfill site.

During operational phase after construction, the facility should not produce any solid wastes.

Liquid effluent (sewage)

Sewage is planned to be treated onsite by means of a septic tank system or conservancy tank system. Due to the locality of the farm, sewage cannot be disposed in a municipal sewage system.

Emissions into the atmosphere and noise generation

Very little emissions should be released into the atmosphere and no significant noise should be generated, except during the construction period with drilling and hammering. Due to the site location this should not pose any issue as no residential area is located nearby.

9. Cost implications & revenue

9.1.Project cost overview

Renewable energy projects, such as the Khoi-Sun Development, require significant investment. Funds of equity and debt investors, either from foreign or domestic sources are obtained. The cost requirements and potential revenue is discussed in this section, sketching a business case for the development of renewable energy projects within South Africa (specifically solar farms in the Northern Cape).

The project costs consist of two parts, capital cost and running cost. The capital cost pertains to all costs incurred for the establishment of a producing facility. The running cost relates to those costs incurred to ensure that the facility operates as it should throughout its expected lifetime.

Solar PV installations can operate for many years with little maintenance or intervention. Therefore after the initial capital outlay required for building the solar power plant, financial investment is limited. Operating costs are also extremely low compared to existing power technologies.

9.2. Project specific costs

The Khoi-Sun Development's detailed costing has not been completed on the date of submitting this engineering report. The project is however based on the industry standard cost, with capital expenditure that can amount to more or less R30M per megawatt installed capacity. The running cost of a Solar PV facility is minimal related to the initial capital cost, contributing to the most significant cost of constructing and running a solar PV facility.

9.3. Revenue streams

The payback of the Khoi-Sun Development results mainly from electricity sales, intended under the current governmental subsidy, known as the Independent Power Producer Procurement Program (IPP procurement program).

The IPP procurement program portrays fixed ceiling prices for bidders to tender against. The establishment of these ceiling prices is based on industry standard return on investments. The governmental study performed identified the feed-in tariff per technology related to the capital cost required per technology against its revenue potential, identifying the required subsidy per technology to be paid.

In short the subsidy offered by the governmental procurement program (IPP procurement program) enables the project to be financially viable by selling electricity at a subsidised price, while the costs of such a facility relates to the industry standard.

As part of the IPP procurement program preferred bidders will enter into a power purchase agreement between the IPP generator and the Single Buyers office. National treasury stands-in for surety, while NERSA regulates the IPP licences.

NERSA and the IPP procurement program require an approved EIA Environmental Authorisation / Record of Decision as a gate keeping criteria, where no project would be considered without the EIA Environmental Authorisation being given.

10. Project program and timelines

As mentioned previously the Khoi-Sun Development is intended to be lodged under the IPP procurement program. The program has definite and stringent timelines, which the project should meet:

#	Description	Timeline
1	IPP procurement program submission (3rd round)	19 August 2013
2	Preferred bidders selected	October 2013
3	Finalisation of agreements	October 2013 – April 2014
4	Procurement of infrastructure	May 2014 – July 2014
5	Construction	August 2014 – January 2016
6	Commissioning	February 2015 – March 2016

The table above clearly depicts the dependence of the project on the IPP procurement program's timelines. Any delay within the IPP procurement program will have a corresponding effect on the timelines of the Khoi-Sun Development's timelines.

11. Conclusion

In conclusion, the overall significance of the Khoi-Sun Development outweighs the negative impacts the project can have. From an environmental perspective the project can be well-managed with sound contingencies being put in place to prevent harm to surrounding areas.

The project does make significant contribution from a social and economic perspective. Such benefits include potential revenue for the landowner, job creation during construction and the 20-30 year operational phase. In addition, much needed electricity is generated and fed into Eskom's national grid, taken from a sustainable carbon-free natural energy resource.

If the recommended mitigation measures contained in the EMP are implemented, there should be no lasting significant negative environmental impacts arising from the development of the project. This pertains to the construction phase as well as the operational phase. Solar projects use remarkable technology which can ensure a sustainable future for electricity generation. This is especially true since it do not severely impact the environment as with coal power generation or similar technologies.

In the light of the long term benefits the Khoi-Sun Development has, upon approval of this application the project can be implemented with minimum environmental negatives.

Appendixes

I. Solek Company Profile

II. Water declaration - Skuitdrift

Solek
Renewable Energy Engineers Est.1988
consulting - supply - partnering

Who we are

Our company Solek, was founded in 1988 and has a proven track record of experience and professional service in South Africa. The company has crossed borders and now extends into Africa. Two decades of practical experience, collaboration with local importers and exporters, and internal knowledge defines our capacity. Research and innovation is the heartbeat of the company. Our focus revolves around doing what we do best:

Consult	Provide key knowledge to meet our client demands
Supply	Source and supply the needed products & technology
Partner	Collaborate with key partners to extend our reach

Resource network

Partnering and long-term relations are the business approach we value. Ongoing partnerships with well-established solar companies provide added resources which the company can tap into. Broad expertise and man-power are available if needed. The aim is to support and collaborate rather than compete.

Experience

New branch in Stellenbosch	Core capacity moved to Western Cape, where engineering office is based; branch in Loeriesfontein, Northern Cape.
***eta* Awards**	Received a Special Award sponsered by Eskom and the Department of Energy in 2011 for the Kleinmond EPC.
PV grid-tie systems	Two-decade client base: hundreds of clients in Northern Cape and elsewhere give evidence of the company's success.
Kleinmond EPC	Design, consulting and procurement of solar PV and solar water heaters for over 400 low-cost houses in Kleinmond.
Solar farms Northern Cape	Secured sites for development of utility scale solar projects. Solek is in the process of assisting the development thereof under the Department of Energy's IPP scheme.
Engen Namibia	3kWp grid-tie PV system for Engen Namibia to provide base load power for evaporative air-cooling units.
Angola off-grid project	Consultants and sub-contractors to partially supply, install and train solar installations for 120 schools & clinics.
Biogas project development	Waste-to-energy project under development in KwaZulu-Natal - to feed Eskom national grid.
Angola village systems	Consulted and supplied solar cells, battery and inverter systems to small households in Angola.
Consulting & advising	Solar energy advisors for Namakwa District Municipality & consultants for Western Cape Department of Agriculture.

Solek Innovations cc t/a Solek
VAT No. 4750253967
www.solek.co.za

George Blake 15
Plankenbrug
Stellenbosch, 7600

Tel: 086 100 4637
Fax: 086 608 8181
info@solek.co.za

Expertise

The heart of the company beats with many years' experience. Engineering knowledge including master-degrees and related qualifications extend management arms. Industrial engineering together with our sought-after technical and electrical know-how boost efficient operations help manage extending projects and deal with sourcing and supply issues.

Supplier support

Solek focuses on long-term customer value. Only quality products are supplied backed by major suppliers for support and warranties, locally and abroad. This provides a knowledge base and strong competitive advantage which differentiate Solek from other solar companies. Products supplied by Solek have proven to last 15 years and more, thus enduring harsh African conditions.

Consulting

Owing to our experience, the company engages in risk assessment, quality assurance and project due diligences. Typically, tenders can be evaluated to ensure the right products are supplied, system design is correct and margins acceptable based on industry models. The company has extensive experience in hybrid and off-grid systems design, providing optimal performance at minimal cost.

Innovation & Research

The company has a track record of innovative ideas. An entrepreneurial spirit boosts performance to deliver inventions and solutions beyond expectations. Research and development reinforce our long-term focus and Solek collaborates with Stellenbosch University as well as Cape Peninsula University of Technology. Products have been patented and released to the market.

Value-added service

In addition to consulting and technology supply, value-added services are provided, such as project management, installation and post-installation services. A lifecycle approach ensures longevity in the solutions we implement and a single sub-contractor to outsource various functions to.

Legacy

As part of our business model we believe industry has to touch lives. The vision of the company ensures that resources are committed beyond monetary value to affect society. Projects have been initiated to serve the less privileged through inventive ways and thousands have been influenced already. The company dedicates its knowledge and expertise to effectively reach this goal.

Solek Innovations cc t/a Solek
VAT No. 4750253967
www.solek.co.za

George Blake 15
Plankenbrug
Stellenbosch, 7600

Tel: 086 100 4637
Fax: 086 608 8181
info@solek.co.za

Water-use application

The water volume required during the construction of the facility would be no more than 24m^3 per day while the water volume required during the operation of the solar facility would be no more than 18m^3 per day. In the past such a small amount of water would have been allocated under Small Industrial Use by means of a General Authorisation. However, since the development area falls within the D81E and D82C quaternary area, a formal water license must be applied for. After various discussions with the Department of Water Affairs (DWA), it was confirmed that the Water Use Licence Application (WULA) would only be undertaken by the DWA once the Department of Environmental Affairs (DEA) have issued the relevant Environmental Authorisation (EA)/ Record of Decision (ROD) and the proposed project has been approved and selected as a preferred bidder by the Department of Energy (DOE). The Environmental Impact Assessment application can therefore be submitted without a water license; as long as there is enough confirmation that sufficient water sources are available.

Considering this process, a preliminary investigation was done to make sure there is sufficient water available. The preliminary investigation showed that the two water-source alternatives, namely the onsite boreholes and water from Southern Farms (from Orange River), both have sufficient capacity to supply in the water demands of the proposed development. Statistics on the boreholes is shown below.

In their comment on the Draft Scoping Report and Engineering Report, dated 28 June 2012, the DWA recommended the following:

- A full geo-hydrological study be done, to ensure that the groundwater use will not affect any surrounding groundwater users. This study will be submitted with the water use license application.
- That the existing farm boreholes be fitted with flow meters to measure the volumes of water abstracted (and keep record of such);
- That the water level of the boreholes be monitored on a monthly basis (and records kept);
- That a 24-hour pump test be done on each borehole to determine the amount of water each borehole can deliver (these pump test results must be submitted to the DWA with the WULA); and
- Should the option to use water from Southern Farm be taken, and the proposed pipeline or road alteration / upgrade cross any dry watercourses/drainage lines/ washes, the Water Use Licence Application (WULA) should be supplemented to apply in terms of Section 21(c)&(i) (DW781 Supplementary Form).
- In addition, water used for dust suppression on gravel roads must be of a quality compliant with the General Special Effluent Standards (31/03/2009): Temperature: max.25°C, pH: between 5.5 & 7.5 and conductivity: not be increased more than 15% above the intake water & not exceed 250 milli-Siemens per metre (determined at 25°C). The water used for dust suppression is likely to be borehole water / water from Southern Farms, and not treated effluent. However the water quality standards mentioned will be taken note of.

As stated in the DWA comments, these requirements will only be applicable once the project has been appointed as a preferred bidder and the application for a water license can be submitted. Regarding water-use, DEA can therefore issue the EA/ROD on the conditions that the abovementioned requirements from the DWA will be adhered to.

Consulting advice regarding this water application process was received from the DWA and MBB South, a consulting engineering company specialising in agricultural developments and water-affairs. Advice was also received from Cape EAPrac, environmental practitioners. Persons spoken to:

DWA:	Danita Hohne,	054 338 5881
	Alexia Hlangane,	054 338 5881
	Annetjie Steenkamp	054 338 5881
MBB South:	Matthys J. Saayman	021 887 1026
	Francios du Plessis	021 887 1026
Cape EAPrac:	Louis-Mari van Zyl	044 874 0365
	Sian Holder	044 874 0365
	Dale Holder	044 874 0365

BOREHOLE CAPACITY DECLARATION

Solek Renewable Energy hereby declare that the following information regarding the three boreholes on Farm 426 Skuitdrift to be accurate and true, as received first-hand from Frederik Johannes Nel, the registered owner of the property Farm 426 Skuitdrift.

The coordinates of the boreholes are as follows:

1. Old House: 28°36'30" S 19°46'24" E
2. Homestead: 28°35'44" S 19°45'13" E
3. Rooidraai: 28°34'5.8" S 19°44'3" E

After these boreholes were sunk, 9 hour constant discharge pump tests were conducted on each hole. According to these tests, the various capacities of the holes were documented to be the following:

Borehole	Kilolitres per 9 hours	Kilolitres per day
Old House	3,6 kl/h for 9h	32.4 kl per day
Homestead	3,375 kl/h for 9h	30.3 kl per day
Rooidraai	8,325 kl/h for 9h	74.9 kl per day
TOTAL	15.3 kl/h for 9h	137.6 kl per day

These boreholes have been utilised for the past 47 years for agricultural purposes and have never run dry or produced less than normal. The groundwater available is more than sufficient to supply the demand of the proposed solar development which requires approximately 20kl per day compared to the total available 137kl.

....10/07/2012.....

Wiehann van Zyl Date

Director

Solek Innovations cc t/a Solek
VAT No. 4750253967
www.solek.co.za

15 George Blake ave.
Stellenbosch, 7600
Private Bag X 5008, Stellenbosch, 7599

Tel: 086 100 4637
Fax: 086 608 8181
info@solek.co.za

southernfarms

Plaas 410, Schuitdrift, Augrabies
Reg:1998/017898/07

PO Box 156 Augrabies South Africa 8874

Tel: +2754 453 3011
Fax: +2754 453 0015
E-mail: info@southernfarms.co.za

To whom it may concern

RE CONSENT FOR WATER USE

I, Louis Hanekom, hereby give consent to the applicant Khoi-Sun Development (Pty) Ltd, that the applicant may negotiate terms and conditions for the use of the water from Southern Farms for the Scuitdrift 75MW Solar Project.

By signing this letter I agree that in principle I do not have objections against the negotiation for the use of water from Southern Farms.

.....
Signature

15 May 2012
Date

Eskom

Upington CS
PO Box 500
UPINGTON
8800

Mev E van der Merwe
Khoi-Sun Development
Posbus 871
STELLENBOCH
7599

11 May 2011

H Blaauw
+27 54 3371257

Mev van der Merwe

BERAAMDE KOSTE TEN OPSIGTE VAN MOONTLIKE 33KV LYNVERSKUIWING TE SCHUITDRIFT

Dit sal egter moontlik wees vir die verskuiwing van die bestaande lyn op die volgende voorwaardes naamlik:

Met grondeienaar se skriftelike toestemming.
Die koste van ongeveer R350 000.00 – R400 000.00 ~~000~~ deur die aansoeker gedra word.

Graag verneem ons van u

Vriendelike Groete.

Z M WALKERS
KLANTEDIENS AREA BESTUURDER

11/5/2012
.....
Date

APPENDIX E:
SURFACE WATER ASSESSMENT REPORT

DIGBY WELLS
ENVIRONMENTAL

Development of the 5 MW Skuitdrift 2 Solar PV Energy Facility

Surface Water Assessment Report

Project Number:

KSD4629

Prepared for:

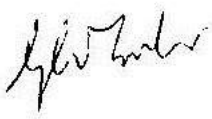
Khoi-Sun Development (Pty) Ltd

January 2018

Digby Wells and Associates (South Africa) (Pty) Ltd
Co. Reg. No. 2010/008577/07. Turnberry Office Park, 48 Grosvenor Road, Bryanston, 2191. Private Bag X10046, Randburg, 2125, South Africa
Tel: +27 11 789 9495, Fax: +27 11 069 6801, info@digbywells.com, www.digbywells.com

This document has been prepared by Digby Wells Environmental.

Report Type:	**Surface Water Assessment Report**
Project Name:	**Development of the 5 MW Skuitdrift 2 Solar PV Energy Facility**
Project Code:	**KSD4629**

Name	Responsibility	Signature	Date
Mashudu Rafundisani	Report Writer		October 2017 January 2018
Graham Trusler	Review		17 October 2017

EXECUTIVE SUMMARY

Digby Wells Environmental (hereafter Digby Wells) has been appointed by Khoi-Sun Development (Pty) Ltd (hereafter Khoi-Sun Development) to undertake a Hydrological/Surface water assessment in support of a water use license application in terms of the National Water Act (Act 36 of 1998) for the proposed development of the 5 MW Skuitdrift 2 Solar PV Energy Facility. The proposed development is located in the Kai! Garib Local Municipality, near Augrabies, Northern Cape District.

Skuitdrift 2 Solar PV Energy Facility is proposed for the purposes of generating sufficient renewable energy capable of supplementing electricity supply to the Eskom Schuitdrift substation located some 500m from the proposed development footprint.

In support of the Water Use License Application, a surface water assessment was conducted with the aim of determining the hydrological baseline conditions of the project area and the surrounds prior to commencement of project, to assess and identify the potential surface water/hydrological impacts that could emanate from the project and its associated activities.

A site visit was conducted on the 29th of May 2017 and the 19th of September 2017 to verify the hydrological characteristics of the site. The Northern Cape is characterised by low rainfall and the extreme temperatures and as a result, the area was completely dry during the site verification with no patches of water visible within the footprint of the project area.

During the site assessment, a number of drainage line/runoff pathways were also identified within and around the demarcated project boundary. Only two drainage lines (as indicated in the 1:50 000 topographic data) exist within the north-west side of the project boundary. Other runoff pathways were classified as “Washes” defined as those areas which show visible signs of occasional water movement and sediment transport, but which do not receive sufficient runoff to develop characteristic soils or vegetation associated with wetlands or drainage lines. Washes are a characteristic feature of arid and semi-arid environments and are related to the occurrence of occasional intense rainfall events within areas of low total rainfall (Cape EAPrac, 2013).

The identified potential surface water/hydrological impacts that could emanate from the project and its associated activities include:

- Disturbance or alteration of the existing washes and drainage lines which may affect runoff finding its way to the drainage lines that are tributary to the Orange River;
- Siltation of the water course when runoff and dust from cleared areas reports into the washes and drainage lines. The significance of such impact is however expected to be minimal considering that no runoff occurs on average.

The D81D quaternary catchment has a net area of 1826 km^2 (182 600 ha) which receives an average of 113 mm of rainfall per annum whilst the evaporation rate is an average of 2750 mm per annum. There is no measurable runoff on average.

The proposed solar project and the associated infrastructure will occupy a total footprint area of 19 ha which amounts to 0.01% of the total quaternary catchment area. Any disturbance or alteration of runoff (if any) from this area will definitely be very small and is considered negligible.

A risk assessment in terms of section 39 (1) of the National Water Act, as defined in section 21(c) or section 21(i), No. 40229, August 2016 has been completed. The identified risks after mitigation measures are in place were rated as low risk. Based on the findings of the risk assessment, it was recommended that a general authorisation be granted for this project and Khoi-Sun Development be exempted from applying for a licence in terms of the National Water Act (Act 36 of 1998).

However, a pre-consultation meeting was held with the DWS and it was decided that a water use license application should be completed since the project involves other section 21 water uses which do not qualify for general authorisation.

This assessment has also provided the appropriate mitigation/management measures to prevent, and/or minimise the identified potential surface water impacts, should they occur.

With all the mitigation and management measures in place, this project is unlikely to pose a significant threat to the natural water course and the hydrological features within and around the project area. The proposed development of the 5 MW Skuitdrift 2 Solar PV Energy Facility can therefore go ahead.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1 Introduction

Digby Wells Environmental (hereafter Digby Wells) has been appointed by Khoi-Sun Development (Pty) Ltd (hereafter Khoi-Sun Development) to undertake a Hydrological/Surface water assessment in support of a water use license application in terms of the National Water Act (Act 36 of 1998) for the proposed development of the 5 MW Skuitdrift 2 Solar PV Energy Facility. The proposed development is located in the Kai! Garib Local Municipality, near Augrabies, Northern Cape District.

1.1 Project Description and Location

Khoi-Sun Development intends to develop a 5 MW photovoltaic solar energy facility on the Farm Skuitdrif 426 which is referred to as the Skuitdrift 2 Solar PV Energy Facility. The development has been granted an environmental authorisation on 26 June 2013 in terms of the National Environmental Management Act, 1998: GN R. 543, 544, 545 and 546 (DEA ref: 12/12/20/2600).

The purpose of the proposed project is to generate sufficient renewable energy capable of supplementing electricity supply to the Eskom Schuitdrift substation located some 500 m from the proposed development footprint. The facility will have a generating capacity of up to 5 MW and will have a facility footprint of 19 ha. In order to evacuate the generated power to the Eskom Schuitdrift substation a new overhead 33 kV power line will be constructed between the onsite substation within the PV Solar Facility footprint and the Eskom Schuitdrift substation. The regional and local setting maps are shown on Figure 1-1 and Figure 1-2.

Within the 19 ha footprint, permanent infrastructure will include:

- A small site office (10m x 10m), and storage facility (20m x 10m), including security and ablution facilities (20m x 20m);
- A lay-down area;
- Two 10kL rain water tanks;
- Inverter stations (built within transporter containers, 25m² in size);
- An onsite substation and transformers;
- A short overhead 33kV power line of ~ 630m;
- Underground cabling to run the length of the arrays and link the arrays to inverters;
- The main re-aligned access road;
- Service roads which will run between the rows of arrays;
- PV panels and trackers;
- Perimeter fencing around the solar facility;

Additional auxiliary electrical equipment includes:

- Diesel generator sets will supply power to security and monitoring systems in the event of a grid failure;
- Security system, fence and access control;
- Fire detection system;
- Weather monitoring equipment (rainfall, wind speed/direction, solar irradiation, air moisture);
- Plant monitoring equipment and associated telecommunication links; and
- Air-conditioning equipment inside inverter/transformer enclosures which will regulate the operating temperature of the inverters.

The proposed infrastructure can be seen in Figure 1-3

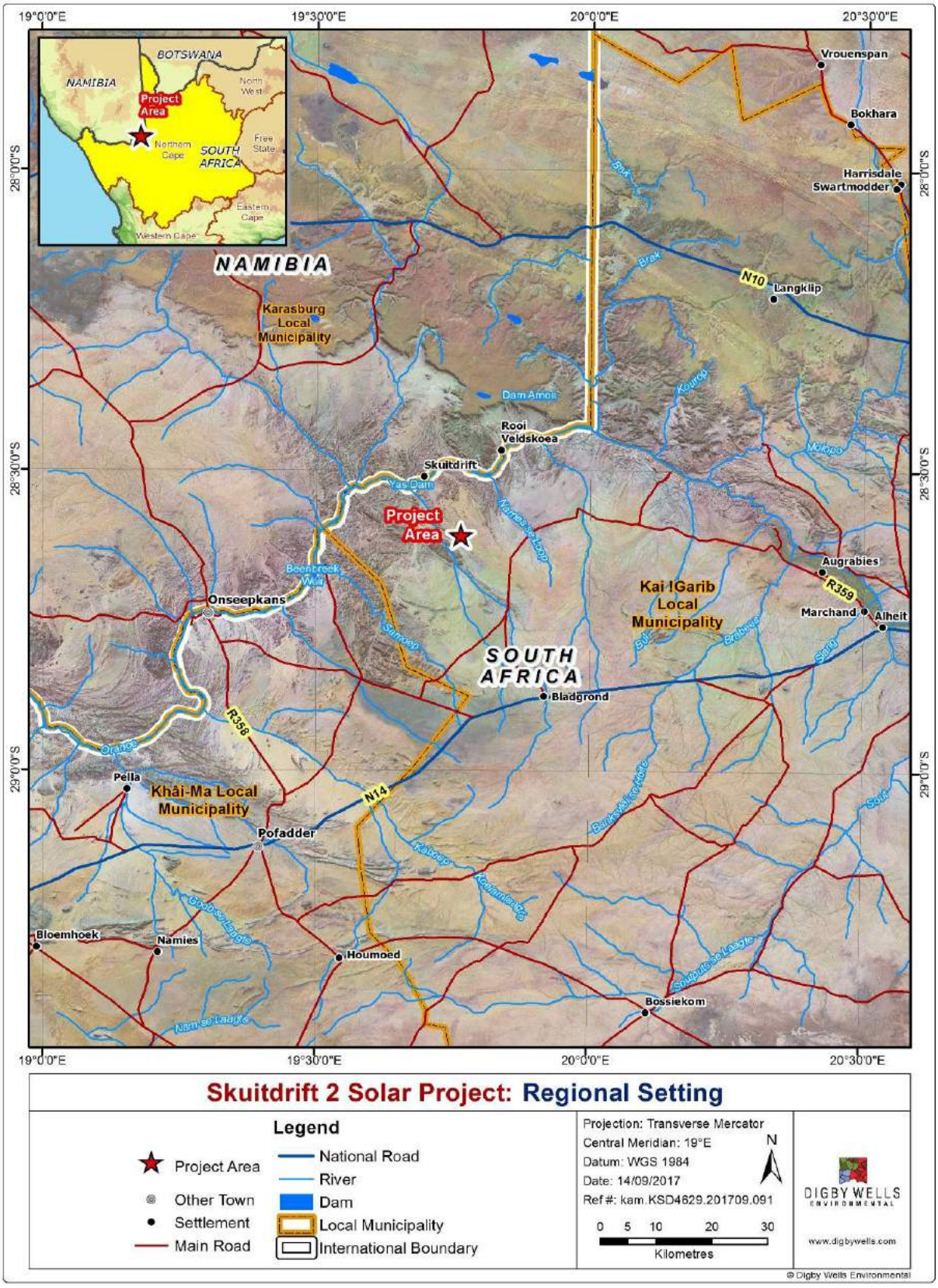


Figure 1-1: Regional Setting

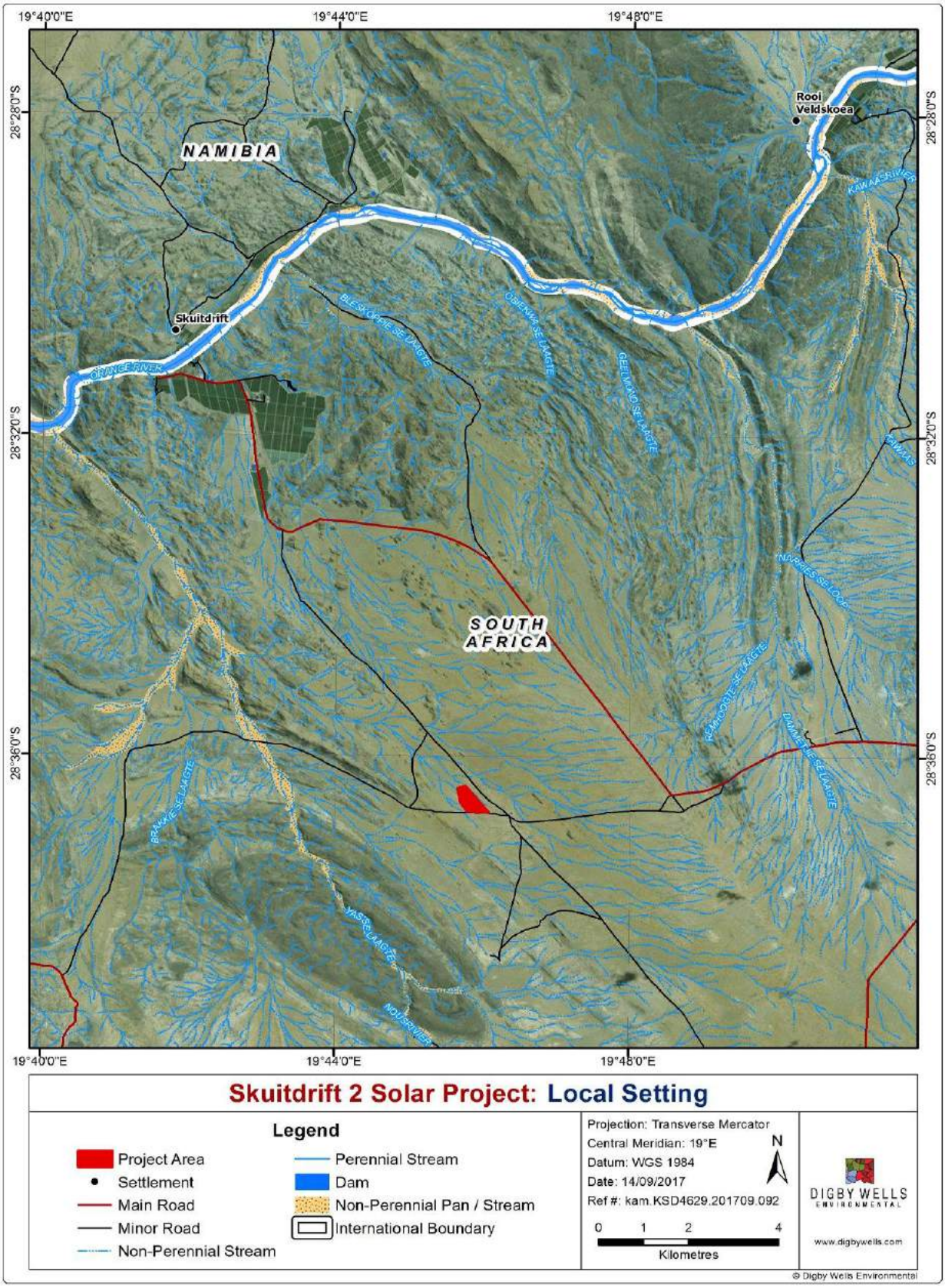


Figure 1-2: Local Setting

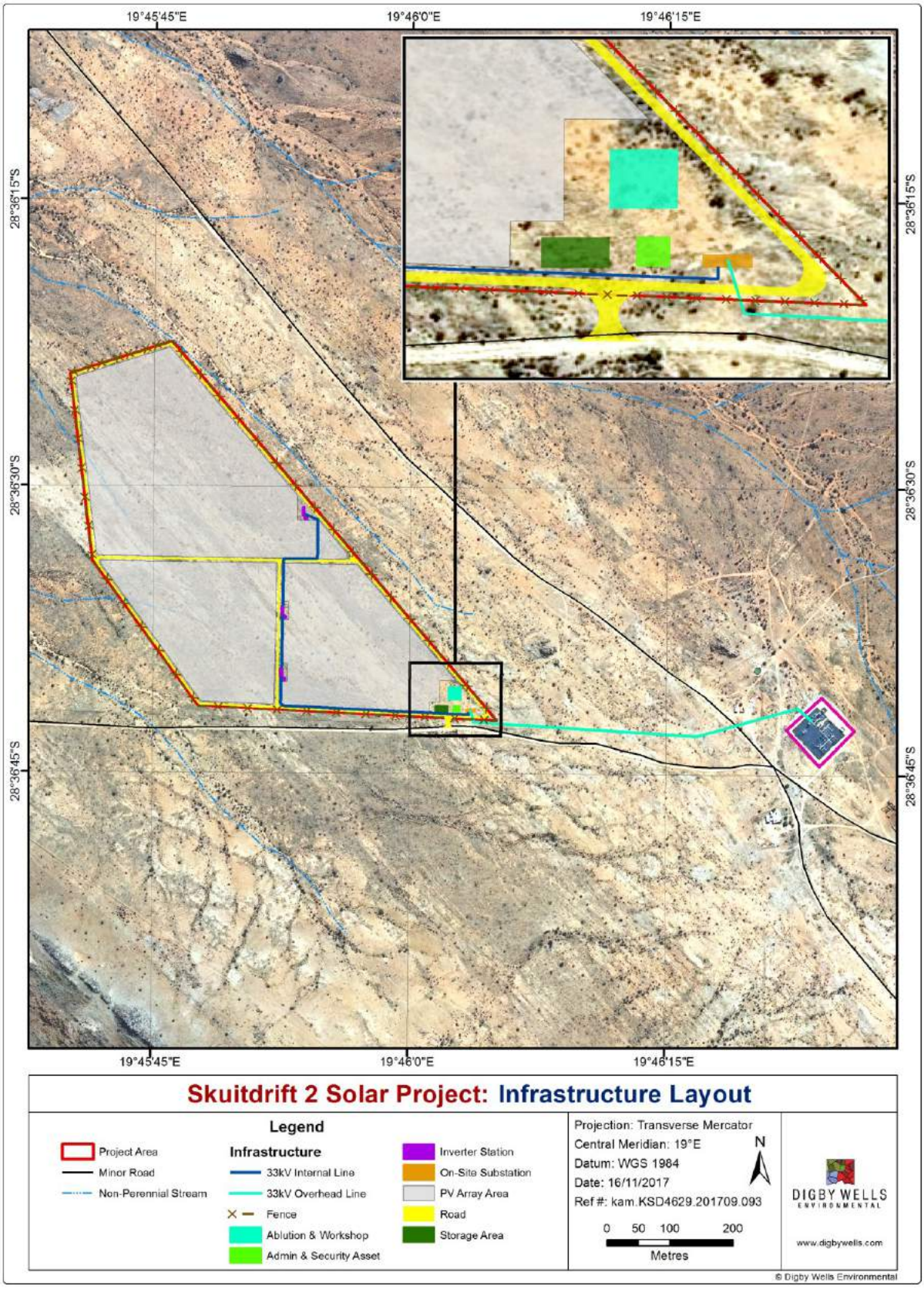


Figure 1-3: Proposed Infrastructure

1.2 Terms of Reference

This report serves to provide the hydrological description of the receiving water environment prior to commencement of project, assess and identify the potential surface water impacts that could emanate from the project and its associated activities. The report will also provide the appropriate mitigation measures to prevent and/or minimise the identified potential impacts. This will be limited to the proposed infrastructure provided in the Infrastructure Plan (Figure 1-3).

2 Details of the Specialist

Mashudu Rafundisani is a Surface Water Consultant (Hydrologist) with over 4 years working experience in the Water Geo-Sciences Department in Digby Wells Environmental. He holds an Honours Degree in Environmental Management from the University of Venda (South Africa). Mashudu has completed numerous surface water specialist studies which includes, but not limited to; floodline modelling using HEC-RAS software, development of Storm Water Management Plans, Water and Salt Balances, Sampling and analysis/interpretation of surface water quality, surface water specialist studies for input on EIA/EMPs and BAR, Integrated Water and Waste Management Plans (IWWMP), Water Use Licence Applications (IWULA) and auditing. He has working experience on projects within South Africa, Mali, Ivory Coast, Malawi and other parts of Africa.

3 Objectives

The objectives of this surface water assessment are to determine the following:

- Baseline hydrological description; and
- Potential surface water impacts that could emanate from the project and its associated activities together with the appropriate management or mitigation measures.

4 Methodology

4.1 Desktop Assessment

Existing reports and aerial images for the area have been reviewed prior to compilation of this report to obtain background information and/or utilise the relevant information when compiling this report. The documents that were reviewed include, but are not limited to (refer to section 12 for complete reference list):

- Final Impact Assessment Report & Environmental Management Programme for 'Khoi-Sun Development' on a portion of Farm 426, Skuitdrift, Northern Cape, March 2013;

- EIA Engineering Report. Compiled by Solek (Renewable Energy Engineers). January 2013; and
- WR2012, "Water Resources of South Africa, 2012 Study (WR2012)", Water Research Commission, Pretoria.

4.2 Fieldwork

A site visit was conducted on the 29th of May 2017 and the 19th of September 2017 to assess and verify the hydrological characteristics of the proposed development site. Northern Cape is characterised by very low rainfall and extreme temperatures. From the historical rainfall data, an average 6.9 mm of rainfall is expected in May while September is one of the driest months in this region (average of 3.4mm). As a result, the area was completely dry during the two site visits with no patches of water observed within the footprint of the project area.

The closest flowing river/stream is the Orange River which is located approximately 12 km north of the proposed project area. Considering this distance, it is unlikely that activities from this project may impact on the water quality observed within the Orange River.

4.3 Assumptions and Limitations

The following defines the assumptions and limitations applicable to this assessment:

- The surface water impact assessment was done based on the provided infrastructure layout (Figure 1-3) plans and the proposed associated activities. Changes to the layout plan after completion of this report may require an update of this report; and
- The area only produce runoff flow during heavy rainfall, therefore surface water quality assessment was not made part of this study as no sampling could be done.

5 Baseline Environment

The project area is in the quaternary catchment D81D which is located at the Orange Water Management Area (WMA 06) as revised in the 2012 water management area boundary descriptions (government gazette No. 35517), this is shown in Figure 5-2. The surface water attributes of the affected quaternary catchment namely Mean Annual Precipitation (MAP), Mean Annual Runoff (MAR), and Mean Annual Evaporation (MAE) were obtained from the Water Resources of South Africa 2012 Study (WR2012) and are summarised in Table 5-1.

Table 5-1: Summary of the surface water attributes of the D81D quaternary catchment

Catchment	Area (km^2)	MAP (mm)	MAR $m^{3*} 10^6$	MAE-Span (mm)
D81D	1826	113	0.00	2750

Water Resources of South Africa 2012 Study

The D81D quaternary catchment has a net area of 1826 km^2 which receives an average of 113 mm of rainfall per annum whilst the evaporation rate is an average of 2750 mm per annum. The study also indicates that there is no measurable runoff on average.

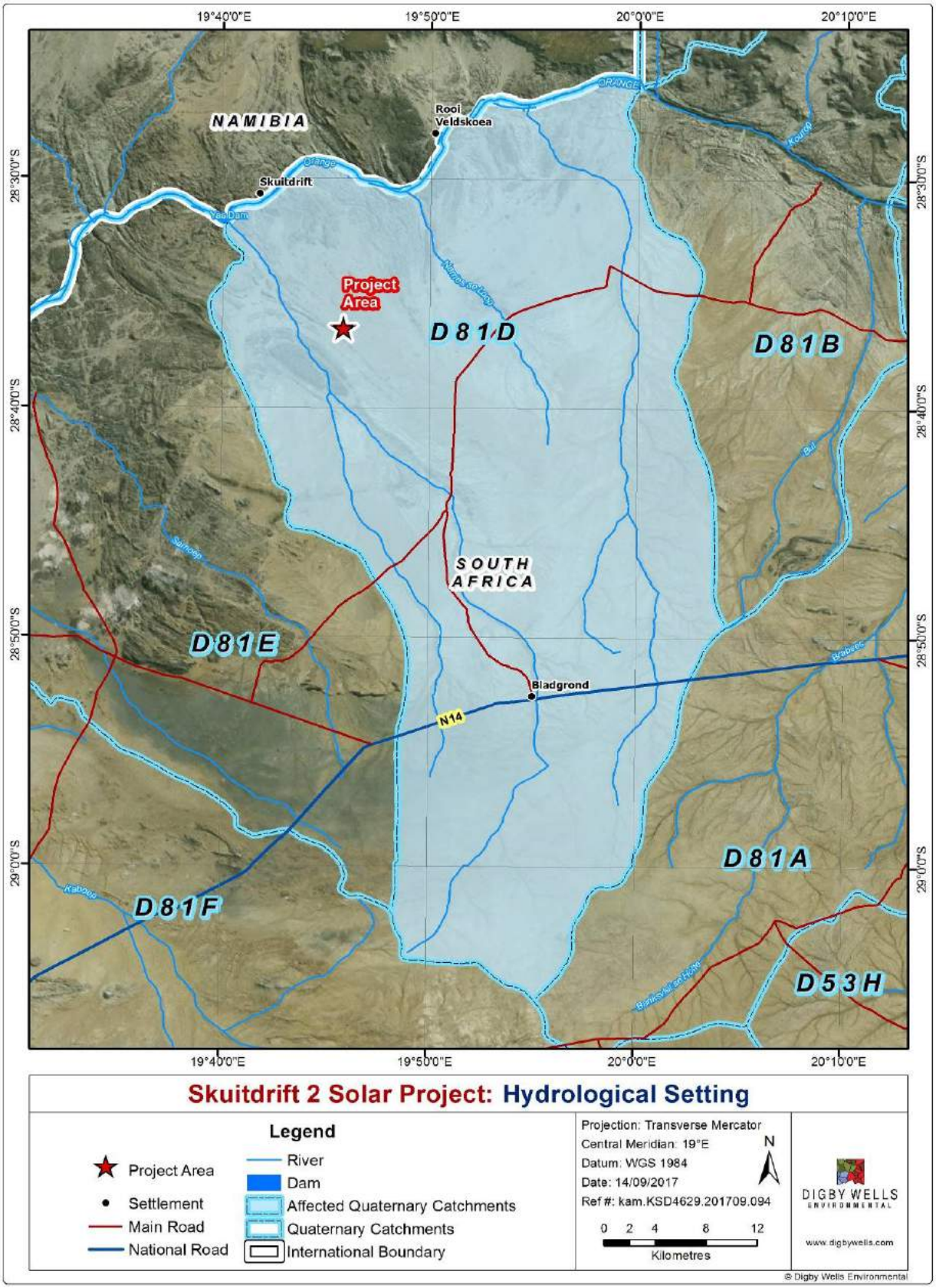
The only perennial river associated with this quaternary catchment is the Orange River which is situated at approximately 12 km north of the proposed project area. Other major non-perennial streams include Narries Se Loop, Kwaaiputs Se Loop and Yas Se Laagte. Runoff emanating from this quaternary catchment drains in a northern direction via these non-perennial streams and then feeds into the Orange River.

The National Geospatial Information (NGI) 1:50 000 topographic data shows that two non-perennial drainage lines originate on the north west boundary of the demarcated project area and two other drainages exist outside the project area, located on the west and east side of the project boundary. This can be seen clearly on the infrastructure map in Figure 1-3. Minor runoff path ways were also observed with the project boundaries

In the 2013 Final Impact Assessment Report, these runoff pathways were classified as “Washes” defined as those areas which show visible signs of occasional water movement and sediment transport, but which do not receive sufficient runoff to develop characteristic soils or vegetation associated with wetlands or drainage lines. Washes are a characteristic feature of arid and semi-arid environments and are related to the occurrence of occasional intense rainfall events within areas of low total rainfall (Cape EAPrac, 2013).

During the site assessment, it was observed that the project footprint area was relatively flat, rocky patches with scattered grass, few shrubs and trees (Figure 5-1). There were no dams or pans identified in the vicinity of the project area.

Figure 5-1: Pictures of the Project area taken during the Site Visit



Skuitdrift 2 Solar Project: Hydrological Setting

Figure 5-2: Hydrological Setting

5.1.1 Climate

The Northern Cape's weather is typical of desert and semi desert areas. This is a large dry region of fluctuating temperatures and varying topographies. This section provides the monthly climatic data conditions (rainfall and evaporation) of the rainfall and evaporation zones in which the project area is located.

5.1.1.1 Rainfall

Table 5-2 present the average monthly rainfall for the quaternary catchment D81D.This is based on the averages of monthly rainfall data from a period of 1920 to 2009.

Table 5-2: Summary of rainfall data extracted from the WR2012

Month	MAP (mm)
January	14.1
February	18.6
March	23.8
April	15.0
May	6.9
June	2.6
July	3.0
August	1.6
September	3.4
October	6.7
November	8.3
December	8.9
MAP	**113**

From the rainfall data above, higher rainfall values (18.6 mm, 23.8 mm and 15.0 mm) were recorded for the months of February, March and April respectively whilst the minimum rainfall was recorded in August (1.6 mm). In general, this area receives minimal rainfall over a year which amounts to an average of 113 mm/annum.

5.1.1.2 Evaporation

Monthly evaporation data was obtained from the WR2012 manual. The project area lies within quaternary catchments D81D, which has a Mean Annual Evaporation (MAE) of 2750 mm. The evaporation obtained is based on Symons Pan evaporation measurements and needs to be converted to lake evaporation. This is due to the Symons Pan being located

below the ground surface and painted black which results in the temperature in the water being higher than that of a natural open water body. The Symons Pan figure is then multiplied by a lake evaporation factor to obtain the adopted lake evaporation figure which presents the monthly evaporation rates of a natural open water body, this was calculated to be a total average of 2315 mm/a. Table 5-3 is a summary of the evaporation for the D81D quaternary.

Table 5-3: Summary of evaporation data

Months	Symons Pan Evaporation (mm)	Lake Evaporation Factor	Lake Evaporation (mm)
January	377.9	0.84	317.4
February	298.9	0.9	263.1
March	254.9	0.9	224.3
April	178.8	0.9	157.3
May	131.5	0.9	114.4
June	100.7	0.9	85.6
July	108.4	0.8	89.9
August	143.6	0.8	116.3
September	192.8	0.8	156.1
October	264.8	0.8	214.5
November	322.3	0.82	264.3
December	375.7	0.83	311.8
Total	**2750**	**N/A**	**2315**

In this area, higher evaporation rates area experienced during the months of November, December, and January whilst the low evaporation occurs in May, June and July respectively. The potential average annual evaporation rate of 2315 mm is higher than the average annual precipitation rate of 113 mm. This area is thus a semi-desert area.

6 Land and Water Uses

The site lies adjacent to the Eskom Schuitdrift 132/33 KV substation with a 33kV overhead line leading to the west and a 132kV overhead line leading to the east (Blouputs). There are farm houses and game reserves around the broader area. Water uses within around the area are mainly for farming which includes livestock watering and irrigation with the sources being the Orange River and boreholes.

7 Sensitivity Analysis and No-Go Areas

The D81D quaternary catchment has a net area of 1826 km^2 (182 600 ha) which receives an average of 113 mm of rainfall per annum whilst the evaporation rate is an average of 2750 mm per annum. However, there is no measurable runoff on average within this quaternary catchment.

The proposed solar project and the associated infrastructure will occupy a total footprint area of 19 ha which amounts to 0.01% of the total quaternary catchment area. Disturbance or alteration of runoff path ways from the project area will definitely be very small and is considered negligible.

The project boundary lies within flat and dry sandy area with limited vegetation. Only two drainage lines originate on the north-west boundary of the project area (as described above).

The regulation also requires that a risk assessment should be completed for the residual risks, this are defined as the risk that that will remain after all the recommended measures. A risk assessment was then completed taking into consideration the nature of the proposed development of the 5 MW Skuitdrift 2 Solar PV Energy Facility and its associated activities, this indicated that the residual risks are of low significance (see Table 8-5).

Based on the findings of the risk assessment, it was recommended that a general authorisation be granted for this project and Khoi-Sun Development be exempted from applying for a licence in terms of the National Water Act (Act 36 of 1998).

However, a pre-consultation meeting was held with the DWS and it was decided that a water use license application should be completed since the project involves other section 21 water uses which do not qualify for general authorisation.

The major drainage lines in the project area (drainage lines that are the primary path way into the second order stream) have been classified as moderate sensitive whilst the minor drainage lines have been classified as moderate sensitive. The sensitivity map is shown in Figure 7-1.

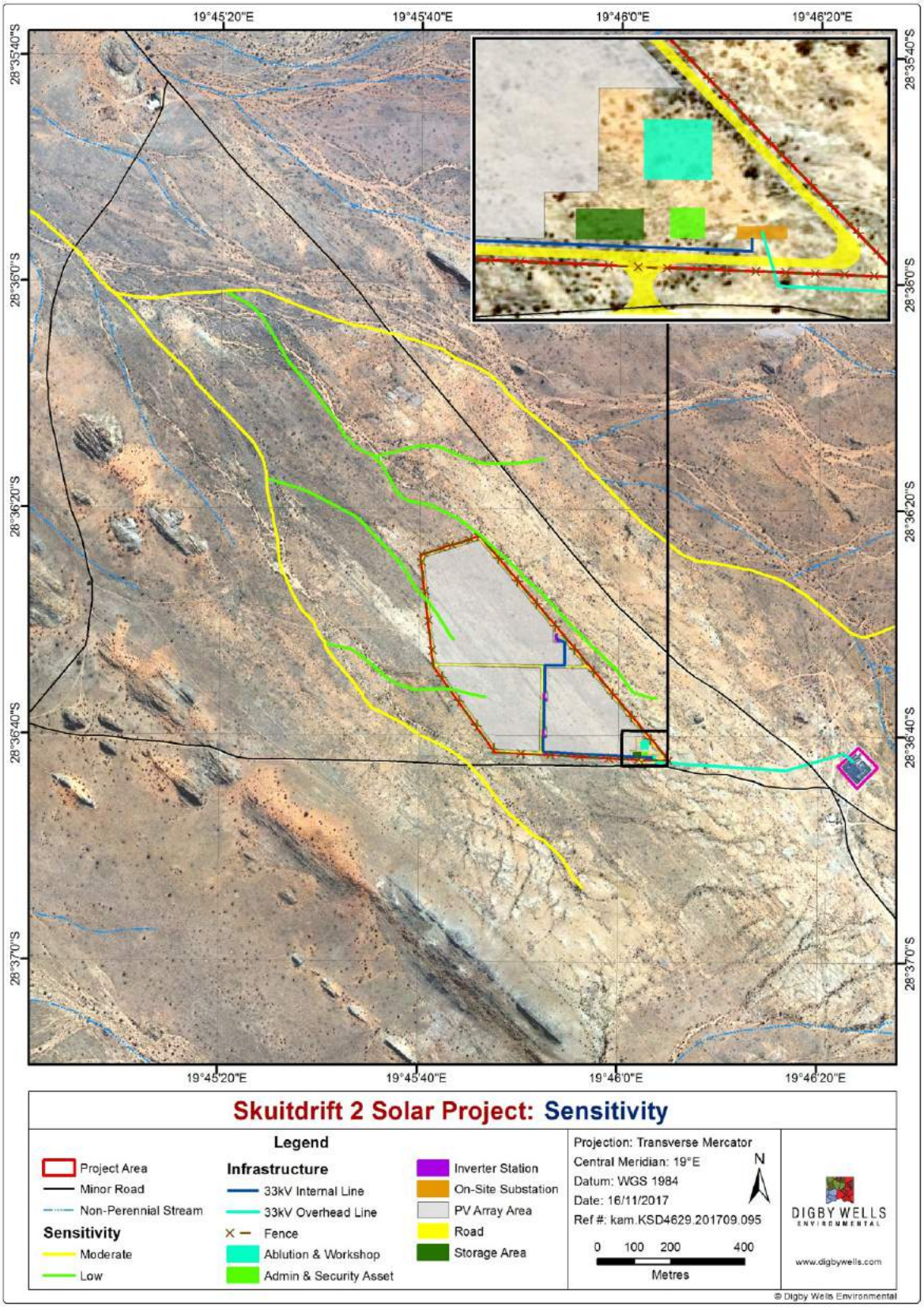


Figure 7-1: Sensitive and No-Go Areas

8 Impact Assessment

A methodology used to determine the environmental impact significance rating is provided below. The rating is based on the Nature, Significance, Consequence, Extent, Duration and Probability of potential direct, indirect and cumulative surface water impacts. This is explained as follows:

- The **nature**, which shall include a description of what causes the effect, what will be affected and how it will be affected.
- The **extent**, wherein it will be indicated whether the impact will be local (limited to the immediate area or site of development) or regional, and a value between 1 and 5 will be assigned as appropriate (with 1 being low and 5 being high):
- The **duration**, wherein it will be indicated whether:
  - the lifetime of the impact will be of a very short duration (0–1 years) – assigned a score of 1;
  - the lifetime of the impact will be of a short duration (2-5 years) - assigned a score of 2;
  - medium-term (5–15 years) – assigned a score of 3;
  - long term (> 15 years) - assigned a score of 4; or
  - permanent - assigned a score of 5;
- The **consequences (magnitude)**, quantified on a scale from 0-10, where 0 is small and will have no effect on the environment, 2 is minor and will not result in an impact on processes, 4 is low and will cause a slight impact on processes, 6 is moderate and will result in processes continuing but in a modified way, 8 is high (processes are altered to the extent that they temporarily cease), and 10 is very high and results in complete destruction of patterns and permanent cessation of processes.
- The **probability** of occurrence, which shall describe the likelihood of the impact actually occurring. Probability will be estimated on a scale of 1–5, where 1 is very improbable (probably will not happen), 2 is improbable (some possibility, but low likelihood), 3 is probable (distinct possibility), 4 is highly probable (most likely) and 5 is definite (impact will occur regardless of any prevention measures).
- The significance, which shall be determined through a synthesis of the characteristics described above and can be assessed as low, medium or high; and
- The **status**, which will be described as positive, negative or neutral.
- The degree to which the impact can be reversed.
- The degree to which the impact may cause irreplaceable loss of resources.
- The degree to which the impact can be mitigated.

The **significance** is calculated by combining the criteria in the following formula:

$$S = (E+D+M)P$$

S = Significance weighting

E = Extent

D = Duration

M = Magnitude

P = Probability

The **significance weightings** for each potential impact are as follows:

- < 30 points: Low (i.e. where this impact would not have a direct influence on the decision to develop in the area),
- 30-60 points: Medium (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated),
- > 60 points: High (i.e. where the impact must have an influence on the decision process to develop in the area).

8.1 Potential Surface Water Impacts

8.1.1 Construction Phase

During the construction phase, there are activities that could potentially have an impact on the natural hydrology of the area. There are no anticipated direct impacts on the natural water course i.e. Orange River. Activities with potential impacts include construction of site offices, services roads, installation of underground cabling to run the length of the arrays and link the arrays to inverters, a lay down area etc.

Table 8-1: Identified Impact Description during Construction Phase

Nature: Disturbance/alteration of the natural hydrology within the project site. Existing washes and drainage lines might be altered during the construction phase, this may lead to limited runoff finding its way to the drainage lines that are tributary to the Orange River.		
	Without mitigation	**With mitigation**
Extent	Medium Low (2)	Medium Low (2)
Duration	Short term (1)	Short term (1)
Magnitude	Low (4)	Low (4)
Probability	Probable (3)	Improbable (2)
Significance	Low (21)	Low (14)
Status (positive or negative)	Negative	Negative

Nature: Disturbance/alteration of the natural hydrology within the project site. Existing washes and drainage lines might be altered during the construction phase, this may lead to limited runoff finding its way to the drainage lines that are tributary to the Orange River.		
	Without mitigation	**With mitigation**
Reversibility	Medium	Medium
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	Yes
Mitigation: ▪ The solar panel lay down supporting structure should not be placed within the identified (highly) sensitive drainage line, and placement on the moderately sensitive drainage lines should be avoided where possible. ▪ The natural topographical surface profile should be maintained as far as possible to allow the normal runoff drainage into the main stream		
Cumulative impacts: Runoff from the D81D quaternary, in which the project area lies, flows towards the north and eventually reports into the Orange River. A lot of farms along the riparian areas of the Orange River abstract water from the river. This could potentially reduce the quantity of water within the water course and hence alters with the normal ecological reserve well-being required to support the aquatic habitat. Alteration and disturbance of the drainage lines may obstruct runoff from reporting into the Orange River. However, no measurable runoff occur in the project area considering the mean annual rainfall and evaporation rates and hence the impact is expected to be negligible		
Residual Risks: Risk of erosion on the developed area that may lead into siltation of the Orange River.		

Table 8-2: Identified Impact Description during Construction Phase

Nature: Clearing or removal of vegetation exposes the surface and leaves the soils prone to erosion during rainfall events and as a result, runoff (if any) from these areas (which will be high in suspended solids) can lead to an increase in turbidity in the water course. Dust generated during the construction activities and caused by increased vehicular movements can also be deposited into the water course, thereby contributing to the accumulation of suspended solids in the water course, leading to the siltation of the water course.		
	Without mitigation	**With mitigation**
Extent	Low (1)	Low (1)
Duration	Short term (1)	Short term (1)
Magnitude	Moderate (6)	Moderate (6)
Probability	Highly probable (4)	Improbable (2)
Significance	Medium (24)	Low (12)
Status (positive or negative)	Negative	Negative
Reversibility	Medium	Medium
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	Yes
Mitigation: ▪ Clearing of vegetation must be limited to the development footprint and the use of existing access roads must be prioritized so as to minimise construction of new access roads in these areas; ▪ Dust suppression measures must be undertaken on the cleared areas during construction; ▪ If possible, construction should be undertaken during the dry periods to minimise erosion and sedimentation/siltation of the water course; ▪ Any construction work that involves site clearance, digging or trenching during installation services should be suspended during heavy rains to avoid erosion and sedimentation of the water course; ▪ When wet season construction cannot be avoided, sedimentation control measures, such as hay bales, sedimentation basins or any silt trap method should be in place during digging and the installation of service infrastructure; and ▪ The engineering report already stated that cleared areas will be revegetated with locally-collected seed of indigenous species once construction is complete. This will limit erosion and potential for dust generation during operation of the solar facility.		

Nature:		
Clearing or removal of vegetation exposes the surface and leaves the soils prone to erosion during rainfall events and as a result, runoff (if any) from these areas (which will be high in suspended solids) can lead to an increase in turbidity in the water course. Dust generated during the construction activities and caused by increased vehicular movements can also be deposited into the water course, thereby contributing to the accumulation of suspended solids in the water course, leading to the siltation of the water course.		
	Without mitigation	**With mitigation**
Cumulative impacts: The area is characterised by loose sandy soils which are more susceptible to erosion during very heavy rainfall. It is likely that erosion can occur during heavy rainfall within this region. Normal rainfall is expected to seep into the ground and not run off. Clearing of vegetation enhances the likelihood of this impact to occur and hence increased siltation of the water course.		
Residual Risks: There is risk of hydrocarbon spills, general and hazardous material spillages during construction. This may lead to contamination of the water course when runoff from such areas reports into the streams.		

8.1.2 Operational Phase

Very little or limited surface water or hydrology impacts are expected during the operational phase. During the operational phase, infrastructure that was installed is expected to get to work with very limited or no man power/human activity involved at the stage. This infrastructure include fire detection system, weather monitoring equipment (rainfall, wind speed/direction, solar irradiation, air moisture), plant monitoring equipment and associated telecommunication links, air-conditioning equipment inside inverter/transformer enclosures which will regulate the operating temperature of the inverters.

Table 8-3: Identified Impact Description during Operational Phase

Nature:		
Increased potential for erosion due to heavy flow of rainwater flowing from the top of solar panel as opposed to normal rainfall into the natural surface. As a result, runoff from the solar site may lead to an increase in turbidity in the water course. However, the area is characterised by loose sandy soils and it likely that normal rainfall will seep into the ground and not run off		
	Without mitigation	**With mitigation**
Extent	Low (2)	Low (2)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Moderate (6)
Probability	Highly probable (4)	Improbable (2)
Significance	Medium (48)	Low (24)

Nature: Increased potential for erosion due to heavy flow of rainwater flowing from the top of solar panel as opposed to normal rainfall into the natural surface. As a result, runoff from the solar site may lead to an increase in turbidity in the water course. However, the area is characterised by loose sandy soils and it likely that normal rainfall will seep into the ground and not run off		
	Without mitigation	**With mitigation**
Status (positive or negative)	Negative	Negative
Reversibility	Medium	Medium
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	Yes
Mitigation: Sedimentation control measures, such as gabions or a layer of rocks (suitable size for this purpose) sedimentation basins or any silt trap method should be placed at the outlet of the drainage line along the project boundary to trap and contain eroded soil materials from reporting into the main drainage which eventually reports into the Orange River.		
Cumulative impacts: The area is characterised by loose sandy soils which are more susceptible to erosion during rainfall. It is likely that erosion occurs during heavy rainfall within this region. Clearing of vegetation enhances the likelihood of this impact to occur and hence increased siltation of the water course. However, Normal rainfall is expected to seep into the ground and not run off		
Residual Risks: There is a risk of hydrocarbons spills, general and hazardous material spillages during construction. This may lead to contamination of the water course when runoff from such areas reports into the streams.		

8.1.3 Decommissioning Phase

The proposed solar energy facility is expected to have a lifespan of approximately 30 years if the specified periodic maintenance is performed. Once the facility has reached the end of its economic life, the infrastructure is to be decommissioned. The decommissioning of the facility would entail the disassembly and replacement of components with other appropriate technologies. However, if not deemed so, then the facility would be completely decommissioned which would include the following decommissioning activities.

Site decommissioning preparation activities should include confirming the integrity of access to the site. Site access should be able to accommodate the required equipment (e.g. lay

down areas, construction platform) and the mobilisation of decommissioning equipment (Solek, 2013).

Table 8-4: Identified Impact Description during Decommissioning Phase

Nature: Dismantling of infrastructure will again expose the surface and leave the soils prone to erosion during high rainfall events. As a result, runoff (if any) from these areas (which will be high in suspended solids) can lead to an increase in turbidity in the water course. Considering the low rainfall produced in this area and the fact that vegetation below the solar panels would have established after 30 years of operation, it is unlikely that erosion would occur during this phase.		
	Without mitigation	**With mitigation**
Extent	Medium Low (2)	Medium Low (2)
Duration	Short term (1)	Short term (1)
Magnitude	Low (4)	Low (4)
Probability	Improbable (2)	Very improbable (1)
Significance	Low (14)	Low (7)
Status (positive or negative)	Negative	Negative
Reversibility	Medium	Medium
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	Yes
Mitigation: ▪ Sedimentation control measures, gabions or a layer of rocks (suitable size for this purpose) sedimentation basins or any silt trap method should still be in place until the entire infrastructure has been removed. ▪ Revegetation should be done on the areas where infrastructure is removed and the surface is left bare.		
Cumulative impacts: If erosion occurs during this phase, this will increase may transport suspended solids to the nearby stream and result in siltation of the water course.		
Residual Risks: There is a risk of hydrocarbons spills, general and hazardous material spillages during construction. This may lead to contamination of the water course when runoff from such areas reports into the streams.		

8.2 Summary of the unplanned Events and Low Risks

There is a risk of accidental spillages of hazardous substances (e.g. hydrocarbons) from vehicles or other machineries and from waste storage facilities during construction, operation and decommissioning phase. During heavy rainfall, the drainage lines around the area produces flow, runoff produced from the spillage area may find its way to the drainage line which flows towards the Orange River. This will deteriorate the quality of water within the water resources.

Table 8-5: Risk Assessment as per section 39 (1) of the National Water Act, as defined in section 21(c) or section 21(i), No. 40229, August 2016.

Risk	**Erosion prior to vegetation establishment**	
Dimension	**Rating**	**Description/Motivation**
Severity	2	Soil erosion increases the turbidity or level of sediments in water; this may lead to water quality deterioration.
Spatial scale	2	The impacts will be Area specific or localized (at impact site)
Duration	1	Silted water may only take few days after the rainfall for sediments to settle down
Consequence	5	SEVERITY + SPATIAL SCALE + DURATION
Frequency of activity	2	From rainfall data above, high rainfall events can occur once or twice in one year
Frequency of impact	2	Though erosion can occur after vegetation has been re-vegetated, it is highly unlikely that this may occur considering the low rainfall on the region and sandy soils which is able to absorb and infiltrate water. The quaternary also do not produce any measurable runoff on average as water research commission research
Legal Issues	5	Water resources are regulated by the National Water Act, 1998 (Act No. 36 of 1998)
Detection	1	One can clearly see the silted runoff as it emanates from the project area
Likelihood	10	FREQUENCY OF THE ACTIVITY+ FREQUENCY OF THE IMPACT + LEGAL ISSUES + DETECTION
Significance	50	Consequence X Likelihood
Risk Rating	(L)	This risk is acceptable, the probability of it occurring is very low on an area that is recorded to not produce any measurable runoff on average.
Risk	**Water quality deterioration when runoff hydrocarbon spillages during construction phase enters the water course**	
Dimension	**Rating**	**Description/Motivation**
Severity	3	Hydrocarbons may lead to water quality deterioration and impact on the aquatic habitat. Fuel storage areas will be bunded and located in areas away from a drainage line
Spatial scale	2	The impacts will be Area specific or localized (at impact site)
Duration	1	It may take few days before the contamination is diluted, or for spills to infiltrate into the soils
Consequence	8	SEVERITY + SPATIAL SCALE + DURATION
Frequency of activity	1	Considering recommended measures to avoid spills, this may not happen or once a annually
Frequency of impact	1	This may not happen for the duration of the project

Legal Issues	5	Water resources are regulated by the National Water Act, 1998 (Act No. 36 of 1998)
Detection	2	A spill can be noticed without much effort by the person on site during construction period
Likelihood	9	FREQUENCY OF THE ACTIVITY+ FREQUENCY OF THE IMPACT + LEGAL ISSUES + DETECTION
Significance	54	Consequence X Likelihood
Risk Rating	(L)	This risk is acceptable, spills may not happen at all on the duration of construction phase.

9 Environmental Management Plan

The objective of an Environmental Management Plan (EMP) is (a) to manage undue or reasonably avoidable adverse impacts associated with the development of a project and (b) to enhance potential positives.

This study has identified the surface water impacts that may occur as a result of the proposed development of the 5 MW Skuitdrift 2 Solar PV Energy Facility and its associated activities. These activities could negatively impact on surface water resources and the natural hydrology of the area by either deterioration of water quality and/or the decrease in water quantity and alteration of the natural drainage lines. The Impacts, Objectives and Outcomes of the EMP are presented in Table 9-1 below.

Table 9-1: Impacts, Objectives and Outcomes of the EMP

Activities	Phase	Impact	Size/scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation	Person Responsible
Site clearing, digging and installation of infrastructures during construction phase	Construction	Siltation of the water course leading to the deterioration in water quality.	19 ha	Clearing of vegetation must be limited to the development footprint area, and the use of existing access roads must be prioritized so as to minimise construction of new access roads in these areas; If possible, construction activities must be prioritised to the dry months of the year (June - August) to limit mobilisation of sediments or hazardous substances from construction vehicles used during site clearing; Dust suppression measures must be undertaken on the cleared areas during construction and use of existing roads should prioritise Any construction work that involves site clearance, digging or trenching during installation services should be suspended during heavy rains to avoid erosion and sedimentation of the water course; and When wet season construction cannot be avoided, sedimentation control measures, such as hay bales, sedimentation basins or any silt trap method should be in place during digging and the installation of service infrastructure.	National Water Act (NWA), 1998 (Act No. 36 of 1998); DWS Best Practice Guideline G4: Impact prediction	This should be implemented during construction phase	Developer/Contractor

Activities	Phase	Impact	Size/scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation	Person Responsible
Site clearing, digging and installation of infrastructures during construction phase	Construction	Hydrocarbons spills, general and hazardous material	Project area	The management of general and other forms of waste must ensure collection and disposal into clearly marked skip bins that can be collected by approved contractors for disposal to the appropriate disposal sites. The fuel storage facilities must be located on a hard standing area (paved or concrete surface that is impermeable), roofed and bunded in accordance with SANS1200 specifications. This will prevent mobilization of leaked hazardous substances. An emergency spillage response plan and spill kits should be in place and accessible to the responsible monitoring team. The Material Safety Data Sheets (MSDS) should be kept on site during construction for reference to anytime in terms of handling, storage and disposal of materials.	SANS1200 specifications National Water Act (NWA), 1998 (Act No. 36 of 1998)	This should be implemented during construction phase	Developer/Contractor
Construction over watercourses,	Construction	Disturbance/alteration of the natural hydrology (drainage lines)	Limited	Placement of the solar panel lay down supporting structure on the drainage lines should be avoided where possible. The natural topographical surface profile should be maintained as far as possible to allow the normal runoff drainage into the main stream	National Water Act (NWA), 1998 (Act No. 36 of 1998) National Water Act (Act No. 36 of 1998) Gazetted Notice 509 of 2016 for the General Authorisation of Section 39 for Water Uses as defined in Section 21 (c) and Section 21 (I):	During the construction and operation of the entire infrastructure.	
Operation of the installed infrastructure	Operational	Siltation of the water course leading to the deterioration in water quality.	19 ha	Sedimentation control measures, such as hay bales, gabions or a layer of rocks sedimentation basins or any silt trap method should be placed at the outlet of the drainage line along the project boundary to trap and contain eroded soil materials from reporting into the main drainage which eventually reports into the Orange River.	SANS1200 specifications. National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended (NEMA), GNR 544 and GNR 545 (Section 24 (1)).	During the entire project life.	Developer/Contractor

10 Monitoring Programme

A monitoring programme is essential as a management tool to detect negative impacts as they arise and to ensure that the necessary mitigation measures are implemented together with ensuring effectiveness of the management measure in place.

It is also recommended that grab samples should be collected on the point upstream and downstream of the project footprint after a rainfall that will produce flow. If this occurs before commencement of the project, the results can be used as baseline and therefore as benchmark when conducting monitoring

Table 10-1 : Monitoring Programme

Monitoring Element	Comment	Frequency	Responsibility
Drainage lines	It is recommended to monitor the existing drainage lines within and in the immediate surround from the project site to ensure that the natural surface profile is still intact and capable of conveying runoff into the main drainage or stream. Grab sampling should also be undertaken (upstream and downstream of the project footprint)	This needs to be done on a regularly during construction phase and could be done quarterly during the operational phase Sampling can be done once a year when there is flow.	Environmental Officer or a person responsible for maintenance
Physical erosion control structures	Personnel should have a walk around the facility to determine the effectiveness of the erosion control structures	During or immediately after heavy rainfall event	Environmental Officer or a person responsible for maintenance
Meteorological data	Measure rainfall to determine the rainfall trend and the influence it has on magnitude of impacts (erosion)	Real time automatic weather system if in place, otherwise collect rainfall readings after every rainfall event or monthly.	Environmental Officer/Technician

11 Conclusion and Recommendation

The development of a 5 MW photovoltaic facility is proposed on the Farm Skuitdrif 426, near Augrabies, Northern Cape Province for the purposes of generating sufficient renewable

energy capable of supplementing electricity supply to the Eskom Schuitdrift substation located some 500m from the proposed development footprint.

In support of the Water Use License Application, a surface water assessment was conducted with the aim of determining the hydrological baseline conditions of the project area and the surrounds prior to commencement of project, to assess and identify the potential surface water/hydrological impacts that could emanate from the project and its associated activities.

A site visit was conducted on the 29th of May 2017 and the 19th of September 2017 to verify the hydrological characteristics of the site. Northern Cape is characterised by low rainfall and the extreme temperatures and as a result, the area was completely dry during the site verification with no patches of water within the footprint of the project area.

During the site assessment, a number of drainage line/runoff pathways were also identified within and around the demarcated project boundary. Only two drainage lines (as indicated in the 1:50 000 topographic data) exist within the north-west side of the project boundary. Other runoff pathways were classified as “Washes” defined as those areas which show visible signs of occasional water movement and sediment transport, but which do not receive sufficient runoff to develop characteristic soils or vegetation associated with wetlands or drainage lines. Washes are a characteristic feature of arid and semi-arid environments and are related to the occurrence of occasional intense rainfall events within areas of low total rainfall (Cape EAPrac, 2013).

The identified potential surface water/hydrological impacts that could emanate from the project and its associated activities include:

- Disturbance or alteration of the existing washes and drainage lines which may lead to limited runoff finding its way to the drainage lines that are tributary to the Orange River;
- Siltation of the water course when runoff and dust from cleared areas during construction reports into the nearby river. The significance of such impact is however expected to be minimal considering that no runoff occurs on average.

The D81D quaternary catchment has a net area of 1826 km^2 (182 600 ha) which receives an average of 113 mm of rainfall per annum whilst the evaporation rate is an average of 2750 mm per annum. There is no measurable runoff on average.

The proposed solar project and the associated infrastructure will occupy a total footprint area of 19 ha which amounts to 0.01% of the total quaternary catchment area Any disturbance or alteration of runoff (if any) from this area will definitely be very small and is considered negligible.

A risk assessment in terms of section 39 (1) of the National Water Act, as defined in section 21(c) or section 21(i), No. 40229, August 2016 has been completed. The identified risks after mitigation measures are in place were rated as low risk.

It is therefore recommended that a general authorisation be granted for this project, in terms of section 39 (1) of the National Water Act, as defined in section 21(c) or section 21(i), No. 40229, August 2016. And the applicant should be exempted from applying for a licence in terms of the National Water Act (Act 36 of 1998).

However, a pre-consultation meeting was held with the DWS and it was decided that a water use license application should be completed since the project involves other section 21 water uses which do not qualify for general authorisation.

This assessment has also provided the appropriate mitigation/management measures to prevent, and/or minimise the identified potential surface water impacts, should they occur.

With all the mitigation and management measures in place, this project is unlikely to pose a significant threat to the natural water course and the hydrological features within and around the project area. The proposed development of the 5 MW Skuitdrift 2 Solar PV Energy Facility can therefore go ahead.

12 References

Final Impact Assessment Report & Environmental Management Programme for 'Khoi-Sun Development' on a portion of Farm 426, Skuitdrift, Northern Cape, March 2013;

EIA Engineering Report. Compiled by Solek (Renewable Energy Engineers). January 2013;

Department of Water and Sanitation notice 509 of 2016. General authorisation in terms of section 39 of the NATIONAL WATER ACT, 1998 (ACT NO. 36 OF 1998) for water uses as defined in section 21(c) or section 21(i)

National Water Act (NWA), 1998 (Act No. 36 of 1998);

WR2012, "*Water Resources of South Africa, 2012 Study (WR2012)*", Water Research Commission, Pretoria.

APPENDIX F:
LAYOUT AND SENSITIVITY MAP

Skuitdrift 2 Solar PV Energy Faciliy, Northern Cape

Environmental Sensitivity and Layout Map

Legend

- Existing Substation
- Existing Powerline
- Secondary Gravel Road

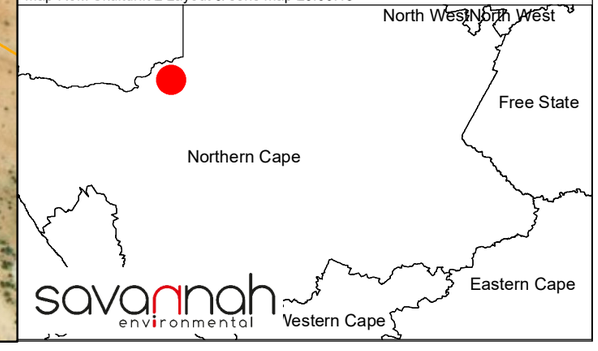
Layout Plan:

- Internal Cabling
- New Power Line
- Internal Access Roads
- Main Entrance
- Ablution and Workshop Area
- Admin and Security Area
- Storage Area
- On-Site Substation
- Inverter Station
- PV Array Area

Environmental Sensitivities:

- Very High Sensitivity
- High Sensitivity

Scale: 1:4 100
Projection: LO19, CGS_WGS_1984
Map Ref.: Skuitdrift 2 Layout & sens map 29.06.18



savannah environmental