REPORT

PROPOSED 200MW NDEBELE AND XHOSA PHOTOVOLTAIC PLANT DEVELOPMENTS AND ASSOCIATED BATTERY ENERGY STORAGE SYSTEM ON THE REMAINING EXTENT OF THE FARM BOKPOORT 390 NEAR GROBLERSHOOP WITHIN THE !KHEIS LOCAL MUNICIPALITY IN THE NORTHERN CAPE PROVINCE

Consultation Basic Assessment Report

Client: ACWA Power Energy Africa Pty (Ltd)

Reference: MD4195-RHD-ZZ-XX-RP-YE-0001

Status: S0/P01.01

Date: 02 March 2020

Royal HaskoningDHV
Enhancing Society Together

ROYAL HASKONINGDHV (PTY) LTD

21 Woodlands Drive
Building 5
Country Club Estate
Woodmead
Johannesburg
2191
Southern Africa
Reg No. 1966/001916/07

+27 87 352 1500 **T**
+27 11 798 6005 **F**
Johannesburg@rhdhv.com **E**
royalhaskoningdhv.com **W**

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Document short title:	
Reference:	MD4195-RHD-ZZ-XX-RP-YE-0001
Status:	P01.01/S0
Date:	02 March 2020
Project name:	PV Plants
Project number:	MD4195
Author(s):	Seshni Govender

Drafted by:	Prashika Reddy and Seshni Govender
Checked by:	Malcolm Roods
Date / initials:	21/02/2020 MR
Approved by:	Malcolm Roods
Date / initials:	21/02/2020 MR

Classification
Project related

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Executive Summary

Background

The environmental team of Royal HaskoningDHV have been appointed as an Environmental Assessment Practitioner (EAP) by ACWA Power Energy Africa (Pty) Ltd (hereafter referred to as ACWA Power) to conduct a Basic Assessment (BA) Study for the project in terms of the Environmental Impact Assessment (EIA) Regulations 2014 (as amended in 2017), as promulgated under the National Environmental Management Act (NEMA) (Act No. 107 of 1998) (as amended).

ACWA Power is proposing to construct a solar energy facility consisting of ten (10) photovoltaic (PV) plants on the north-eastern portion of the Remaining Extent (RE) of the Farm Bokpoort 390, located 20 km north-west of the town of Groblershoop within the !Kheis Local Municipality in the ZF Mgcawu District Municipality, Northern Cape Province.

On 21 October 2016, 150 MW Concentrating Solar Power (CSP) plant a 900 ha, was authorised by the Department of Environmental Affairs (DEA) – *Ref 14/12/16/3/3/2/879*. Due to the changes in the Integrated Resource Plan (IRP) published in October 2019, ACWA Power intend replacing the authorised CSP site with eight (8) new PV plants. The updated layout has been revised to incorporate the 8 new PV plants of 200 MW each, covering a total of 1200 ha (i.e. 150 ha for each plant).

Two (2) 75 MW PV plants including ancillary infrastructure (*Ref 14/12/16/3/3/2/880* and *14/12/16/3/3/2/881*), were also authorised by the DEA on 24 October 2016. The intention to replace the CSP with 8 PV plants will result in development footprint changes of the overall project. As such PV 1 (Ndebele) and PV 2 (Xhosa) plants will undergo an amendment to better cater for the overall project development and ancillary infrastructure.

This Basic Assessment process will occur concurrently to these processes mentioned above to accommodate:

1. The Battery Energy Storage System (BESS) that will be associated with the Ndebele PV Plant (formerly PV 1) and the Xhosa PV Plant (formerly PV2). This activity was applied for in the original environmental process but was not approved due to lack of information with regards to the type of technology to be used. The BESS footprint is approximately 16ha and will store 4500m^3 of hazardous substances with a battery power capacity of 150 MW.
2. The electricity generation capacity of the PV 1 & 2 Plants will be 200 MW [75 MW was originally approved in the EAs dated 24/10/2016 (Ref: 14/12/16/3/3/2/881 & Ref 14/12/16/3/3/2/880). It was confirmed in the IQ/20/0004 correspondence from the Environment, Forestry and Fisheries (DEFF) that the electricity generation of more than 20MW from a Renewable Resource listed activity is now triggered and must be applied for due to the increase in capacity]

Process

This Basic Assessment (BA) follows the legislative process prescribed in the Environmental Impact Assessment (EIA) Regulations 2014 (as amended in 2017). This report constitutes the draft Consultation Basic Assessment Report (cBAR) which details the environmental outcomes, impacts and residual risks of the proposed activities. The report aims to assess the key environmental issues and impacts associated with the development, and to document Interested and Affected Parties' (I&APs) issues and concerns. Furthermore, it provides background information of the proposed project, a motivation and details of the proposed project, and describes the public participation undertaken to date.

In order to protect the environment and ensure that the development is undertaken in an environmentally responsible manner, there are a number of significant environmental legislation that were taken into consideration during this study and are elaborated on in this report.

The Department of Environment, Forestry and Fisheries (DEFF) is the lead/ Competent Authority for this BA study and the project needs to be authorised by this Department.

This draft cBAR provides an assessment of both the benefits and potential negative impacts anticipated as a result of the proposed project. Having duly considered the project, in the Environmental Assessment Practitioner's (EAP's) opinion, the project (installation of a BESS and increase in capacity using improved technology) does not pose a detrimental impact on the receiving environment and it inhabitants and can be mitigated significantly. The Applicant should be bound to stringent conditions to maintain compliance and a responsible execution of the project.

The impacts identified and assessed by way of risk ratings, have been extensively reported herein.

Key Findings

Geology and Topography:
Excavations for foundations for the PV panels and associated infrastructure will have a highly localised and negligible effect on the geology and topography of the site.

Air Quality:
The facility does not require an Atmospheric Emissions Licence as no listed activities are triggered under section 21 of the NEM:AQA (Act 39 of 2004). The key pollutant from the proposed site during the construction and decommissions phases would be Particulate Matter (PM). Strict BESS management and maintenance procedures will ensure containment and prevent any significant air quality impacts. On decommissioning, the BESS should be promptly removed offsite in line with manufacturer guidance and taken to the nearest appropriate recycling facility. While there are recycling options for lead-acid batteries in South Africa, opportunities for the recycling of lithium ion batteries needs further investigation.

Agricultural Potential, Soil, Land Capability and Land Use:
The proposed development is on land zoned as 'Special'. South Africa has very limited arable land and it is therefore critical to ensure that development does not lead to an inappropriate loss of land that may be valuable for cultivation. The specialist assessment has found that the investigated site is on land which is of low agricultural potential and is not suitable for cultivation.

Ecology:
The various assessments of the ecological receiving environment that were accessed to compile the specialist report revealed a moderate, at best, ecological sensitivity of remaining and untransformed portions of the site. The photovoltaic plant development will potentially affect biodiversity in three main ways; loss in extent of vegetation communities and loss and associated disturbance of species of conservation concern during construction; effects on fauna species of conservation concern as a result of site lighting, security fencing and increased road traffic during operation, and the spread of invasive species and potential contamination of remaining natural (surrounding) ecosystems during closure.

A review of the anticipated impacts associated with the proposed development on the ecological environment indicates that none of the anticipated impacts can be highlighted or construed to represent an unacceptable or severe threat to sensitive biological or biodiversity components within the study area and wider region. Ecological attributes and characteristics and biological components that were recorded on the

site during the brief survey period are regarded common and typical of the larger region and are not restricted to the site, i.e. no plant or animal species or habitat type will be affected in such a manner that the conservation status (local, regional, global) will be affected adversely.

Although several species of conservation concern have been recorded within the study area, no species were recorded that would trigger 'Critical Habitat' as defined by IFC. As with any type of anthropogenic development, the decimation of natural habitat is an unfortunate result and the reduction in the local abundance of animals and plants represent natural and anticipated consequences.

Avifauna:
The PV plant which was already authorised but the additional activities of the increase in capacity and the battery energy storage system will allow for additional bird flight deterrent devices to be investigated to reduce the potential impact of collisions with overhead power lines as well as reduced habitat fragmentation and disruption of bird movements across the project site for a number of ground dwelling species.

If temperatures rise in the medium to long term, some species will be living closer to the limits of their thermal tolerances, with species in arid environments expected to be among the first to reach the limits of their thermoregulatory capacities[1]. It is anticipated that much of the Kalahari's avian biodiversity will be lost by the end of the century due to loss of body condition, delayed fledging, reduced fledging size, and outright breeding failure as a result of increased exposure to higher temperatures[2]. PV panels may provide more shaded environments (thermal refugia) for ground dwelling and ground nesting birds near their thermal limits and also offer a certain amount of protection to more open habitat species against bush encroachment[3].

The PV plant, if mitigation such as the rehabilitation of natural vegetation under solar panels is implemented, could potentially therefore even provide an improvement of the habitat for certain important bird species such as coursers, francolins and other open-country birds by offering shade and grassland in the face of potentially rising temperatures and bush encroachment.

Bat:
The PV plants should have fewer negative impacts on bats. The impact assessment ratings of the PV plants are all reduced to a low significance impact rating after application of mitigation measures listed in Section 7.3.7 of this report.

Surface Water:
A Stormwater Management Plan (SWMP) must be implemented during the construction phase of the project. Spillage of fuels, lubricants and other chemicals must be cleaned up immediately and disposed of at an appropriately licenced landfill site. Mitigation for spillage or leakages must include bunded areas to store chemicals and/ or fuel and containerisation of the BESS.

The change in water demand which will be affected positively with the total demand changing to 0.22 million cubic metres per annum (Mm^3/a) (10 x 0.022 Mm^3/a) for the 10 PV solar facilities instead of the 0.3 Mm3/a (0.25 + 2 x 0.025 Mm^3/a) for the CSP and two (2) PV solar facilities.

[1] *van de Ven, T.M.F.N. 2017. Implications of climate change on the reproductive success of the Southern Yellow-billed Hornbill, Tockus leucomelas. PhD Thesis. Percy FitzPatrick Institute of African Ornithology, DST-NRF Centre of Excellence, Department of Biological Sciences, Faculty of Science, University of Cape Town.*
[2] *Conradie, S.R., Woodborne, S.M., Cunningham, S.J. and McKechnie, A.E. 2019. Chronic, sublethal effects of high temperatures will cause severe declines in southern African arid-zone birds during the 21st century.*
[3] *Towards a policy on indigenous bush encroachment in South Africa (2019), Department of Environmental Affairs, Pretoria, South Africa.*

Groundwater:
Overall the accumulative risk associated with the project (when operational) is of low environmental significance from a groundwater perspective. With proper mitigations in place the significance of the impact is likely to be low.

Visual:
The visual impact from the solar installation will be cumulative to the existing visual transformation of anthropological origin (Bokpoort I installation, farm buildings, power lines, railway line, roads) and will be present for the operational life of the facility (estimated at 30 years). The impact will be totally reversible upon decommissioning and closure of the solar facility.

Heritage:
From a heritage point of view, it is recommended that the proposed development be allowed to continue on acceptance of the proposed mitigation measures and the conditions proposed for inclusion in the environmental authorisation:

- Should archaeological sites or graves be exposed in other areas during construction work, it must immediately be reported to a heritage practitioner so that an investigation and evaluation of the finds can be made.

Palaeontology:
No significant fossil heritage resources have been recorded within the Bokpoort II solar power facility study area. The area is inferred to be of low sensitivity in terms of palaeontological heritage and no sensitive or no-go areas have been identified within it during the present desktop assessment.

Traffic:
Travel to and from the facility by personnel, deliveries and visitors will add to the existing traffic on the approach roads, affecting road safety, create dust from unpaved roads and road surface quality as experienced by existing road users. The cumulative impact due to the solar facility will be completely reversible upon decommissioning and closure.

Socio-Economic:
The proposed increase in capacity from 75 to 200MW will be a positive impact as this will provide further support to the national grid therefore aiding in provide electricity security to the region and the country. The potential job creation at the construction phase of the project will be a positive for the local and regional economy as unemployment in the country is increasing. An assured and diversified electricity generation mix is a key step in attracting investors into South Africa and is key for the growth and development.

Recommendations
The project, in the EAP's opinion, does not pose a detrimental impact on the receiving environment and its inhabitants and can be mitigated significantly. The main activities associated with PV1 and PV2 have already been granted an Environmental Authorisation and the new project components (i.e. Battery Energy Storage System and increase in capacity) emanates from the technology optimisation and engineering design. Considering the opportunities that have been granted in the IRP 2019, the new project components (i.e. capacity increase and BESS) cannot be viewed in isolation to the previous authorisations as well as to the proposed 8 other PV Plants on the site. The project is critical in terms of the current energy crisis that has impacted our country and makes an important addition to sustainability goals by increasing investment and development in the renewable energy sector.

Acronyms

AC	Alternating Current
BA	Basic Assessment
BAR	Basic Assessment Report
BESS	Battery Energy Storage System
BID	Background Information Document
CA	Competent Authority
CBA	Critical Biodiversity Area
CBAR	Consultation Basic Assessment Report
CSP	Concentrating Solar Power
CV	Curriculum Vitae
DC	Direct Current
DEFF	Department of Environment, Fisheries and Forestry
DHSW&S	Department of Human Settlements, Water and Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
EAPASA	Environmental Assessment Practitioner Association of South Africa
ECO	Environmental Control Officer
EHS	Environmental, Health and Safety
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
EP	Equator Principles
EPFI	Equator Principles Financial Institutions
GA	General Authorisation
GIS	Geographic Information System
GNR	Government Notice Regulation
I&AP	Interested and Affected Party
IFC	International Finance Corporation
IDP	Integrated Development Plan
IRP	Integrated Resources Plan
IEM	Integrated Environmental Management
MW	Megawatt
NCDENC	Northern Cape Department of Environment and Nature Conservation
NEMA	National Environmental Management Act (Act No. 107 of 1998)
NEM:AQA	National Environmental Management Air Quality Act (Act No. 39 of 2004)
NEM:BA	National Environmental Management Biodiversity Act (Act No. 10 of 2004)
NEM:PAA	National Environmental Management Protected Areas Act (Act No. 57 of 2003)
NEM:WA	National Environmental Management – Waste Act (Act No. 59 of 2008)
NFA	National Forests Act (Act No. 84 of 1998)
NGO	Non-Governmental Organisation
NHRA	National Heritage Resources Act (Act No. 25 of 1999)
NWA	National Water Act (Act No. 36 of 1998)
OHSA	Occupational Health and Safety Act (Act No 85 of 1993)
PES	Present Ecological State
PP	Public Participation
PS	Performance Standards
PV	Photovoltaic

REC	Recommended Ecological Category
REDZ	Renewable Energy Development Zone
SACNASP	South African Council of Natural Science Professionals
SDG	Sustainable Development Goals
SWMP	Stormwater Management Plan
UNFCC	United Nations Framework Convention on Climate Change
WUA	Water Use Authorisation

Glossary

Activity (Development)	An action either planned or existing that may result in environmental impacts through pollution or resource use. For the purpose of this report, the terms 'activity' and 'development' are freely interchanged.
Alternatives	Different means of meeting the general purpose and requirements of the activity, which may include site or location alternatives; alternatives to the type of activity being undertaken; the design or layout of the activity; the technology to be used in the activity and the operational aspects of the activity.
Applicant	The project proponent or developer responsible for submitting an environmental application to the relevant environmental authority for environmental authorisation.
Biodiversity	The diversity of animals, plants and other organisms found within and between ecosystems, habitats, and the ecological complexes.
Buffer	A buffer is seen as an area that protects adjacent communities from unfavourable conditions. A buffer is usually an artificially imposed zone included in a management plan.
Construction	The building, erection or establishment of a facility, structure or infrastructure that is necessary for the undertaking of a listed or specified activity but excludes any modification, alteration or expansion of such a facility, structure or infrastructure and excluding the reconstruction of the same facility in the same location, with the same capacity and footprint.
Cumulative Impact	The impact of an activity that in itself may not be significant but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area.
Decommissioning	The demolition of a building, facility, structure or infrastructure.
Direct Impact	Impacts that are caused directly by the activity and generally occur at the same time and at the same place of the activity. These impacts are usually associated with the construction, operation or maintenance of an activity and are generally quantifiable.
Ecosystem	A dynamic system of plant, animal (including humans) and micro-organism communities and their non-living physical environment interacting as a functional unit. The basic structural unit of the biosphere, ecosystems are characterised by interdependent interaction between the component species and their physical surroundings. Each ecosystem occupies a space in which macro-scale conditions and interactions are relatively homogenous.
Environment	In terms of the National Environmental Management Act (NEMA) (Act No 107 of 1998) (as amended), "Environment" means the surroundings within which humans exist and that are made up of: i. the land, water and atmosphere of the earth; ii. micro-organisms, plants and animal life; iii. any part or combination of (i) and (ii), and the interrelationships among and between them; and iv. the physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and wellbeing.
Environmental Assessment	The generic term for all forms of environmental assessment for projects, plans, programmes or policies and includes methodologies or tools such as environmental impact assessments, strategic environmental assessments and risk assessments.
Environmental Authorisation	An authorisation issued by the competent authority in respect of a listed activity, or an activity which takes place within a sensitive environment.
Environmental Assessment Practitioner (EAP)	The individual responsible for planning, management and coordination of environmental impact assessments, strategic environmental assessments, environmental management programmes or any other appropriate environmental instrument introduced through the EIA Regulations.

Environmental Control Officer (ECO)	An individual nominated through the Client to be present on site to act on behalf of the Client in matters concerning the implementation and day to day monitoring of the EMPr and conditions stipulated by the authorities.
Environmental Impact	Change to the environment (biophysical, social and/ or economic), whether adverse or beneficial, wholly or partially, resulting from an organisation's activities, products or services.
Environmental Management	Ensuring that environmental concerns are included in all stages of development, so that development is sustainable and does not exceed the carrying capacity of the environment.
Environmental Management Programme (EMPr)	A detailed plan of action prepared to ensure that recommendations for enhancing or ensuring positive impacts and limiting or preventing negative environmental impacts are implemented during the life cycle of a project. This EMPr focuses on the construction phase, operation (maintenance) phase and decommissioning phase of the proposed project.
Fatal Flaw	An event or condition that could cause an unanticipated problem and/or conflict which will could result in a development being rejected or stopped.
Groundwater	Water in the ground that is in the zone of saturation from which wells, springs, and groundwater runoff are supplied.
Hazardous Waste	Any waste that contains organic or inorganic elements or compounds that may, owing to the inherent physical, chemical or toxicological characteristics of that waste, have a detrimental impact on health and the environment and includes hazardous substances, materials or objects within business waste, residue deposits and residue stockpiles as outlined in the National Environmental Management: Waste Amendment Act (No 26 of 2014).Schedule 3: Category A – Hazardous Waste.
Hydrology	The science encompassing the behaviour of water as it occurs in the atmosphere, on the surface of the ground, and underground.
Indirect Impacts	Indirect or induced changes that may occur as a result of the activity. These types if impacts include all of the potential impacts that do not manifest immediately when the activity is undertaken or which occur at a different place as a result of the activity
Integrated Environmental Management	A philosophy that prescribes a code of practice for ensuring that environmental considerations are fully integrated into all stages of the development and decision-making process. The IEM philosophy (and principles) is interpreted as applying to the planning, assessment, implementation and management of any proposal (project, plan, programme or policy) or activity - at local, national and international level – that has a potentially significant effect on the environment. Implementation of this philosophy relies on the selection and application of appropriate tools for a particular proposal or activity. These may include environmental assessment tools (such as strategic environmental assessment and risk assessment), environmental management tools (such as monitoring, auditing and reporting) and decision-making tools (such as multi-criteria decision support systems or advisory councils).
Interested and Affected Party (I&AP)	Any person, group of persons or organisation interested in or affected by an activity; and any organ of state that may have jurisdiction over any aspect of the activity.
Method Statement	A method statement is a written submission by the Contractor to the Engineer in response to the specification or a request by the Engineer, setting out the plant, materials, labour and method the Contractor proposes using to carry out an activity, identified by the relevant specification or the Engineer when requesting a Method Statement. It contains sufficient detail to enable the Engineer to assess whether the Contractor's proposal is in accordance with the Specifications and/or will produce results in accordance with the Specifications.
Mitigate	The implementation of practical measures designed to avoid, reduce or remedy adverse impacts or enhance beneficial impacts of an action.

No-Go Option	In this instance the proposed activity would not take place, and the resulting environmental effects from taking no action are compared with the effects of permitting the proposed activity to go forward.
Pollution	The National Environmental Management Act, No. 107 of 1998 defines pollution to mean any change in the environment caused by – substances; radioactive or other waves; or noise, odours, dust or heat emitted from any activity, including the storage or treatment of waste or substances, construction and the provision of services, whether engaged in by any person or an organ of state, where that change has an adverse effect on human health or well-being or on the composition, resilience and productivity of natural or managed ecosystems, or on materials useful to people, or will have such an effect in the future.
Public Participation Process	A process in which potential interested and affected parties are given an opportunity to comment on, or raise issues relevant to, specific matters.
Re-use	To utilise articles from the waste stream again for a similar or a different purpose without changing the form of properties of the articles.
Rehabilitation	A measure aimed at reinstating an ecosystem to its original function and state (or as close as possible to its original function and state) following activities that have disrupted those functions.
Sensitive Environments	Any environment identified as being sensitive to the impacts of the development.
Significance	Significance can be differentiated into impact magnitude and impact significance. Impact magnitude is the measurable change (i.e. magnitude, intensity, duration and likelihood). Impact significance is the value placed on the change by different affected parties (i.e. level of significance and acceptability). It is an anthropocentric concept, which makes use of value judgements and science-based criteria (i.e. biophysical, social and economic).
Stakeholder Engagement	The process of engagement between stakeholders (the proponent, authorities and I&APs) during the planning, assessment, implementation and/or management of proposals or activities.
Sustainable Development	Development which meets the needs of current generations without hindering future generations from meeting their own needs.
Visual Contrast	The degree to which the development would be congruent with the surrounding environment. It is based on whether or not the development would conform with the land use, settlement density, forms and patterns of elements that define the structure of the surrounding landscape.
Watercourse	Defined as: i. a river or spring; ii. a natural channel or depression in which water flows regularly or intermittently; iii. a wetland, lake or dam into which, or from which, water flows; and iv. any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse as defined in the National Water Act, 1998 (Act No. 36 of 1998) and a reference to a watercourse includes, where relevant, its bed and banks.
Water Pollution	The National Water Act, 36 of 1998 defined water pollution to be the direct or indirect alteration of the physical, chemical or biological properties of a water resource so as to make it – less fit for any beneficial purpose for which it may reasonably be expected to be used; or harmful or potentially harmful (aa) to the welfare, health or safety of human beings; (bb) to any aquatic or non-aquatic organisms; (cc) to the resource quality; or (dd) to property".
Wetland	Land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil.

1 INTRODUCTION

ACWA Power Energy Africa (Pty) Ltd (hereafter referred to as ACWA Power) is proposing to construct a solar energy facility consisting of ten (10) photovoltaic (PV) plants on the north-eastern portion of the Remaining Extent (RE) of the Farm Bokpoort 390, located 20 km north-west of the town of Groblershoop within the !Kheis Local Municipality in the ZF Mgcawu District Municipality, Northern Cape Province.

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b) The electricity generation capacity of the PV 1 & 2 Plants will be 200 MW [75 MW was originally approved in the EAs dated 24/10/2016 (Ref: 14/12/16/3/3/2/881 & Ref 14/12/16/3/3/2/880). It was confirmed in the IQ/20/0004 correspondence from the Environment, Forestry and Fisheries (DEFF) that the electricity generation of more than 20MW from a Renewable Resource listed activity is now triggered and must be applied for due to the increase in capacity]

ACWA Power has indicated that the development will be funded from local and international sources and hence the EIA for the proposed development would need to comply with the International Finance Corporation Performance Standards (IFC) 2012 and the Equator Principles.

The locality map including the layout of the new PV plants and ancillary infrastructure is provided in Figure 1 and ***Appendix A***.

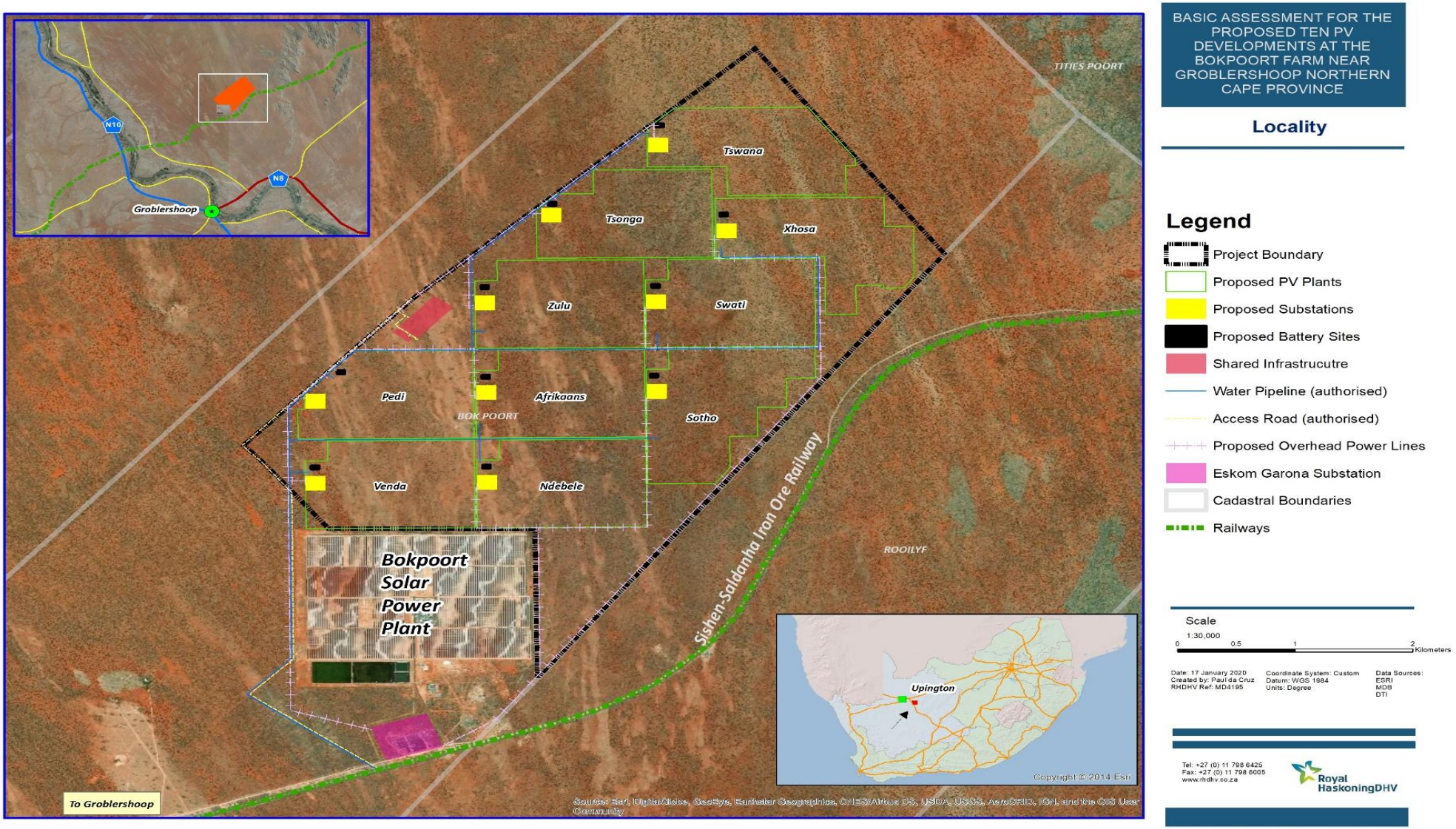


Figure 1: Locality Map

1.1 Approach to the Study

Since the project will take place in a Renewable Energy Development Zone (REDZ)(GNR113 of 16 February 2018) and Activity 1 and 4 (Listing Notice 2) of the EIA Regulations 2014 (as amended in 2017) is triggered, a BA procedure as contemplated in Regulation 19 and 20 of the EIA Regulations 2014 (as amended in 2017), must be followed in order to obtain environmental authorisation (EA). The aforementioned was also confirmed in pre-applications with the Department and in an interpretation, query lodged with DEFF.

1.1.1 Previous EIA Studies

This BA study relies on the previous EIA studies including specialist assessments listed below:

- Proposed 75 MW Concentrating Solar Thermal Power Plant and Associated Infrastructure in the Siyanda District, Northern undertaken by Bohlweki SSI Environmental, 2011[4].
- Proposed 150 MW CSP Tower Development on the Remaining Extent of the Farm Bokpoort 390, Northern Cape undertaken by Golder Associates Africa, 2016[5].
- Proposed 75 MW Photovoltaic (PV 1) Solar Development on the Remaining Extent of the Farm Bokpoort 390, Northern Cape undertaken by Golder Associates Africa, 2016[6].
- Proposed 75 MW Photovoltaic (PV 2) Solar Development on the Remaining Extent of the Farm Bokpoort 390, Northern Cape undertaken by Golder Associates Africa, 2016[7].

1.1.2 Applications for Environmental Authorisation

Two separate applications for authorisation will be submitted to the Competent Authority- the Department of Environment, Forestry and Fisheries (DEFF):

- Proposed 200MW Ndebele Photovoltaic Plant and Associated Battery Energy Storage System on the Remaining Extent of the Farm Bokpoort 390 near Groblershoop within the !Kheis Local Municipality in the Northern Cape Province
- Proposed 200MW Xhosa Photovoltaic Plant and Associated Battery Energy Storage System on the Remaining Extent of the Farm Bokpoort 390 near Groblershoop within the !Kheis Local Municipality in the Northern Cape Province

1.1.3 Basic Assessment Study

A Basic Assessment (BA) is the level of environmental assessment applicable to activities listed in Listing Notices 1 and 3. A BA is applied to activities that are considered less likely to have significant environmental impacts and, therefore, unlikely to require a detailed Environmental Impact Assessment (EIA).

The BA aims to achieve the following:

- Determine the policy and legislative context within which the proposed activity is undertaken and how the activity complies with and responds to the policy and legislative context;
- Describe the need and desirability of the proposed project;
- Identify the alternatives considered, including the activity, location, and technology alternatives;

[4] *Benedek, F; Roods, M. 2011. Environmental Impact Assessment for a Proposed 75MW Concentrating Solar Thermal Power Plant and Associated Infrastructure in the Siyanda District, Northern Cape. Bohlweki SSI Environmental. DEA Reference number: 12/12/20/1920.*

[5] *Schlechter, M., & Baxter, B. 2016. Final EIA Report: Proposed 150MW CSP Tower Development on the Remaining Extent of Farm Bokpoort 390, Northern Cape. Golder Associates. Ref 14/12/16/3/3/2/879.*

[6] *Schlechter, M., & Baxter, B. 2016. Final EIA Report: Proposed 75MW Photovoltaic (PV1) Solar Development on the Remaining Extent of the Farm Bokpoort 390, Northern Cape. Golder Associates. Ref 14/12/16/3/3/2/881.*

[7] *Schlechter, M., & Baxter, B. 2016. Final EIA Report: Proposed 75MW Photovoltaic (PV2) Solar Development on the Remaining Extent of the Farm Bokpoort 390, Northern Cape. Golder Associates. Ref 14/12/16/3/3/2/880.*

- Undertake an impact and risk assessment process inclusive of reasonably foreseeable cumulative impacts (where applicable). The focus being; determining the geographical, physical, biological, social, economic, heritage and cultural sensitivity of the project and the risk of impact of the proposed activity on these aspects to determine the nature, significance, consequence, extent, duration, and probability of the impacts occurring to; and the degree to which these impacts:
  - can be reversed;
  - may cause irreplaceable loss of resources; and
  - can be avoided, managed or mitigated.

This consultation Basic Assessment Report (cBAR) has been compiled in accordance with the stipulated requirements in GNR 326, Appendix 1 of the EIA Regulations, 2014 (as amended in 2017), which outlines the legislative BA process and requirements for assessment of outcomes, impacts and residual risks of the proposed development. The cBAR further incorporates the findings and recommendations of the specialist studies conducted for the project.

An Environmental Management Programme (EMPr) has been compiled according to Appendix 4 of GNR 326 of the EIA Regulations, 2014 (as amended in 2017) for the construction and rehabilitation phases of the project. The EMPr has been compiled as a stand-alone document from the cBAR and is submitted to the DEFF along with the cBAR. The EMPr provides the actions for the management of identified environmental impacts emanating from the project and a detailed outline of the implementation programme to minimise and/ or eliminate any anticipated negative environmental impacts and to enhance positive impacts. The EMPr provides strategies to be used to address the roles and responsibilities of environmental management personnel on site, and a framework for environmental compliance and monitoring.

1.2 Structure of the Basic Assessment Report (BAR)

The BAR is Structured as follows:

Table 1: Structure of the Report

Appendix 1: Content of Basic Assessment Reports	Chapter / Section
(a) details of i) the EAP who prepared the report; and ii) the expertise of the EAP to carry out an environmental impact assessment	Section 1.5
(b) The location of the activity (21-digit Surveyor General code, physical address and farm name where available, coordinates of the boundary of the property)	Section 2.1 & 2.2
(c) A plan which locates the proposed activity or activities applied for as well as associated structures and infrastructure at an appropriate scale or, if it is – a linear activity, a description of the route of the activity.	Figure 1
(d) A description of the scope of the proposed activity, including – i) all listed and specified activities triggered and being applied for; and ii) a description of the activities to be undertaken including associated structures and infrastructure.	Chapter 2&3
(e) A description of the policy and legislative context within which the development is proposed including – i) an identification of all legislation, policies, plans, guidelines, spatial tools, municipal development planning frameworks, and instruments that are applicable to this activity and have been considered in the preparation of the report; and	Chapter 3

Appendix 1: Content of Basic Assessment Reports	Chapter / Section
ii) how the proposed activity complies with and responds to the legislation and policy context, plans, guidelines, tools frameworks, and instruments.	
(f) A motivation for the need and desirability for the proposed development including the need and desirability of the activity in the context of the preferred location.	Section 2.4 & 2.5
(g) A motivation for the preferred site, activity and technology alternative.	Section 2.4 & Chapter 4
(h) A full description of the process followed to reach the proposed preferred alternative within the site. i) details of all the alternatives considered; ii) details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs; iii) a summary of the issues raised by interested and affected parties, and an indication of the manner in which the issues were incorporated, or the reasons for not including them; iv) the environmental attributes associated with the alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects; v) the impacts and risks identified for each alternative, including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts – (aa) can be reversed; (bb) may cause irreplaceable loss of resources; and (cc) can be avoided, managed or mitigated. vi) the methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks associated with the alternatives.	Chapter 4
(i) A full description of the process undertaken to identify, assess and rank the impacts the activity will impose on the preferred location through the life of the activity including – i) a description of all environmental issues and risks that were identified during the environmental impact assessment process; and ii) an assessment of the significance of each issue and risk and an indication of the extent to which the issue and risk could be avoided or addressed by the adoption of mitigation measures.	Chapter 7
(j) An assessment of each identified potentially significant impact and risk including – a) cumulative impacts; b) the nature, significance and consequences of the impact and risk; c) the extent and duration of the impact and risk; d) the probability of the impact and risk occurring; e) the degree to which the impact and risk can be reversed; f) the degree to which the impact and risk may cause irreplaceable loss of resources; and g) the degree to which the impact and risk can be avoided, managed or mitigated.	Chapter 7
(k) Where applicable, a summary of the findings and impact management measures identified in any specialist report complying with Appendix 6 to these Regulations and an indication as to how these findings and recommendations have been included in the final report.	Chapter 7 & 8
(l) An environmental impact statement which contains- i) a summary of the key findings of the environmental impact assessment; ii) a map at an appropriate scale which superimposes the proposed activity and its associated structures and infrastructure on the environmental sensitivities of the preferred site indicating any areas that should be avoided, including buffers; and iii) a summary of the positive and negative impacts and risks of the proposed activity and identified alternatives.	Chapter 8

Appendix 1: Content of Basic Assessment Reports	Chapter / Section
(m) Based on the assessment, and where applicable, impact management measures from specialist reports, the recording of the proposed impact management objectives, and the impact management outcomes for the development for inclusion in the EMPr.	Chapter 7
(n) Any aspects which were conditional to the findings of the assessment either by the EAP or specialist which are to be included as conditions of authorisation.	Section 8.5.1
(o) A description of any assumptions, uncertainties, and gaps in knowledge which relate to the assessment and mitigation measures proposed.	Section 8.4
(p) A reasoned opinion as to whether the proposed activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation.	Section 8.5
(q) Where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required, the date on which the activity will be concluded, and the post construction monitoring requirements finalised.	Section 8.5
(r) An undertaking under oath or affirmation by the EAP in relation to: i) the correctness of the information provided in the reports; ii) the inclusion of comments and inputs from stakeholders and I&APs; iii) the inclusion of inputs and recommendations from the specialist reports where relevant; and any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested and affected parties.	Section 8.6
(s) Where applicable, details of any financial provisions for the rehabilitation, closure, and on-going post decommissioning management of negative environmental impacts.	N/A
(t) Any specific information that may be required by the competent authority.	N/A
(u) Any other matters required in terms of section 24(4)(a) and (b) of the Act.	N/A

1.3 Specialist Assessment

To ensure the scientific rigour of the BA study, as well as a robust assessment of impacts, Royal HaskoningDHV commissioned a number of studies in order to comprehensively identify both potentially positive and negative environmental impacts (social and biophysical), associated with the proposed project, and where possible to provide mitigation measures to reduce the potentially negative impacts and enhance the positive impacts (Table 2). The specialist studies can be found in ***Appendix B***.

Table 2: Specialist assessments conducted for the project

Specialist Study	Organisation	Appendix
Soils and Agricultural Potential	Johann Lanz (private)	***Appendix B1***
Hydrogeology	GCS	***Appendix B2***
Surface Water (Hydrology)	GCS[8]	***Appendix B3***
Surface Water (Wetlands)	Royal HaskoningDHV	***Appendix B4***
Ecology	Bathusi Environmental Consultants	***Appendix B5***

[8] *Must be read in conjunction with the Surface Water Baseline and Impact Assessment Report compiled by Dateling, J and Boyd, L;(2016). Surface Water Baseline and Impact Assessment Report for the Proposed 75 MW PV2 Solar Facility (Proposed Bokpoort II Solar Development) near Groblershoop, Northern Cape. Golder Associates Africa (Pty) Ltd.*

Specialist Study	Organisation	Appendix
Avifauna	Arcus Consulting Services	***Appendix B6***
Bats	Arcus Consulting Services	***Appendix B7***
Air Quality	WSP	***Appendix B8***
Heritage	Johnny van Schalkwyk (private)	***Appendix B9***
Palaeontology	Natura Viva	***Appendix B10***
Traffic	Royal HaskoningDHV	***Appendix B11***
Visual	Royal HaskoningDHV	***Appendix B12***
Socio-economic	Royal HaskoningDHV[9]	***Appendix B13***

1.4 Details of the Project Developer

The Developer is ACWA Power and the details of the responsible person are listed in Table 3 below.

Table 3: Applicant details

Applicant	ACWA Power Energy Africa (Pty) Ltd	
Representative	Prabashen Govender	
Physical Address	7th Floor 90 Grayston Drive Sandton 2196	
Telephone	(011) 722 4100	
E-mail	pgovender@acwapower.com	

1.5 Details of the Environmental Assessment Practitioner

The environmental team of Royal HaskoningDHV have been appointed as an Environmental Assessment Practitioners (EAP) by ACWA Power to undertake the appropriate environmental studies for this proposed project.

The professional team of Royal HaskoningDHV has considerable experience in the environmental management field. Royal HaskoningDHV been involved in and/ or managed several of the largest EIAs undertaken in South Africa to date. A specialist area of focus is on the assessment of multi-faceted projects, including the establishment of linear developments (national and provincial roads, and powerlines), mixed-use developments, bulk infrastructure and supply (e.g. wastewater treatment works, pipelines, landfills), electricity generation and transmission, urban, rural and township developments, environmental aspects of Local Integrated Development Plans, as well as general environmental planning, development and management.

[9] *Must be read in conjunction with the Socio-economic Impact Assessment compiled by Smith, T; de Waal, D. 2016. Socio-economic Impact Assessment for the proposed 75 MW Photovoltaic (PV2) Solar Facility (Bokpoort II Solar Development). Golder Associates Africa (Pty) Ltd.*

Details of the EAPs are provided in Table 4 below.

Table 4: EAP details

Consultant	Royal HaskoningDHV	
Contact Persons	Malcolm Roods	Seshni Govender
Postal Address	PO Box 867, Gallo Manor, 2191	PO Box 867, Gallo Manor, 2191
Telephone	087 352 1528	087 352 1592
E-mail	malcolm.roods@rhdhv.com	Seshni.govender@rhdhv.com
Qualification	BA (Hons) Environmental Management LLB	Bsc (Hons) Environmental Science
Expertise	Malcolm Roods is a Principal with RHDHV specialising in Environmental Impact Assessments (EIA) for electricity supply (generation, transmission and distribution), road infrastructure, residential developments as well as water management projects. This builds on a broad government background, which has made him particularly flexible. His past experience includes 6 years public service which included policy development, environmental law reform and EIA reviews. His experience also includes more than 12 years of environmental consulting in the field of Impact Assessment and Authorisation Applications, with a focus on legislative requirements and business management. Since joining the company he has been involved with major EIA projects such as the Transnet New Multi Product Pipeline (NMPP), various Rand Water Pipeline projects, numerous Eskom Research, Generation, Transmission and Distribution projects, SANRAL road developments, Waste Water Treatment & Re-use projects as well as undertook Independent Reviews of the EIA process for the National Department of Environmental Affairs, etc to name but a few.	Seshni is an Environmental Consultant working on strategic environmental planning and water related projects. Seshni has been involved in numerous Water Use Licence projects, including complex integrated licencing that requires understanding cumulative environmental impacts. She also has been involved in the development of the Gauteng Environment Outlook, the N11-13X Mokpane Ring Road Environmental Authorisation Processes and Open Space plans for the City of Joburg. Seshni has drafted applications for complex integrated licences that include components of National Environmental Management Act and National Water Act on behalf of Eskom and private companies. This has exposed me to complex matters of trying to integrate environmental impacts with mitigations measures that will be in line with the sustainable development principles. As an Environmental Scientist Seshni contributes to projects through; report writing, data management and analysis, environmental impact analysis, policy review and public engagement/consultation.

The Curriculum Vitae (CV) of the respective consultants can be found in ***Appendix C***.

2 PROJECT DESCRIPTION

2.1 Property Description

The project area is located on the north eastern portion of the Farm Bokpoort 390 RE which is 20 km north-west of the town of Groblershoop within Ward 3 of the !Kheis Local Municipality in the ZF Mgcawu District Municipality, Northern Cape Province. The total Bokpoort II project area designated for the development is approximately 1500 ha. The project site is situated approximately 77 km south-east of Upington. The Orange River is located approximately 12 km south-west of the site.

The landowner details as well as 21-digit surveyor general codes are provided in Table 5.

Table 5: Property details

Property	Owner	21 Digit Surveyor-General Code
Farm Bokpoort 390 RE	ACWA Power SolAfrica Bokpoort CSP Power Plant (Pty) Ltd (RF)	C02800000000038900000

2.2 Project Location and Co-ordinates

The corner point co-ordinates of each PV plant are provided in Table 6.

Table 6: PV Plant Project co-ordinates

PV Plant Identifier	PV Plant Co-ordinates	BESS Co-ordinates	Overhead Powerline Co-ordinates
PV 1 – Ndebele	NW: 28°42'41.94"S; 21°59'18.97"E NE: 28°42'41.64"S; 21°59'59.23"E SE: 28°43'10.62"S; 21°59'59.50"E SW: 28°43'10.95"S; 21°59'13.07"E	NW: 28°42'49.99"S; 22° 0'1.79"E NE: 28°42'49.84"S; 22° 0'3.77"E SE: 28°42'50.89"S; 22° 0'3.82"E SW: 28°42'50.89"S; 22° 0'1.84"E	28°43'10.76"S; 22° 0'7.77"E 28°43'10.71"S; 21°59'59.93"E 28°43'2.58"S; 21°59'59.84"E 28°42'57.40"S; 22° 0'0.64"E
PV 2 – Xhosa	NW: 28°42'12.24"S; 21°59'26.32"E NE: 28°42'12.04"S; 21°59'58.93"E SE: 28°42'40.99"S; 21°59'59.22"E SW: 28°42'41.34"S; 21°59'10.94"E	NW: 28°41'26.77"S; 22° 1'6.95"E NE: 28°41'26.61"S; 22° 1'8.99"E SE: 28°41'27.63"S; 22° 1'9.02"E SW: 28°41'27.79"S; 22° 1'7.11"E	28°42'4.95"S; 22° 1'34.59"E 28°41'56.87"S; 22° 1'34.44"E 28°41'48.55"S; 22° 1'34.45"E 28°41'41.41"S; 22° 1'32.89"E 28°41'41.45"S; 22° 1'23.78"E 28°41'41.53"S; 22° 1'14.61"E 28°41'41.36"S; 22° 1'5.33"E 28°41'33.94"S; 22° 1'6.09"E

2.3 Technical Description

A PV plant converts the sun's energy directly into electrical energy and will consist of 200 MW photovoltaic solar arrays. The general position of the PV plant is shown in Figure 1 above.

Each of the PV plants will consist of the following infrastructure:

- Solar PV panel that will be able to deliver up to 200 MW to the Eskom National Grid;
- Inverters that convert direct current (DC) generated by the PV modules into alternating current (AC) to be exported to the electrical grid;
- A transformer that raises the system AC low voltage to medium voltage. The transformer converts the voltage of the electricity generated by the PV panels to the correct voltage for delivery to Eskom;

- Transformer substation; and
- Instrumentation and Control consisting of hardware and software for remote plant monitoring and operation of the facility.

Associated infrastructure includes:

- Mounting structures for the solar panels;
- Cabling between the structures, to be lain underground where practical;
- A new 132 kV overhead powerline (servitude spanning 15.5 m on both sides with towers that will be 35 m high) which was already approved as part of the previous EIA process and will connect the facility to the National Grid via Eskom's existing Garona Substation;
- Battery Energy Storage System (BESS);
- Internal access roads (4 – 6 m wide roads will be constructed but existing roads will be used as far as possible) and fencing (approximately 3 m in height); and
- Shared infrastructure consisting of buildings, including a workshop area for maintenance, storage (i.e. fuel tanks, etc.), laydown area, parking, warehouse, and offices (previously approved).

Table 7 summarises the main technical details for a PV plant and associated infrastructure.

Table 7: Technical details of the proposed PV plant/s

Facility Component	Description/ Dimensions
Height of PV panels	4.5 m
Area of PV Array	150 ha
Area occupied by inverter/ transformer stations/ substations	150 m x 150 m
Capacity of on-site substation	11 kV/132 kV on site substation
Area occupied by both permanent and construction laydown areas	5 ha
Area occupied by buildings	
Length of internal roads	Approximately 5 ha (temporary facilities used during the construction and operational phase will be less than as PV does not require a lot of operational staff)
Width of internal roads	4 m
Proximity to grid connection	Approximately 5 km
Height of fencing	3 m
Type of fencing	Security Fencing
Overhead powerline length	Varies in length
Overhead powerline servitude	15.5 m on each side
Overhead powerline tower height	35 m
BESS (either lead-acid or lithium-ion)	Battery power at point of connection: 150 MW Area required: 400 m x 400 m Quantity of hazardous substance: 4500 m^3
Construction/ labour camp	Construction camp to be constructed for up to 200 people

2.3.1 Battery Energy Storage System

Battery Storage is one of the energy storage technologies that can provide flexibility and services in managing the electricity system in order to create a more resilient energy infrastructure. There are various types of energy storage technologies available at the current time, including the following:

- Batteries: Devices that store energy electrochemically in a way that allows for direct conversion to electricity
- Flow Batteries: Batteries in which the electrodes are in liquid form, allowing increased flexibility in design
- Flywheels: Devices that store energy in a rotating mass, convertible to and from electricity through a motor/generator
- Compressed Air: Systems that store energy in compressed air, which can be run through expanders to regenerate electricity
- Thermal Storage: Systems that capture heat or cold and allows them to be released as required to serve customer loads
- Pumped Storage: Systems that store energy in large reservoirs of water held at a height

Battery storage technology is an emerging global technology and recent world trends suggest it is best used to support national electricity grids. It is only recently that battery storage has become sufficiently economically viable to start playing a significant energy storage role in the power system. In South Africa, as a result of the Renewable Energy Independent Power Producer Procurement, the variable energy sources, specifically solar (photovoltaic (PV)) and wind have multiplied. Solar without storage predominantly provides the predictable component of energy generation, whilst wind provides the far less predictable component; as a result, power must be generated at short notice in order to sustain the supply/demand balance. Battery storage provides this flexibility and deploying the batteries in areas where there are a lot of renewable energy power plants will allow energy generators to take advantage of the surplus energy generation capacity provided by this increased renewable technology.

There is no perfect energy storage solution and with the variety of technologies available, it is both difficult and important to have quantifiable ways in which to compare them. Selecting the ‘best’ storage technology will depend on the application and system requirements.

The following technology options have been considered by ACWA Power:

- Lithium Ion and Lythium Polymer Batteries
- Lead Acid Battery

2.4 Project Motivation

South Africa experiences some of the highest levels of solar radiation in the world. The average daily solar radiation in South Africa varies between 4.5 and 6.5 kWh/m^2 (16 and 23 MJ/m^2), compared to about 3.6 kWh/m^2 for parts of the United States and about 2.5 kWh/m^2 for Europe and the United Kingdom. Figure 2 below shows the annual solar radiation (direct and diffuse) for South Africa, which reveals considerable solar resource potential for solar water heating applications, solar photovoltaic and solar thermal power generation. The Northern Cape Province is one of the best places in South Africa to harness solar radiation.

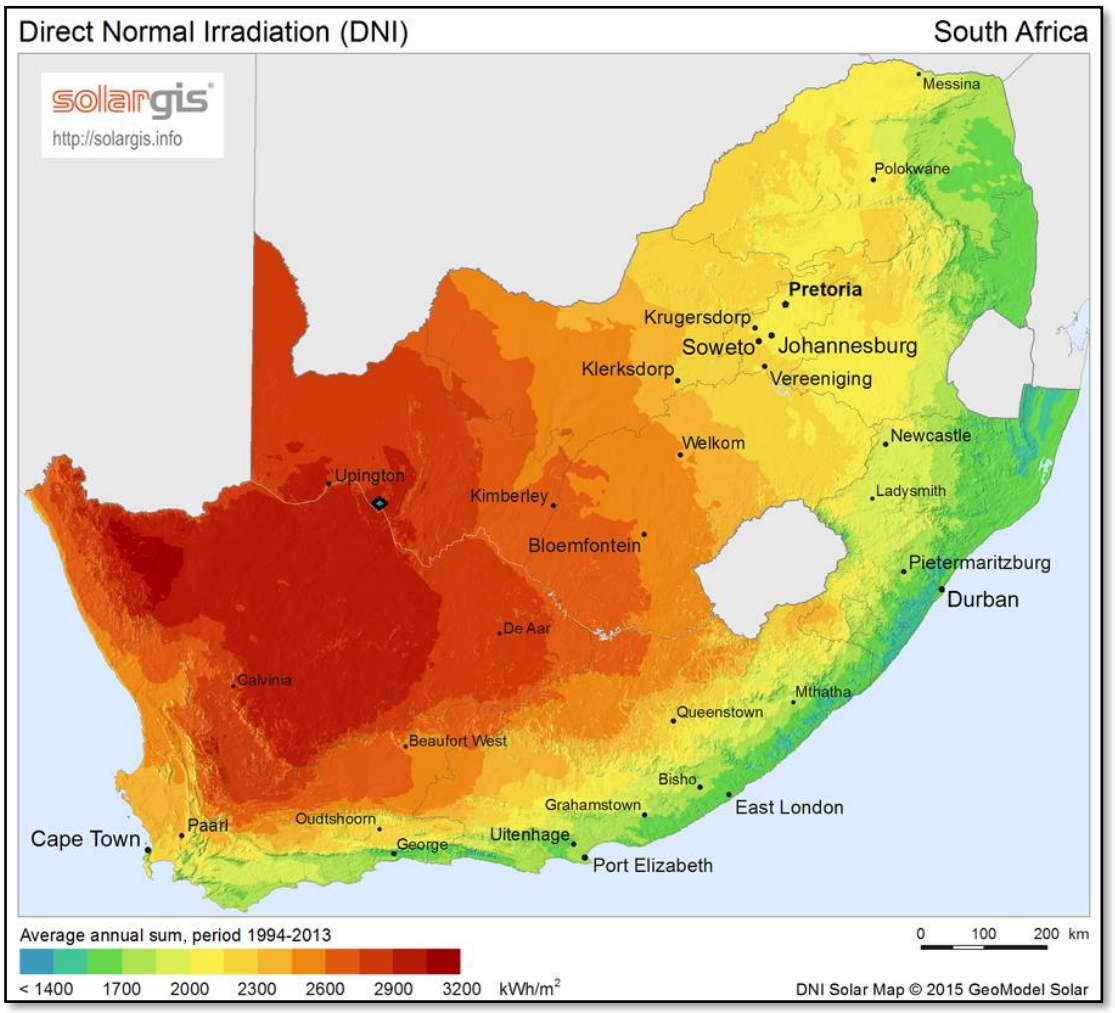


Figure 2: Annual incoming short-wave radiation for South Africa[10]

2.5 Integrated Resource Plan (IRP 2019)

The IRP is an electricity infrastructure development plan based on least-cost electricity supply and demand balance, taking into account security of supply and the environment (minimize negative emissions and water usage). The promulgated IRP 2010–2030 identified the preferred generation technology required to meet expected demand growth up to 2030. It incorporated government objectives such as affordable electricity, reduced greenhouse gas (GHG) emissions, reduced water consumption, diversified electricity generation sources, localisation and regional development.

Besides capacity additions, a number of assumptions have changed since the promulgation of IRP 2010–2030. Key assumptions that changed include the electricity demand projection, Eskom's existing plant performance, as well as new technology costs. These changes necessitated the review and update of the IRP which resulted in the draft IRP 2018 and the promulgation of the IRP 2019.

The IRP recognises that whilst South Africa relies heavily on coal to meet its energy needs, the country is well endowed with renewable energy resources that offer sustainable alternatives to fossil fuels and therefore the country continues to pursue a diversified energy mix that reduces reliance on a single or a few

[10] *www.solargis.info*

primary energy sources. The extent of decommissioning of the existing coal fleet due to end of design life, could provide space for a completely different energy mix relative to the current mix. Solar PV, wind and CSP with storage present an opportunity to diversify the electricity mix, to produce distributed generation and to provide off-grid electricity. Renewable technologies also present huge potential for the creation of new industries, job creation and localisation across the value chain[11].

During the State of the Nation Address 2020, it was indicated that a "*section 34 Ministerial Determination will be issued "shortly" to give effect to the country's Integrated Resource Plan 2019, enabling the development of additional grid capacity from renewable energy, natural gas, hydropower, battery storage and coal. This includes starting to procure emergency power from projects that can deliver electricity into the grid within 3 to 12 months from approval*." ACWA Power has noted the urgency of these projects and has taken all the necessary steps to provide solutions to one of South Africa's greatest threats to development.

2.5.1 Need & Desirability

Table 8: Project need, desirability and benefits

(i) Is the activity permitted in terms of the property's existing land use rights?	**YES**		**Please explain**
ACWA Power Solafrica Bokpoort CSP Power Plant (Pty) Ltd is the landowner of the Farm Bokpoort 390 RE and in 11 January 2017 obtained approval for the rezoning of farm for Agriculture Zone 1 to a Special Zone (Solar Energy Facility). The activity is therefore permitted in terms of the property's existing land use rights.			
(ii) Will the activity be in line with the following?			
(a) Provincial Spatial Development Framework (PSDF)	**YES**		**Please explain**
The proposed activity is in line with the Northern Cape PSDF (2012) Energy Policy, which states that "renewable energy sources (e.g. wind, solar thermal, biomass, and domestic hydroelectricity generation) are to comprise 25% of the province's energy generation capacity by 2020" and the PSDF Objectives which include "to promote the development of renewable energy supply schemes. Large-scale renewable energy supply schemes are strategically important for increasing the diversity of domestic energy supplies and avoiding energy imports while minimizing detrimental environmental impacts". Recognising the suitability of the province to optimise the use of solar power, the Northern Cape Provincial Spatial Development Framework (PSDF) has set the following energy objectives for the province: ▪ to promote the development of renewable energy supply schemes; ▪ to reinforce the existing transmission network and to ensure a reliable electricity supply in the Northern Cape; ▪ to develop and institute innovative new energy technologies to improve access to reliable, sustainable and affordable energy services with the objective to realise sustainable economic growth and development; and ▪ to develop and institute energy supply schemes with the aim to contribute to the achievement of the targets set by IRP 2010 – 2030.			
(b) Urban edge / Edge of Built environment for the area		**NO**	**Please explain**
The project is located outside of the urban edge. The proposed development site is in a remote, rural area and so it will neither contribute to, nor compromise urban growth.			

[11] *Department of Energy. 2019. Integrated Resources Plan.*

(c)	**Integrated Development Plan (IDP) and Spatial Development Framework (SDF) of the Local Municipality (e.g. would the approval of this application compromise the integrity of the existing approved and credible municipal IDP and SDF?).**		**NO Please explain**

According to the !Kheis Local Municipality IDP 2017-2022: "*The Municipality is in the middle of the Presidential Infrastructure Coordinating Committee (PICC), Strategic Infrastructure Program (SIP) and is therefore part of the Special Economic Development Zone of the Solar Corridor. !Kheis Municipal area could benefit from a number of programs that are not available to other Municipalities, and must be incorporated in the approach in the IDP.*

Solar energy is a natural resource like water, mining, iron and copper. A lot of macro solar projects is happening around the Municipality. Micro solar opportunities can assist sustainability of the Municipality by attracting new businesses and in the provision of basic services to residents. The Municipal area has a high solar radiation which can open enormous potential of green technology and innovation such as powering solar vehicles to render basic services. This resource can be a major advantage to assist the poor rural communities in the creation of jobs and providing electricity to under privilege families and business opportunities."

Therefore, this project is in line for the vision for the Municipality and will assist the Municipality in developing solar projects in the future.

(d)	**Approved Structure Plan of the Municipality**		**NO Please explain**

As stated above a key opportunity for the Municipality is to develop green technologies due to the unique position that the municipality is located in, therefore this project will assist the municipality in developing this vision.

(e)	**An Environmental Management Framework (EMF) adopted by the Department (e.g. Would the approval of this application compromise the integrity of the existing environmental management priorities for the area and if so, can it be justified in terms of sustainability considerations?)**		**NO Please explain**

The ZF Mgcawu District Municipality (formerly known as the Siyanda District) EMF within the !Kheis Municipality IDP (2014 - 2015) states that due to the climate of the area there is huge potential to utilise solar energy more widely, especially in the remote areas of the district. The proposed activity is a solar plant which is a sustainable and renewable operation that provides an additional economic resource to the area.

Furthermore, this Basic Assessment study is a mechanism of a management intervention that considers the principles of the National Environmental Management Act which includes sustainability.

(f)	**Any other Plans (e.g. Guide Plan)**		**NO Please explain**

The IRP 2019 stated that the "*Solar PV, wind and CSP with storage present an opportunity to diversify the electricity mix, to produce distributed generation and to provide off-grid electricity. Renewable technologies also present huge potential for the creation of new industries, job creation and localisation across the value chain*."

(iii) Is the land use (associated with the activity being applied for) considered within the timeframe intended by the existing approved SDF agreed to by the relevant environmental authority (i.e. is the proposed development in line with the projects and programmes identified as priorities within the credible IDP)?	**YES**		**Please explain**
The project poses no threat to the land uses, the location of the project is in a strategically important area known as renewable energy development zones (REDZ). REDZ are gazetted geographical areas: ▪ In which clusters (several projects) of wind and PV solar development will have the lowest negative impact on the environment while yielding the highest possible social and economic benefit to the country; ▪ That are widely agreed to have strategic importance for wind and PV solar development; ▪ Where the environmental and other authorisation processes have been aligned and streamlined based on scoping level pre-assessment and clear development requirements; ▪ Where pro-active and socialised investment can be made to provide time efficient infrastructure access The study area falls within the REDZ 7 which is earmarked for large scale solar energy facilities and is within the Northern Corridor Strategic Transmission Corridor. As stated above, it is one of the initiatives of the Municipality to use this opportunity for the improvement of the community by ensuing that these solar plants will directly benefit the Municipality through the creation of jobs as well as creating self-sufficient cities.			
(iv) Does the community / area need the activity and the associated land use concerned (is it a societal priority)? (This refers to the strategic as well as local level (e.g. development is a national priority, but within a specific local context it could be inappropriate.)	**YES**		**Please explain**
The recent power cuts or load shedding by Eskom have emphasised the need for additional power generation capacity in South Africa. There is a focus on moving towards increased generation from renewable energy sources. The Department of Energy's Renewable Energy Independent Power Producer Procurement (REIPPP) Programme is designed to stimulate more independent power producers to meet the country's ever-growing electricity demand. The IRP 2019 being implemented by the Department of Energy, highlights the electricity demand forecasts and Government's plan to meet this demand through a variety of approaches and technologies, one of which is to implement more renewable energy projects. Due to South Africa's electricity generation and supply system being overloaded, the demand for an increased and stable electricity supply is a priority not only in the Northern Cape, but in all the other South African provinces. Solar energy plants are important for reducing the country's overall environmental footprint from power generation and for directing a pathway towards sustainability. Thus, the proposed project addresses a national/ strategic priority.			
(v) Are the necessary services with adequate capacity currently available (at the time of application), or must additional capacity be created to cater for the development?	**YES**		**Please explain**
There are no services at the site and none will be required from the municipality. The construction of a new water supply pipeline, access roads, a powerline from the PV installation to Eskom's Garona substation and installation of a package plant (sewage treatment) has already been authorised. Domestic and office waste will be removed by a Contractor.			
(vi) Is this development provided for in the infrastructure planning of the municipality, and if not what will the implication be on the infrastructure planning of the municipality (priority and placement of services and opportunity costs)?		**NO**	**Please explain**
The infrastructure required for the proposed development is to be provided and maintained by both the Developer and the end user which in this case is Eskom, and it will not conflict with municipal infrastructure planning or priorities. In addition, the proposed development is to be constructed on overgrazed agricultural land outside of an urban area, with little or no existing or planned infrastructure.			

(vii) Is this project part of a national programme to address an issue of national concern or importance?	**YES**		**Please explain**
The project aims at meeting the National Development Plan objectives. The National Development Plan states the following as a priority objective: *Procuring at least 20 000 MW of renewable electricity by 2030, importing electricity from the region, decommissioning 11 000 MW of ageing coal-fired power stations and stepping up investments in energy-efficiency.*			
(viii) Do location factors favour this land use (associated with the activity applied for) at this place? (This relates to the contextualisation of the proposed land use on this site within its broader context.)	**YES**		**Please explain**
The Northern Cape has been recognised as having the highest solar resource in the country and so is ideally suited to solar power generation. Further this is in keeping with the Bokpoort I plant recently constructed close to the proposed site. The proposed site is well located in terms of proximity to Eskom's Garona Substation, road access (Transnet Service Road) and access to water (Orange River).			
(ix) Is the development the best practicable environmental option for this land/site?	**YES**		**Please explain**
The site is within one of South Africa's eight REDZs i.e. *REDZ 7 Upington*, applicable to Large scale solar PV facilities and has therefore been identified as one of the most suitable areas in the country for renewable energy development, in terms of several environmental impacts, economic and infrastructural factors. Renewable energy development is therefore a very suitable land use option for the site. The property is already partly development for renewable power generation. The current development (Bokpoort I) comprises a CSP parabolic trough facility generating 50 MW of electricity. The property is well located in terms of connection to power infrastructure and water availability.			
(x) Will the benefits of the proposed land use/development outweigh the negative impacts of it?	**YES**		**Please explain**
The proposed activity will supply renewable energy to Eskom and will consequently increase the amount of electricity available to users. The site is well positioned for production of renewable energy given its proximity to a key grid substation and Eskom transmission lines together with access to water (Orange River). The site is already partly developed for renewable power production. These are positive factors in motivation of extending renewable energy production at the site. Potential negative impacts are anticipated however these can be mitigated.			
(xi) Will the proposed land use/development set a precedent for similar activities in the area (local municipality)?		**NO**	**Please explain**
The existing Bokpoort I project has already set a precedent and the extension of renewable energy production at the site will be in line with the REDZ for large scale solar PV facilities.			
(xii) Will any person's rights be negatively affected by the proposed activity/ies?		**NO**	**Please explain**
The public participation process will allow I&AP's an opportunity to raise any concerns with the proposed project.			
(xiii) Will the proposed activity/ies compromise the "urban edge" as defined by the local municipality?		**NO**	**Please explain**
It is not foreseen that the proposed project and associated activities will compromise the "urban edge" as the project components fall outside the urban edge. The proposed development site is located a short distance outside the rural town of Groblershoop and approximately 110 km by road from Upington. Infrastructure within these towns is under pressure from a variety of solar development projects which are currently under construction in the area. The introduction of a large construction workforce, as is typical of this type of development, will place further strain on the municipal infrastructure, but the relatively small workforce associated with the operation of the proposed PV plants is unlikely to require an expansion of the urban edge of any town.			

(xiv) Will the proposed activity/ies contribute to any of the 17 Strategic Integrated Projects (SIPS)?		NO	Please explain
The proposed development is in line with Strategic Integrated Projects (SIPs) in that it relates to social and economic infrastructure across all nine provinces and include catalytic projects that can fast-track development and growth but the process of being a SIP project has not been initiated. SIP 9: Electricity generation aims at supporting socio- economic development (Accelerate the construction of new electricity generation capacity in accordance with the IRP to meet the needs of the economy and address historical imbalances).			
(xv) What will the benefits be to society in general and to the local communities?			**Please explain**
The access to adequate electricity is a basic human right, which will also ensure the growth and development of the area is maintained as the project area is an important economic area within the municipality. The project is also in line with Sustainable Development Goal 7 (SDG 7) which stipulates *Affordable and Clean Energy* for all. Investing in solar, wind and thermal power, improving energy productivity, and ensuring energy for all is vital if we are to achieve SDG 7 by 2030. Expanding infrastructure and upgrading technology to provide clean and more efficient energy in all countries will encourage growth and help the environment.			
(xvi) Any other need and desirability considerations related to the proposed activity?			**Please explain**
Society: The operations will contribute electricity to the National Grid, thereby improving Eskom's ability to meet the growing demands of the country. Additional power on the National Grid will in turn mean a lesser likelihood of power outages and an increased amount of power for the Nation's industrial sector to operate more efficiently, which is of critical importance to the national economy. The PV plants also fits into the country's national goals to reduce greenhouse gas emissions and impacts on climate change, which on an international and global scale is aligned with the International Conventions and Agreements (Section 3.2). **Communities:** The project will have a positive socio-economic impact with an increase in job opportunities and indirect economic spin offs. Among those employed for the project, skills will be developed through training thus bringing about empowerment for both permanent and temporary employees. The jobs generated would benefit households by uplifting their socio-economic standards through an increase in income. Secondary jobs and income sustainability will also be created in terms of repair and supply of the solar panels. The circulation of additional money within the micro-economy will also benefit those who are not directly affiliated with the project. As people will receive an increased income, they will have more money to spend on amenities for both themselves and their families, thus uplifting the local and national economy via the energy saved and jobs created from this initiative.			
(xvii) How does the project fit into the National Development Plan for 2030?			**Please explain**
The National Development Plan for 2030 seeks to promote economic growth and development through the provision of quality energy services that are competitively priced, reliable and efficient. The National Development Plan also seeks to promote social equity through the expansion of access to energy services. The National Development Plan states the following as a priority objective: *Procuring at least 20 000 MW of renewable electricity by 2030, importing electricity from the region, decommissioning 11 000MW of ageing coal-fired power stations and stepping up investments in energy-efficiency.* This project provides an opportunity to meet these goals.			
(xviii) Please describe how the general objectives of Integrated Environmental Management as set out in section 23 of NEMA have been taken into account.			
The impacts associated with the proposed project will be identified, predicted and evaluated to minimise negative impacts, maximise benefits and promote compliance with the principles of environmental management set out in Section 2 of NEMA (Section D). Mitigation and management measures to minimize negative impacts and maximize benefits from the proposed project have been included in the EMPr attached as ***Appendix D*** to this Report.			

(xix) Please describe how the principles of environmental management as set out in section 2 of NEMA have been taken into account.
The proposed project will be sustainable in terms of the following: ▪ Social: Local communities will benefit from the project in terms of receiving adequate electrical supply that serve to meet basic human needs. The local community and society in general will also benefit from the project in terms of direct and indirect job creation. ▪ Economic: Provision of adequate electrical supply is a major contributor to the economic development. Society in general will benefit from the project in terms of indirect job creation as it will contribute to improving service delivery. ▪ Environmentally: the proposed project will avoid as far as practically possible any environmentally and socially sensitive areas such as human settlements and where this is not possible, mitigation measures have been proposed to minimise the impact. ▪ An EMPr (***Appendix D***) has been compiled that provides the actions for the management of identified environmental impacts emanating from the project and a detailed outline of the implementation programme to minimise and /or eliminate the anticipated negative environmental impacts.

2.5.2 Socio-economic Value

The socio-economic details for the project are provided in Table 9.

Table 9: Socio-economic details

Description	Details
What is the expected capital value of the activity on completion?	R 1.2 billion
What is the expected yearly income that will be generated by or as a result of the activity?	R 180 million
Will the activity contribute to service infrastructure?	Yes
Is the activity a public amenity?	No
How many new employment opportunities will be created in the construction phase of the activity?	100 to 250 construction jobs and 20 to 40 permanent operations and maintenance positions during its lifespan
What is the expected value of the employment opportunities during the construction phase?	R 350 million
What percentage of this will accrue to previously disadvantaged individuals?	This will be in-line with the economic obligations under the implementation agreement which will be between IPP and the DMRE
How many permanent new employment opportunities will be created during the operational phase of the activity?	20 - 40 jobs
What is the expected current value of the employment opportunities during the first 10 years?	R 20 million/ annum
What percentage of this will accrue to previously disadvantaged individuals?	This will be in-line with the economic obligations under the implementation agreement which will be between IPP and the DMRE

3 ENVIRONMENTAL LEGISLATIVE CONTEXT

In order to protect the environment and ensure that the development is undertaken in an environmentally responsible manner, there are a number of significant environmental legislation (Table 10) that need to be considered during this study.

This section outlines the legislation that is applicable to the proposed project and has been considered in the preparation of this report.

Table 10: Key legislation considered

Acts	Objectives, important aspects, associated notices and regulations
National Environmental Management Act, 1998 (Act No. 107 of 1998)(as amended)	***Objectives:*** To provide for co-operative environmental governance by establishing principles for decision-making on matters affecting the environment, institutions that will promote co-operative governance and procedures for co-ordinating environmental functions exercised by organs of state. ***Relevant Notices and Regulations:*** ▪ Environmental Impact Assessment Regulations, 2014 (GNR 326 in GG 40772 as amended on 04 April 2017) ▪ Listing Notice 1 (GNR 327) as amended in 2017 ▪ Listing Notice 2 (GNR 325) as amended in 2017 ▪ Listing Notice 3 (GNR 324) as amended in 2017 ***Relevance to the proposed project:*** ▪ Development must be socially, environmentally and economically sustainable. ▪ Environmental management must be integrated, acknowledging that all elements of the environment are linked and interrelated; the social, economic and environmental impacts of activities including disadvantages and benefits, must be considered, assessed and evaluated and decisions must be appropriate in the light of such consideration. ▪ 'Polluter Pays' principle. ▪ Any activity that is proposed and which is listed in the NEMA EIA Regulations, requires environmental authorisation. ***Listed Activity/ ies & Applicability:*** **Listing Notice 1** None - all the relevant LN1 activities have been authorised in EA dated 24/10/2016 (Ref: *14/12/16/3/3/2/880 & 14/12/16/3/3/2/881)* **Listing Notice 2** ▪ Activity 1 - The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20 MW or more. *Applicability: Increasing the capacity of the already authorised PV 1 and PV2 facilities* (EA dated 24/10/2016 (Ref: *14/12/16/3/3/2/880 & 14/12/16/3/3/2/881)) by 125 MW (i.e. from 75 MW to 200MW).* ▪ Activity 4 - The development and related operation of facilities or infrastructure, for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of more than 500 m^3.

Acts	Objectives, important aspects, associated notices and regulations
	Applicability: Development of the BESS (either lead-acid or lithium-ion) that will have a storage capacity of 4500m^3 of hazardous / dangerous substance. **Listing Notice 3** None as the study area /site is not affected by any sensitive geographical areas.
National Water Act (Act No. 36 of 1998) (as amended)	***Objectives:*** The National Water Act (NWA) is a legal framework for the effective and sustainable management of water resources in South Africa. Central to the NWA is recognition that water is a scarce resource in the country which belongs to all the people of South Africa and needs to be managed in a sustainable manner to benefit all members of society. The NWA places a strong emphasis on the protection of water resources in South Africa, especially against its exploitation, and the insurance that there is water for social and economic development in the country for present and future generations. ***Relevance to the proposed project:*** ▪ Sustainable protection, use, development and conservation of water resources – including aquatic ecosystems. ▪ Defines 11 water uses and provides licencing procedures. ***Notices and Regulations:*** ▪ General Authorisation in terms of Section 39 of the National Water Act (Act No. 36 of 1998, Water Uses Section 21 (a) and (b) (GN in GG 40243 of 02 September 2016). ▪ General Authorisation in terms of Section 39 of the National Water Act (Act No. 36 of 1998, Water Uses Section 21 (c) and (i) (GN in GG 40229 of 26 August 2016).

3.1 Other Relevant Acts, Guidelines, Department Policies and Environmental Management Instruments

Table 11: Other relevant acts, guidelines, policies and environmental management instruments

Acts/Guideline/Policies/Environmental Management Instruments	Considerations
The Constitution (No. 108 of 1996)	Chapter 2 – Bill of Right Section 24 – Environmental Rights
National Environmental Management Biodiversity Act (Act No. 10 of 2004) and Regulations: ▪ **Threatened or protected species (GN 388)** ▪ **Lists of species that are threatened or protected (GN 389)** ▪ **Alien and invasive species regulations (GNR 506)** ▪ **Publication of exempted alien species (GNR 509)** ▪ **Publication of National list of invasive species (GNR 507)** ▪ **Publication of prohibited alien species (GNR 508)**	Provide for the protection of species and ecosystems that warrant national protection and the sustainable use of indigenous biological resources.
World Heritage Convention Act (Act No. 49 of 1999)	South Africa is home to eight of the world's official heritage sites, as determined by UNESCO's World Heritage Committee. The Cape Floral Region has been recognised as one of the most special places for plants in the world in terms of diversity, density and number of endemic species.
National Environmental Management: Waste Act (Act No. 59 of 2008) as amended	Section 17 - Every attempt must be made to reduce, recycle or re-use all waste before it is disposed. Section 25 - All waste (general and hazardous) generated during construction may only be disposed of at appropriately licenced waste disposal sites. All waste management activities (e.g. recycling, treatment) meeting the relevant thresholds should be authorised under the National Environmental Management: Waste Act (Act No. 59 of 2008) [NEM:WA] (as amended) and Government Notice (GN) 921 of 29 November 2013 (as amended in 2015 and 2017). No person may commence, undertake or conduct a waste management activity listed GN 921 (as amended) unless a licence is issued in respect of that activity.
National Environmental Management: Air Quality Act (Act No 39 of 2004)	Section 32 - Control of dust. Section 34 - Control of noise. Section 35 - Control of offensive odours.
National Heritage Resources Act (Act No. 25 of 1999)	Section 34 - 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 relevant provincial heritage resources authority. Section 35 - No person may, without a permit issued by the responsible heritage resources authority destroy, damage,

Acts/Guideline/Policies/Environmental Management Instruments	Considerations
	excavate, alter, deface or otherwise disturb any archaeological or palaeontological site. Section 36 - No person may, without a permit issued by the South African Heritage Resource Agency (SAHRA) or a provincial heritage resources authority destroy, damage, alter, exhume, 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. “Grave” is widely defined in the Act to include the contents, headstone or other marker of such a place, and any other structure on or associated with such place. Section 38 - The construction of a bridge or similar structure exceeding 50 m in length.
Electricity Regulation Act No. 4 of 2006 as amended by the Electricity Regulation Amendment Act No. 28 of 2007	These regulations regulate the use and generation of electricity.
Occupational Health and Safety Act (Act No. 85 of 1993)	Section 8 - General duties of employers to their employees. Section 9 - General duties of employers and self-employed persons to persons other than their employees.
Construction Regulations (2014)	Contractors must comply with the Construction Regulations which lay out the framework for construction related activities.

Other:

- Hazardous Substance Act (Act No. 15 of 1973) and Regulations
- Conservation of Agricultural Resources Act (Act No. 43 of 1983)
- Civil Aviation Act (Act No. 13 of 2009) and Civil Aviation Regulations (CAR) of 1997
- Electricity Act (Act No. 41 of 1987)
- Civil Aviation Authority Act (Act No. 40 of 1998)
- White Paper on Renewable Energy (2003)
- Integrated Resource Plan for South Africa (2019)
- Environmental Impact Assessment Guidelines for Renewable Energy Projects, GNR 989 of 2015 in terms of NEMA (Act No. 107 of 1998)
- Land Use Planning Ordinance (Ordinance 15 of 1985)
- National Road Traffic Act (Act No. 93 of 1996)
- Procedure to be followed in Applying for Environmental Authorisation for Large Scale Wind and Solar Photovoltaic Energy Development Activities in terms of Section 24(2)a of NEMA, 1998 when occurring in Geographical Areas of Strategic Importance (GG No. 114, 16 February 2018)
- ZF Mgcawu District Municipality Integrated Development Plan 2017-2022
- Northern Cape PSDF (2012) Energy Policy
- !Kheis Local Municipality By-laws

3.2 International Conventions and Agreements

Relevant environmental and social international conventions and agreements to which South Africa is a party that is applicable to this project are presented in Table 12.

Table 12: Relevant international conventions to which South Africa is a party[12] [13]

Convention	Summary of objectives or relevant conditions	South African Status
Convention on Biological Diversity (29 December 1993)	Develop strategies, plans or programs for conservation and sustainable use of biological diversity or adapt for this purpose existing strategies, plans or programs which shall reflect, inter alia, the measures set out in this Convention.	Party to
United Nations Framework Convention on Climate Change - Kyoto Protocol (23 February 2005)	To further reduce greenhouse gas emissions by enhancing the national programs of developed countries aimed at this goal and by establishing percentage reduction targets for the developed countries and through the clean development mechanism (CDM) (where developed countries can invest in developing country clean technology to offset emissions).	Party to
Montreal Protocol on Substances That Deplete the Ozone Layer (1 January 1989)	Calculated levels of consumption and production of CFCs must not exceed the stipulated thresholds.	Party to
United Nations Convention to Combat Desertification (26 December 1996)	To combat desertification and mitigate the effects of drought through national action programs.	Party to
United Nations Framework Convention on Climate Change (21 March 1994)	Protection of the climate system: Operations must protect the climate system by controlling greenhouse gases not controlled by the Montreal Protocol, which cause climate change through anthropogenic interference with the climate system.	Party to
Stockholm Convention on Persistent Organic Pollutants (POPs) (17 May 2004)	This convention seeks to ban the production and use of persistent organic chemicals but allow the use of some of these banned substances, such as DDT, for vector control.	Party to
The Fourth ACP-EEC Convention 15 December 1989 (Lome)	Control of hazardous and radioactive waste: the operation must be aware that international law emphasizes strict control of hazardous waste and compliance with domestic legislation in this regard. It also seeks to prohibit imports and exports of such substances.	Party to
Convention concerning the Protection of the World Cultural and Natural Heritage 1972 (Paris)	Ensuring the identification, protection, conservation, presentation and transmission to future generations of the cultural and natural heritage	Ratification
Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and	Promote shared responsibility and cooperative efforts among Parties in the international trade of certain hazardous chemicals in order to protect human health and the environment from potential harm	Party to

[12] *Sources: United States Central Intelligence Agency World Fact book (www.cia.gov/library/publications/the-world-factbook/index.html)*

[13] *Schlechter, M., & Baxter, B. 2016. Final EIA Report: Proposed 75MW Photovoltaic (PV2) Solar Development on the Remaining Extent of the Farm Bokpoort 390, Northern Cape. Golder Associates. Ref 14/12/16/3/3/2/880.*

Convention	Summary of objectives or relevant conditions	South African Status
Pesticides in International Trade (24 February 2004)		
Paris Agreement adopted on 12 December 2015 at the 21st session of the Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC CoP21)	The Agreement is a comprehensive framework which will guide international efforts to limit greenhouse gas emissions and to meet all the associated challenges posed by climate change. The main objective of the Agreement is to limit the global temperature increase to well below 2 degrees Celsius, while pursuing efforts to limit the increase to 1.5 degrees.	Ratified

3.3 International Standards

3.3.1 International Finance Corporation Performance Standards

ACWA Power is committed to complying with the IFC Performance Standards (PS) on social and environmental sustainability. These were developed by the IFC and were last updated on 1st January 2012.

The PS comprise of eight performance standards as described in Table 13.

Table 13: IFC Performance Standards

Objective	Applicability
PS 1: Assessment and Management of Environmental and Social Risks and Impacts Guidance note on the categorisation of projects during project screening, requirements for institutional capacity and requirements for public consultation and disclosure.	This Basic Assessment Study supported by comprehensive specialist assessments (***Appendix B1 – B13***) has identified environmental and social risks and impact of the project and provided mitigation measures to enhance positive impacts and minimise negative impacts. The impact assessment is consistent with Good International Industry Practices (GIIP) and takes into account the nature, extent, duration, intensity, probability and significance of the identified impacts both before and after mitigation measures (***Chapter 7***). Cumulative impacts that result from the incremental impacts on areas or resources directly impacted by the project have also been identified and noted in the study (***Chapter 7)***. The EMPr (***Appendix D***) provides the actions for the management of identified environmental impacts and a detailed outline of the implementation programme. The EMPr provides strategies to be used to address the roles and responsibilities of environmental management personnel on site, and a framework for environmental compliance and monitoring. Extensive engagement has taken place with project affected people for the previously authorised 2 PV plants and CSP plant and will continue for the development of the PV plants (***Chapter 6***).
PS 2: Labour and Working Conditions Recognises that the pursuit of economic growth through employment creation and income generation should be accompanied by protection of	The project will provide employment opportunities for 100 – 250 people during the construction phase and 20 – 40 people during the operations phase.

Objective	Applicability
the fundamental rights of workers, including health and safety. Failure to establish and foster a sound worker-management relationship can undermine worker commitment and retention and can jeopardise a project.	Prior to development, human resource policies and procedures, working conditions and terms of employment, equal opportunity, retrenchment policy and a formal grievance mechanism must be established to promote the fair treatment, non-discrimination and equal opportunity of workers in line with national employment and labour laws. Further to this, the Developer also has an obligation to provide a safe and healthy work environment for its employees in terms of the Occupational Health and Safety Act (Act No. 85 of 1993).
PS 3: Resource Efficiency and Pollution Prevention Recognises that increased economic activity and urbanisation often generate increased levels of pollution to air, water, and land, and consume finite resources in a manner that may threaten people and the environment at the local, regional, and global levels. More efficient and effective resource use and pollution prevention and greenhouse gas emission avoidance and mitigation technologies enhance the efficiency and sustainability of the project.	South Africa's reliance on fossil fuels as a primary energy source is well known and coal combustion is the main contributor to carbon dioxide emissions, a greenhouse gas that has been linked to climate change. The proposed renewable energy project utilising PV technology offers a sustainable alternative to fossil fuels and in line with the South Africa's IRP (2019) which ensures that a more diversified energy mix is sought that reduces reliance on a single or a few primary energy sources. The change from CSP technology to PV technology further decreases the demand for water consumption from 0.3 million cubic metres per annum (Mm^3/ a) to 0.22 Mm^3/ a. Pollution prevention measures contained in the Basic Assessment report and EMPr (***Appendix D***) are in line with GIIP and contain comprehensive management outcomes and impact management actions for waste generation during the different project phases as well as the storage and use of hazardous substances that may have a potential to have a detrimental impact on the environment.
PS 4: Community Health, Safety and Security Recognises that project activities, equipment, and infrastructure can increase community exposure to risks and impacts. This Performance Standard addresses the Promotor' responsibility to avoid or minimise the risks and impacts to community health, safety, and security.	The proposed project will be designed, constructed, operated and decommissioned in accordance with GIIP. Mitigation measures and controls are provided in the EMPr (***Appendix D***) for spills, incidents and pollution control as well as for containment losses of hazardous substances particularly the BESS. An Emergency Preparedness and Response Plan must be compiled by the Developer for the project prior to implementation. Traffic and dust impacts have been assessed as being moderate prior to the implementation of mitigation measures and have to be carefully managed as these impacts have been documented during the stakeholder engagement process as being major safety and nuisance factors. An adequate resolution needs to be obtained regarding the upgrading (re-gravelling, surfacing etc.) of existing roads and intersections in the study area separate to this environmental assessment process.
PS 5: Land Acquisition and Involuntary Resettlement Recognises that project-related land acquisition and restrictions on land use can have adverse impacts on communities and persons that use this land. Involuntary resettlement refers both to physical	No physical displacement and resettlement of people will take place. In terms of land acquisition, the study area is owned by ACWA Power SolAfrica Bokpoort CSP Power Plant (Pty) Ltd (RF).

Objective	Applicability
displacement (relocation or loss of shelter) and to economic displacement (loss of assets or access to assets that leads to loss of income sources or other means of livelihood) as a result of project-related land acquisition and/or restrictions on land use, while temporary or permanent.	
PS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources Recognises that protecting and conserving biodiversity, maintaining ecosystem services, and sustainably managing living natural resources are fundamental to sustainable development.	The project will not impact any proclaimed protected biodiversity area. As assessment of the critical habitats (***Appendix B5***) have shown that apart from the rocky outcrop to the north of the study area associated with the Koranna-Langeberg Mountain Bushveld Vegetation type which is classified as a Natural Habitat, the calcareous low shrub plains, open shrub plains, open shrub duneveld and transformed areas are classified as Modified Habitats. A 250 m buffer has been applied to the rocky outcrop and no development is allowed to encroach this area. The Biodiversity Assessment (***Appendix B5***) was compiled with impacts managed in line with the mitigation hierarchy. No impacts were identified that could not be mitigated to an acceptable level. Mitigation measures associated with the protection of fauna and flora and management of alien invasive species have been included in the EMPr (***Appendix D***).
PS 7: Indigenous Peoples Recognises that Indigenous Peoples, as social groups with identities that are distinct from mainstream groups in national societies, are often among the most marginalised and vulnerable segments of the population. In many cases, their economic, social, and legal status limits their capacity to defend their rights to, and interests in, lands and natural and cultural resources, and may restrict their ability to participate in and benefit from development.	The Socio-economic study confirmed that there is no evidence of the presence of any indigenous people residing or utilising the project area and immediate surrounds.
PS 8: Cultural Heritage Recognises the importance of cultural heritage for current and future generations. Consistent with the Convention Concerning the Protection of the World Cultural and Natural Heritage, this Performance Standard aims to ensure that protect cultural heritage in the course of their project activities.	A comprehensive Heritage Impact Assessment (***Appendix B9***) and Desktop Palaeontology Impact Assessment (PIA) together with Chance Find Protocol (***Appendix B10***) were conducted for the project. No sites, features or objects of cultural significance are known to exist in the development area, there would be no impact as a result of the proposed development. Should archaeological sites or graves be exposed in other areas during construction work, measures and controls have been stipulated in this report and EMPr (***Appendix D***) for the management of the site/ graves. No significant fossil heritage resources have been recorded within the study area. The area is inferred to be of low sensitivity in terms of palaeontological heritage and no sensitive or no-go areas have been identified within it during the desktop PIA. In the case of any significant chance fossil finds during construction (e.g. vertebrate teeth, bones, burrows, petrified wood, shells), these must be safeguarded - preferably in situ -

Objective	Applicability
	and reported as soon as possible to the South African Heritage Resources Agency (SAHRA).

3.4 Equator Principles

The Equator Principles (EPs) is a risk management framework, adopted by financial institutions, for determining, assessing and managing environmental and social risk in projects and is primarily intended to provide a minimum standard for due diligence and monitoring to support responsible risk decision-making.

Project finance is often used to fund the development and construction of major infrastructure and industrial projects.

The EPs are adopted by financial institutions and are applied where total project capital costs exceed US$10 million. The EPs are primarily intended to provide a minimum standard for due diligence to support responsible risk decision-making. The EPs are based on the IFC PS 2012 and on the World Bank Group Environmental, Health and Safety Guidelines (EHS Guidelines).

The Equator Principles Financial Institutions (EPFIs) have consequently adopted these Principles in order to ensure that the projects they finance are developed in a manner that is socially responsible and reflect sound environmental management practices.

EPFIs will only provide loans to projects that conform to the following principles:

- Principle 1: Review and Categorisation;
- Principle 2: Social and Environmental Assessment;
- Principle 3: Applicable Social and Environmental Standards;
- Principle 4: Action plan and Management;
- Principle 5: Consultation and Disclosure;
- Principle 6: Grievance Mechanism;
- Principle 7: Independent review;
- Principle 8: Covenants;
- Principle 9: Independent Monitoring and Reporting; and
- Principle 10: EPFI Reporting.

3.4.1 The World Bank Group Environmental Health and Safety (EHS) Guidelines

The EHS Guidelines (World Bank Group, 2007) are technical reference documents with general and industry specific examples of Good International Industry Practice (GIIP). Reference to the EHS guidelines is required under IFC PS 3.

The EHS Guidelines contain the performance levels and measures normally acceptable to the IFC and are generally considered to be achievable in new facilities at reasonable cost. When host country regulations differ from the levels and measures presented in the EHS Guidelines, projects are expected to achieve whichever standard is more stringent.

3.5 Sustainable Development Goals

The Sustainable Development Goals (SDGs), also known as the Global Goals, were adopted by all United Nations Member States in 2015 as a universal call to action to end poverty, protect the planet and ensure that all people enjoy peace and prosperity by 2030. South Africa has embraced sustainable development as its development approach and is fully committed to the 2030 Agenda for Sustainable Development, its principles, goals, targets and indicators.

The 17 SDGs recognise that action in one area will affect outcomes in others, and that development must balance social, economic and environmental sustainability.

Figure 3: Sustainable Development Goals

SDG 7 requires Affordable and Clean Energy for all. Investing in solar, wind and thermal power, improving energy productivity, and ensuring energy for all is vital if we are to achieve SDG 7 by 2030. Expanding infrastructure and upgrading technology to provide clean and more efficient energy in all countries will encourage growth and help the environment[14].

SDG 13 advocates taking urgent action to combat climate change and its impacts. The Paris Agreement is universally regarded as a seminal point in the development of the international climate change regime under the UNFCCC. The main objective of the Agreement is to limit the global temperature increase to well below 2 degrees Celsius, while pursuing efforts to limit the increase to 1.5 degrees. The recognition of the 1.5 degree target is of central importance to South Africa as an African and developing country that is highly vulnerable to climate change.

[14] *https://sustainabledevelopment.un.org/sdg7*

4 PROJECT ALTERNATIVES

In terms of the EIA Regulations 2014 (as amended in 2017) feasible alternatives are required to be considered as part of the environmental investigations. In addition, the obligation that alternatives are investigated is also a requirement of Section 24(4) of the NEMA (Act No. 107 of 1998) (as amended).

An alternative in relation to a proposed activity refers to the different means of meeting the general purpose and requirements of the activity which may include alternatives to:

- the property on which or location where it is proposed to undertake the activity;
- the type of activity to be undertaken;
- the design or layout of the activity;
- the technology to be used in the activity;
- the operational aspects of the activity; and
- the option of not implementing the activity.

4.1 Site Alternatives

No site alternative has been considered for the project as this application is for supporting infrastructure and a generation capacity increase for the already authorised Ndebele (formerly PV1) and Xhosa (formerly PV2) PV Plants (EA dated 24/10/2016 – Ref: 14/12/16/3/3/2/880 and 14/12/16/3/3/2/881). This decision is based on site selection and sensitivity assessments conducted during the previous EIA studies and the criteria for the decision is summarised in Table 14.

Table 14: Site selection criteria[15]

Criteria	Description
Site Extent	The PV plants will require 150 ha for the construction of the solar panels and associated infrastructure. The proposed site, which is approximately 1500 ha in extent will therefore be sufficient for the construction of the proposed plants including the already authorised PV plants (PV 1 & PV 2).
Site Availability	ACWA Power acquired the project site during the development of the Bokpoort I CSP Trough facility. The site is therefore available for development.
Site Access	The project site is most easily accessed from the N8 via the Gariep Road and then via the Transnet Service Road. Alternatively, the site can be accessed from the N14 via the Gariep Road/ Loop16 and Transnet Service Road.
Grid connection	The project site is located in close proximity to the Garona Substation, which is located directly adjacent to the Bokpoort I CSP Trough facility. A new 132 kV overhead powerline from each PV plant will connect the facility to the national grid via the substation.
Site Gradient	The slope of the project site is considered to be acceptable for the development of the PV plants. This reduces the need for any extensive earthworks or levelling activities.
Availability of water	The PV facility will require 0.22 Mm^3/ annum of water that will be used during the construction of the facility as well as for human consumption and panel washing during the operational phase. The Orange River is located approximately 20 km from the project site. It is proposed that water will be abstracted and transferred to the facility *via* an underground pipeline. There is an established water pipeline servitude currently being utilised by the Bokpoort I CSP Trough facility. A water pipeline has also been approved as part of the PV1 and PV2 authorisations

[15] *Schlechter, M., & Baxter, B. 2016. Final EIA Report: Proposed 75MW Photovoltaic (PV2) Solar Development on the Remaining Extent of the Farm Bokpoort 390, Northern Cape. Golder Associates. Ref 14/12/16/3/3/2/880.*

Criteria	Description
Availability of environmental baseline and sensitivity information	The project site for the proposed Bokpoort II project falls within the area previously assessed in the Phase 1 EIA for the Bokpoort I 75 MW CSP project facility. During the EIA process for the already constructed Bokpoort I project, site zoning sensitivity maps were produced which have added value to the process of site selection and considering placement of infrastructure for the current project. The Bokpoort I EIA study's sensitivity zoning map indicates that the project footprint for the Bokpoort II project does not contain features on the site footprint itself which would limit disturbance of and development on the site (Figure 4).

Further to the above site selection process, the site is within one of South Africa's eight renewable energy development zones (REDZ) i.e. *REDZ 7 Upington*, applicable to Large scale solar PV facilities (Figure 4), and has therefore been identified as one of the most suitable areas in the country for renewable energy development, in terms of a number of environmental impact, economic and infrastructural factors. Renewable energy development is therefore a very suitable land use option for the site.

In order for South Africa to achieve its renewable energy generation goals, agriculturally-zoned land will need to be used for renewable energy generation. It is far more preferable to incur a cumulative loss of agricultural land in a region such as the one being assessed, which has no cultivation potential, and low grazing capacity, than to lose agricultural land that has a higher potential, and that is much scarcer, to renewable energy development elsewhere in the country.

It is also preferable, from an impact point of view as well as from practical considerations, to rather have a concentrated node of renewable energy development within one area, as is the case around this project, than to spread out the same number of developments over a larger area.

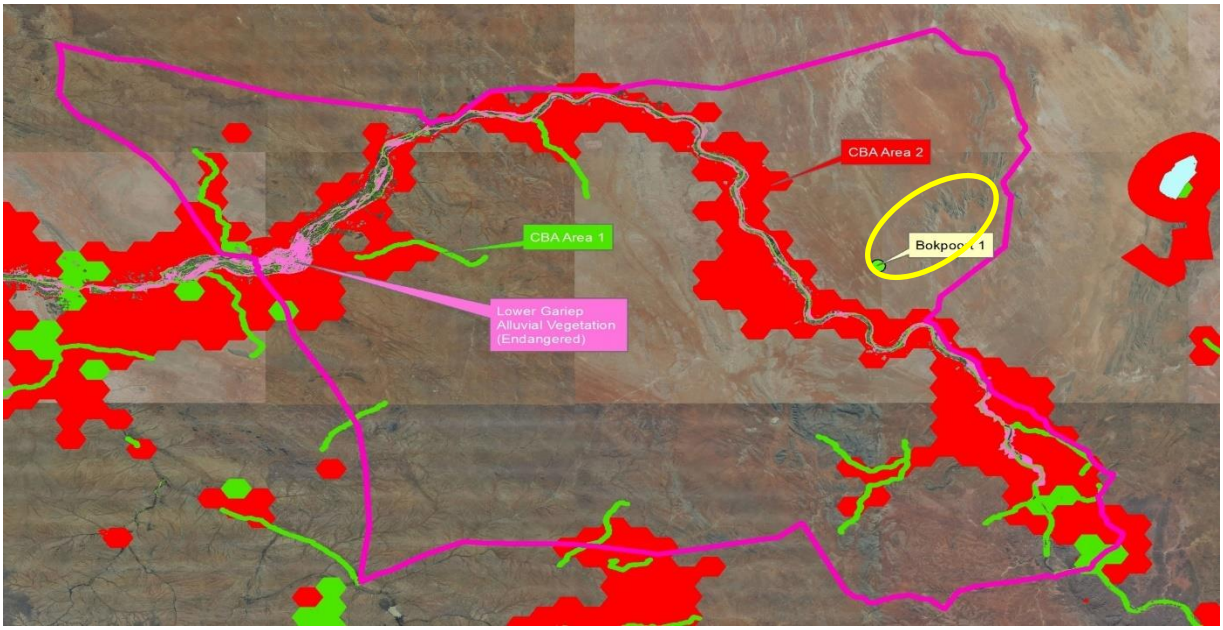


Figure 4: REDZ 7 Upington (project area indicated by yellow area)

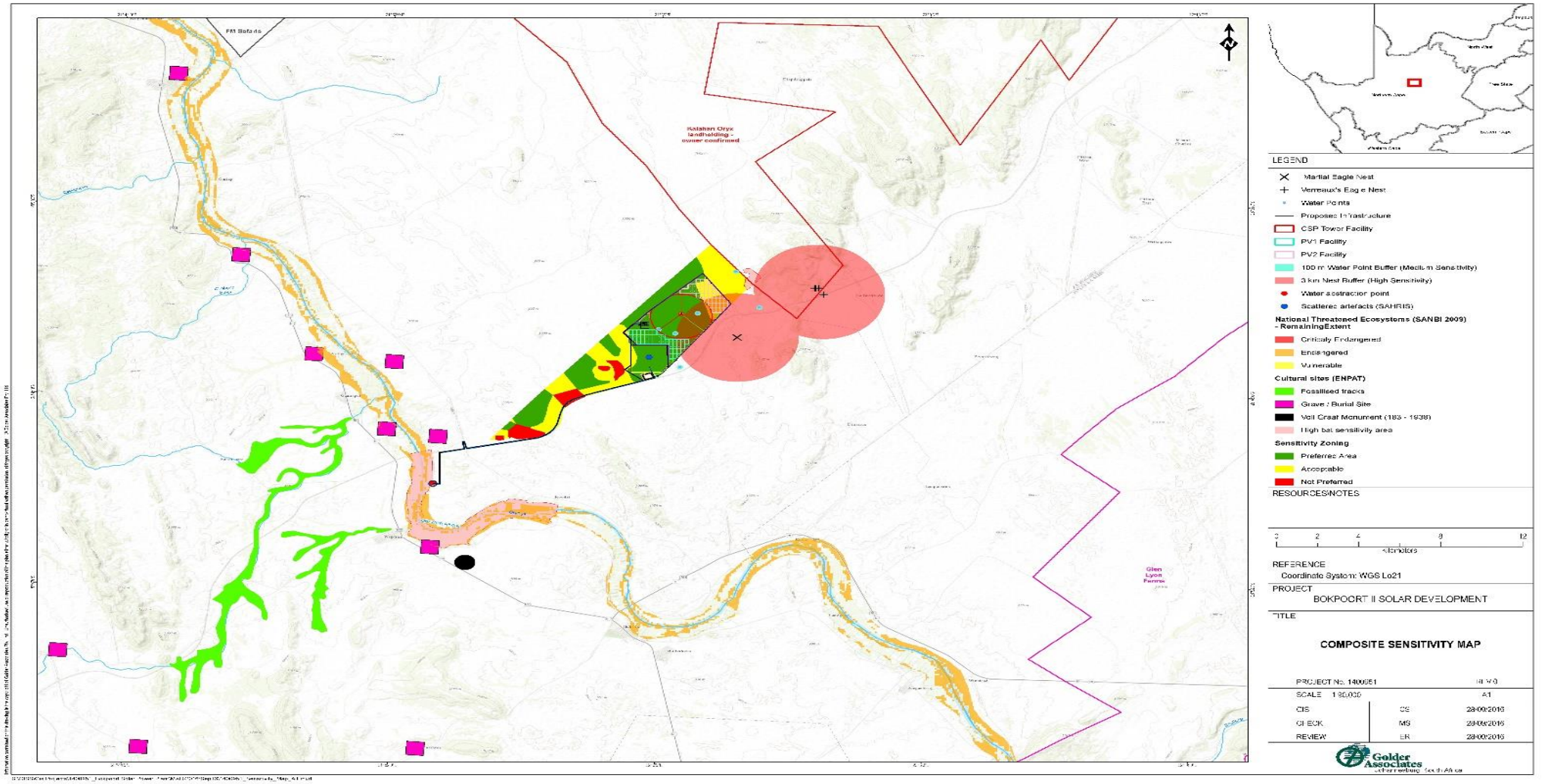


Figure 5: Sensitivity map of Farm Bokpoort 390 RE[16]

[16] *Schlechter, M., & Baxter, B. 2016. Final EIA Report: Proposed 75MW Photovoltaic (PV2) Solar Development on the Remaining Extent of the Farm Bokpoort 390, Northern Cape. Golder Associates. Ref 14/12/16/3/3/2/880.*

4.2 Technology Alternatives

4.2.1 PV Plants

ACWA Power submitted applications for Environmental Authorisation to the DEA for three different technologies, by means of six different applications, namely PV solar power technology, CSP Parabolic Trough and CSP Towers. These applications were undertaken by Golder Associates between 2014 – 2016. Subsequent to consultation with the DEA at the time, ACWA Power performed an in-depth analysis of the proposed project which resulted in the optimisation of the project development to include only three applications. ACWA Power applied for the development of PV and CSP Tower technologies by means of three different applications. Two of these applications were for the construction of a 75 MW PV plant (PV1 and PV2) and a third application was for a 150 MW CSP Tower.

There are no technology alternatives for the PV Plants as the Ndebele and Xhosa PV Plants have already been approved as mentioned above and this technology option is further backed by the IRP 2019.

4.2.2 Battery Energy Storage System[17]

As mentioned previously ACWA Power has considered two alternatives namely: Lithium Ion and Lead Acid Batteries, the merits of both these options will be discussed below. The Lithium Polymer option has been included as an alternative but as it is relatively less reliable than the Lithium Ion and Lead Acid option, this is the least preferred option and the main analysis will be based on Lithium Ion and Lead Acid BESS.

4.2.2.1 Lithium Ion BESS

The use of lithium as a battery source began in 1912 under G.N. Lewis, but the first commercially available non-rechargeable battery was released in the 1970s. Lithium is the lightest of all metals, has the greatest electrochemical potential and provides the largest energy density for weight. Initial attempts to create a rechargeable version of the battery failed due to the instability of the lithium metal. Further research resulted in the conclusion that the use of lithium ions (Li-ion) instead of the metal form yielded a viable rechargeable battery option. Although slightly lower in energy density than lithium metal, lithium-ion is safe, provided certain precautions are met when charging and discharging. The Sony Corporation in 1991 was the first manufacturers to utilise the lithium ion batteries in products.

The energy density of lithium-ion is typically twice that of the standard nickel-cadmium. There is potential for higher energy densities. The load characteristics are reasonably good and behave similarly to nickel-cadmium in terms of discharge. Lithium-ion is a low maintenance battery, an advantage that most other chemistries cannot claim. There is no memory and no scheduled cycling is required to prolong the battery's life. In addition, the self-discharge is less than half compared to nickel-cadmium, making lithium-ion well suited for modern fuel gauge applications. Lithium-ion cells cause little harm when disposed.

The disadvantages of Lithium ion are that it is fragile and requires a protection circuit to maintain safe operation. Built into each pack, the protection circuit limits the peak voltage of each cell during charge and prevents the cell voltage from dropping too low on discharge. In addition, the cell temperature is monitored to prevent temperature extremes. The maximum charge and discharge current on most packs are is limited to between 1C and 2C. With these precautions in place, the possibility of metallic lithium plating occurring due to overcharge is virtually eliminated.

Aging is a concern with most lithium-ion batteries and many manufacturers remain silent about this issue. Some capacity deterioration is noticeable after one year, whether the battery is in use or not. The battery

[17] *https://batteryuniversity.com*

frequently fails after two or three years. It should be noted that other chemistries also have age-related degenerative effects. This is especially true for nickel-metal-hydride if exposed to high ambient temperatures. At the same time, lithium-ion packs are known to have served for five years in some applications.

Manufacturers are constantly improving lithium-ion. New and enhanced chemical combinations are introduced every six months or so. With such rapid progress, it is difficult to assess how well the revised battery will age. Storage in a cool place slows the aging process of lithium-ion (and other chemistries). Manufacturers recommend storage temperatures of 15°C (59°F). In addition, the battery should be partially charged during storage.

4.2.2.2 Lithium Polymer BESS

The lithium-polymer differentiates itself from conventional battery systems in the type of electrolyte used. The original design, dating back to the 1970s, uses a dry solid polymer electrolyte. This electrolyte resembles a plastic-like film that does not conduct electricity but allows ions exchange (electrically charged atoms or groups of atoms). The polymer electrolyte replaces the traditional porous separator, which is soaked with electrolyte.

The dry polymer design offers simplifications with respect to fabrication, ruggedness, safety and thin-profile geometry. With a cell thickness measuring as little as one millimetre (0.039 inches), equipment designers are left to their own imagination in terms of form, shape and size.

Unfortunately, the dry lithium-polymer suffers from poor conductivity. The internal resistance is too high and cannot deliver the current bursts needed to power modern communication devices and spin up the hard drives of mobile computing equipment. Heating the cell to 60°C (140°F) and higher increases the conductivity, a requirement that is unsuitable for portable applications.

To compromise, some gelled electrolyte has been added. The commercial cells use a separator/ electrolyte membrane prepared from the same traditional porous polyethylene or polypropylene separator filled with a polymer, which gels upon filling with the liquid electrolyte. Thus, the commercial lithium-ion polymer cells are very similar in chemistry and materials to their liquid electrolyte counter parts.

Lithium-ion-polymer has not caught on as quickly as some analysts had expected. Its superiority to other systems and low manufacturing costs has not been realized. No improvements in capacity gains are achieved - in fact, the capacity is slightly less than that of the standard lithium-ion battery. Lithium-ion-polymer finds its market niche in wafer-thin geometries, such as batteries for credit cards and other such applications.

4.2.2.3 Lead Acid BESS

Invented by the French physician Gaston Planté in 1859, lead acid was the first rechargeable battery for commercial use. Despite its advanced age, the lead chemistry continues to be in wide use today. There are good reasons for its popularity; lead acid is dependable and inexpensive on a cost-per-watt base. There are few other batteries that deliver bulk power as cheaply as lead acid, and this makes the battery cost-effective for automobiles, golf cars, forklifts, marine and uninterruptible power supplies (UPS).

The grid structure of the lead acid battery is made from a lead alloy. Pure lead is too soft and would not support itself, so small quantities of other metals are added to get the mechanical strength and improve electrical properties.

Lead acid is heavy and is less durable than nickel- and lithium-based systems when deep cycled. A full discharge causes strain and each discharge/charge cycle permanently robs the battery of a small amount

of capacity. This loss is small while the battery is in good operating condition, but the fading increases once the performance drops to half the nominal capacity. This wear-down characteristic applies to all batteries in various degrees.

Depending on the depth of discharge, lead acid for deep-cycle applications provides 200 to 300 discharge/charge cycles. The primary reasons for its relatively short cycle life are grid corrosion on the positive electrode, depletion of the active material and expansion of the positive plates. This aging phenomenon is accelerated at elevated operating temperatures and when drawing high discharge currents.

Ever since Cadillac introduced the starter motor in 1912, lead acid batteries served well as battery of choice. Thomas Edison tried to replace lead acid with nickel-iron (NiFe), but lead acid prevailed because of its rugged and forgiving nature, as well as low cost. Now the lead acid serving as starter battery in vehicles is being challenged by Li-ion.

Figure 6 illustrates the characteristics of lead acid and Li-ion. Both chemistries perform similarly in cold cranking. Lead acid is slightly better in W/kg, but Li-ion delivers large improvements in cycle life, better specific energy in Watt Hours Per Kilogram (Wh/kg) and good dynamic charge acceptance. Where Li-ion falls short is high cost per kWh, complex recycling and less stellar safety record than lead acid.

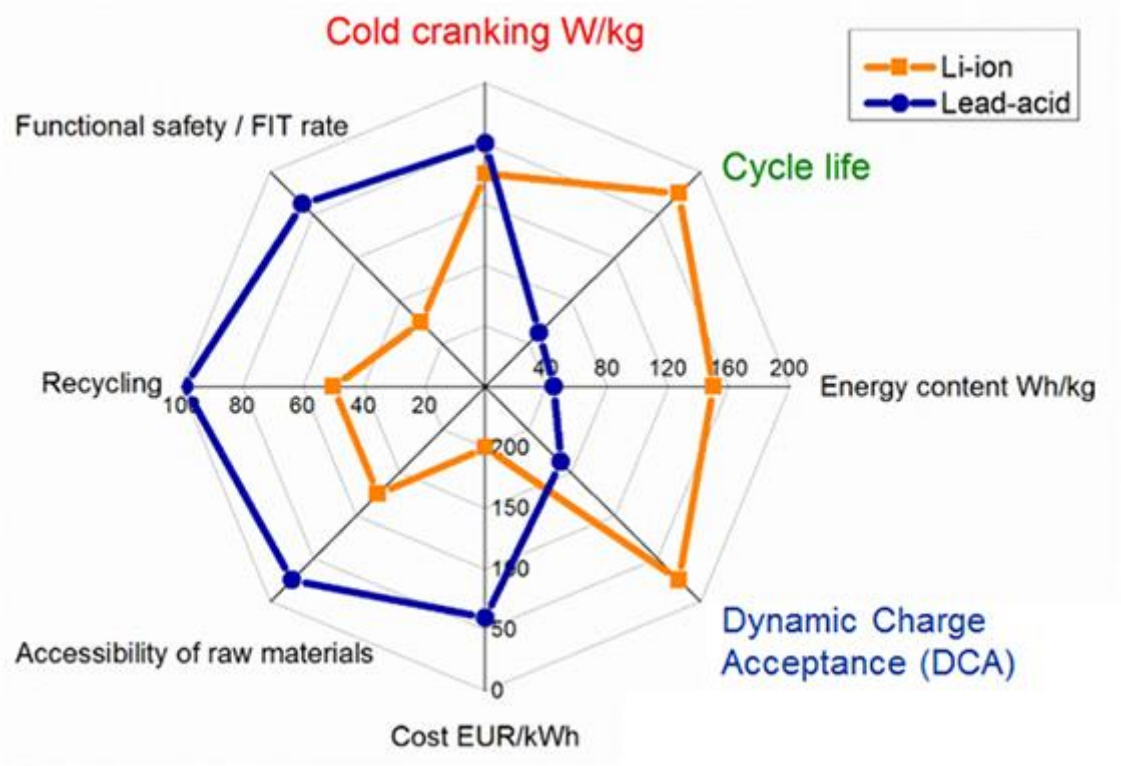


Figure 6: Comparison of lead acid and Li-ion as starter battery.

Lead acid maintains a strong lead in starter battery. Credit goes to good cold temperature performance, low cost, good safety record and ease of recycling. Lead is toxic and environmentalists would like to replace the lead acid battery with an alternative chemistry. Europe succeeded in keeping Nickel-Cadmium out of consumer products, and similar efforts are being made with the starter battery. The choices are nickel metal hydride and Li-ion, but the price is too high and low temperature performance is poor. With a 99 percent recycling rate, the lead acid battery poses little environmental hazard and will likely continue to be the battery of choice.

4.2.3 Technology Comparison: Li-ion vs Lead Acid BESS

Table 15 provides a breakdown of the different proposed BESS technologies for the PV Plants.

Table 15: Comparison between Lithium Ion and Lead Acid BESS

Parameter	Lead Acid Battery	Li-Ion Battery
Capacity De-rating	▪ Rated at 10hr discharge rate ▪ For faster discharge, capacity degrades/reduces ▪ Utilised at 50% Depth of Discharge	▪ Capable for faster discharge without any capacity de-rating ▪ Utilized at 80-90% Depth of Discharge
Space Requirement	▪ Requires at least 2X the space for Li-ion battery as energy density is low	▪ Compact Solution with very less space requirement
Regular Maintenance	▪ Electrolyte filling is needed ▪ Even in advance Valve Regulated Lead Acid, Boost Charging up to 12hrs is needed every month	▪ No electrolyte filling ▪ No regular boost charging or any other maintenance activity needed other than for regular electrical systems
Life Cycles	▪ Life impacted by partial state of charge operation ▪ Low Cycle life (900 to 200 cycles)	▪ No impact of partial state of charge operation on life ▪ Cycle life over 5000 cycles
Environmentally Friendly	▪ Lead is toxic in nature	▪ Restriction of Hazardous Substances Compliant-No use of certain hazardous substances in electric and electronic equipment
Efficiency	▪ Watt-hour efficiency ~80%	▪ Watt-hour efficiency >93%
Self-discharge	▪ High self-discharge ▪ Lower Self life of 5-10 years	▪ Negligible self-discharge ▪ Higher self-life of 15 years
Performance Monitoring and Self-protection	▪ No data monitoring or recording system	▪ In built data monitoring and logging systems for important parameters
State of Health (SOH) Monitoring	▪ Not Available	▪ In built system to monitor battery SOH & monitoring through Supervisory Control and Data Acquisition (SCADA) system possible

Lithium-ion battery has significant advantages over lead-acid battery in every aspect and therefore is the preferred option for ACWA Power. However, ACWA Power requires flexibility to install the technology that best suits the site from a technical perspective, integration with the existing substation network and the space limitations at each site.

4.3 Layout Alternatives

Previously, two 75 MW PV plants (250 ha each) and one 150 MW CSP plant (900 ha) were approved on the Farm Bokpoort 390 RE. In terms of the site layout, the two alternatives that have been provided are the previous approved layout (Figure 7) and the proposed layout that includes all 10 PV Plants (Figure 8). Figure 8 is the preferred alternative as this option caters for the new hectarage of the approved PV plants which will now be reduced from 250 ha to 150 ha to accommodate the other 8 new PV plants of 150 ha each and to ensure that there is no overlapping of applications. The CSP technology is no longer part of the approved energy mix for South Africa according to the IRP (2019) and therefore not feasible.

Ancillary infrastructure e.g. water pipeline, main access road, and shared infrastructure including buildings, including a workshop area for maintenance, storage (i.e. fuel tanks, etc.), laydown area, parking, warehouse, and offices have been approved in the previous EIA studies.

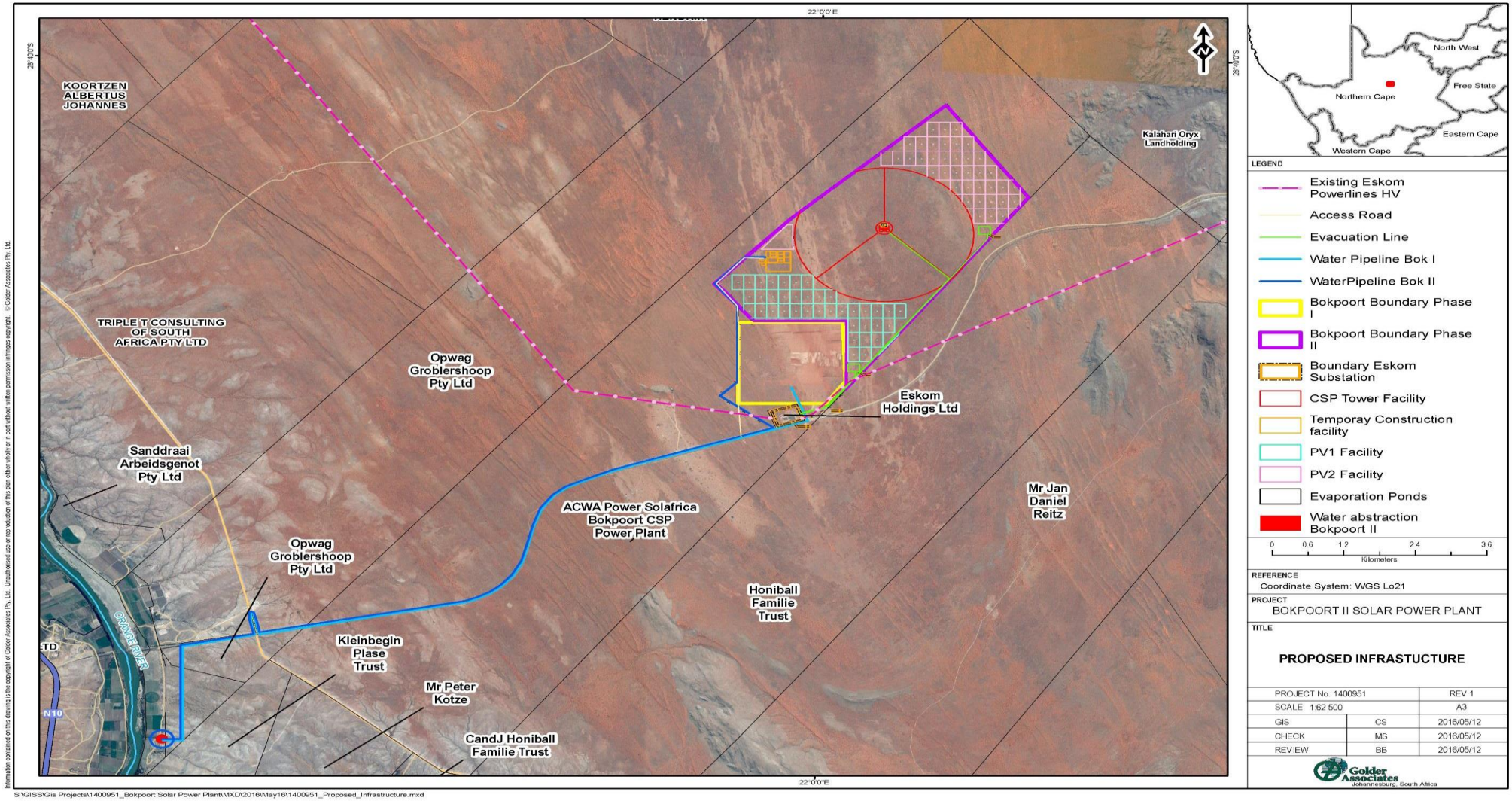


Figure 7: Previously approved PV 1, PV 2 and CSP plants[18]

[18] *Schlechter, M., & Baxter, B. 2016. Final EIA Report: Proposed 75MW Photovoltaic (PV2) Solar Development on the Remaining Extent of the Farm Bokpoort 390, Northern Cape. Golder Associates. Ref 14/12/16/3/3/2/880.*

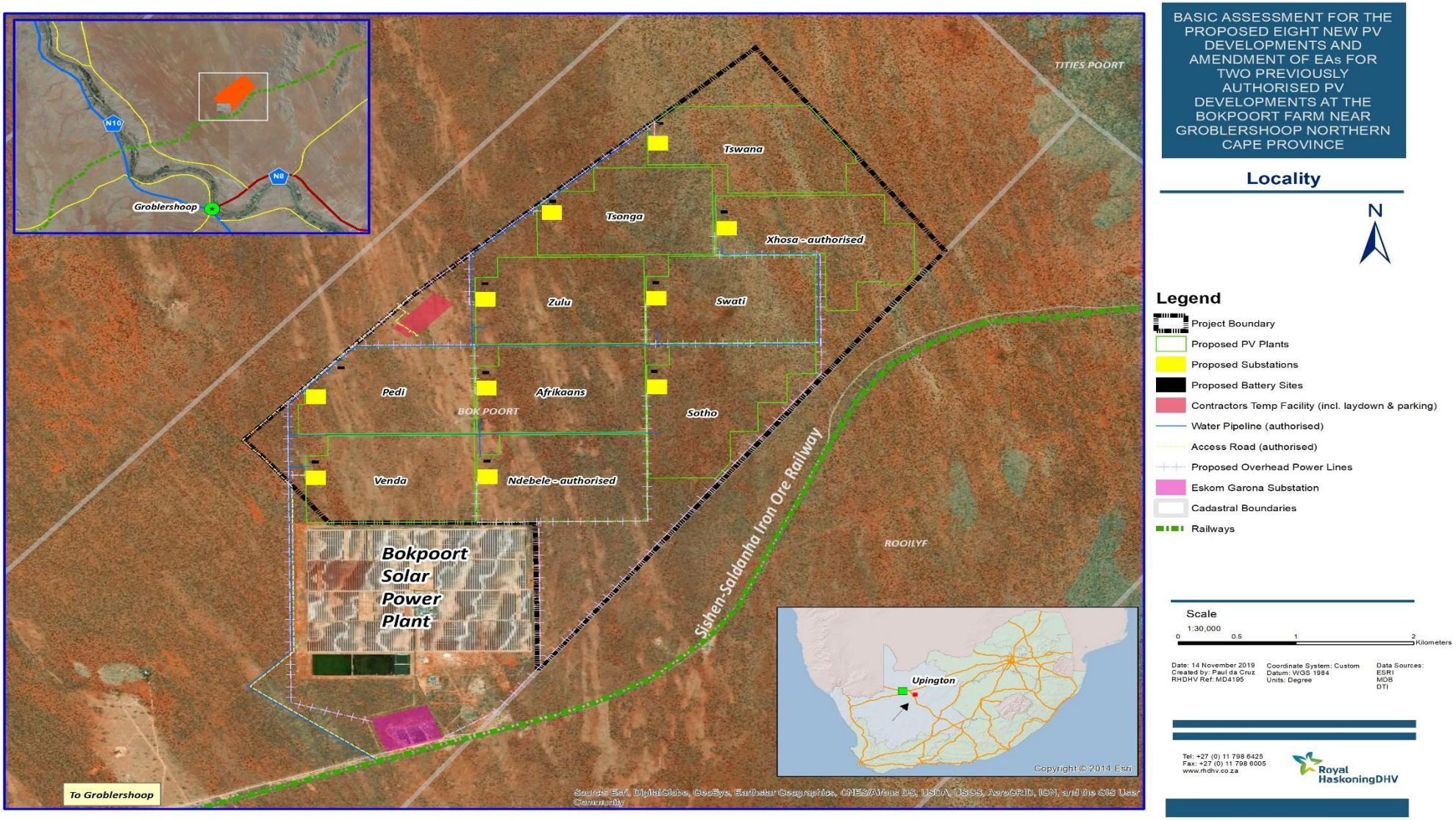


Figure 8: Proposed layout including all 10 PV Plants

4.4 No-Go Alternatives

The No-Go alternative is the option of not establishing new PV plants and associated BESS at the identified site in the Northern Cape Province. South Africa currently relies almost completely on fossil fuels as a primary energy source with coal providing 75% of the fossil fuel-based energy supply[19]. Coal combustion in South Africa is the main contributor to carbon dioxide emissions, which is the main greenhouse gas that has been linked to climate change.

Solar without storage predominantly provides the predictable component of energy generation, as a result, power must be generated at short notice in order to sustain the supply/demand balance. Battery storage provides this flexibility and deploying the batteries in areas where there are a lot of renewable energy power plants will allow energy generators to take advantage of the surplus energy generation capacity provided by this increased renewable technology. The No-go option of not utilising BESS technology will result in the PV plants not being able to take advantage of the surplus energy produced and therefore ensuring that the energy generation remains unstable.

An emphasis has therefore been placed on securing South Africa's future power supply through the diversification of power generation sources. Furthermore, South Africa would have to invest in a power generation mix, and not solely rely on coal-fired power generation, to honour its commitment made under the Copenhagen Accord and Paris Agreement to mitigate climate change challenges. Under the Accord, the country committed to reduce its carbon dioxide emissions by 34% below the "business as usual" level by 2020. Under the Paris Agreement, the country is committed to limiting the global temperature increase to well below 2 degrees Celsius.

With an increasing demand in energy predicted and growing environmental concerns about fossil fuel-based energy systems, the development of large-scale renewable energy supply schemes such as PV is strategically important for increasing the diversity of domestic energy supplies and avoiding energy imports in the country.

Without the implementation of this project, the use of renewable options for power supply will be compromised in the future. This has potentially significant negative impacts on environmental and social well-being. Therefore, the No-Go option is not considered as a feasible option on this proposed project.

5 DESCRIPTION OF THE BASELINE ENVIRONMENT

The following section describes the biophysical and socio-economic environment that may be affected by the proposed developments. The baseline studies for the authorised PV1 (Ndebele)[20] and PV2 (Xhosa)[21] solar development plants focussing on significant environmental aspects of the proposed development were consulted to describe the baseline conditions.

[19] *Department of Minerals and Energy. 1999. Digest of South African Energy Statistics, compiled by CJ Cooper.*
[20] *Schlechter, M., & Baxter, B. 2016. Final EIA Report: Proposed 75MW Photovoltaic (PV1) Solar Development on the Remaining Extent of the Farm Bokpoort 390, Northern Cape. Golder Associates. Ref 14/12/16/3/3/2/881.*
[21] *Schlechter, M., & Baxter, B. 2016. Final EIA Report: Proposed 75MW Photovoltaic (PV2) Solar Development on the Remaining Extent of the Farm Bokpoort 390, Northern Cape. Golder Associates. Ref 14/12/16/3/3/2/880.*

5.1 Geology

The geology of the area is generally characterised by metamorphosed sediments and volcanics intruded by granites and is known as the Namaqualand Metamorphic Province.

Groblershoop is located on the Kalahari Group. The Kalahari Group is divided into four formations. At the base is a soft, clay gravel of fluvial origin (the Wessels Formation). Upon this follows calcareous claystone with interlayered gravel (the Budin Formation). This is in turn overlain by clay-containing, calcareous sandstone (the Eden Formation). Upon the Eden Formation follows the aeolian surface which is characteristic of the group (the Gordonia Formation) (Council for Geoscience , 2016)[22]. The proposed solar development project site is situated on red-brown windblown sands of the Gordonia Formation, Kalahari Group.

The general geology of the site mainly comprises red-brown, coarse-grained granite gneiss; and quartz-muscovite schists, quartzite, quartz-amphibole schists and greenstones of the Groblershoop formation, Brulpan group. Calcrete is also found especially on the south eastern part of the area. The geology map is shown Figure 9.

Dune ridges occur in the northern portions of the site and are characterised by NNW-SSE orientation. Calcrete outcrops occur approximately 2km west and southwest from the Garona Substation. An anticlinal structure (upward pointing fold) causes the Groblersdal formation to be elevated in the area to the east of the site where it forms a range of hills known as the Skurweberge.

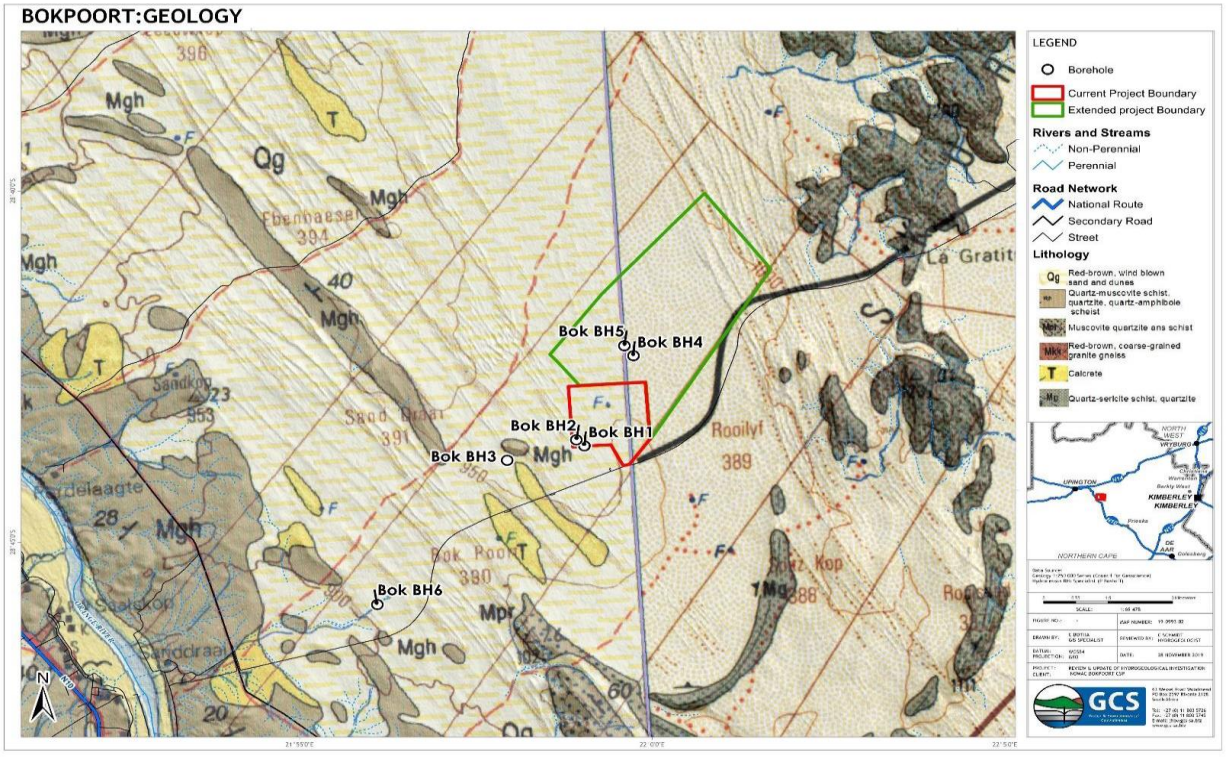


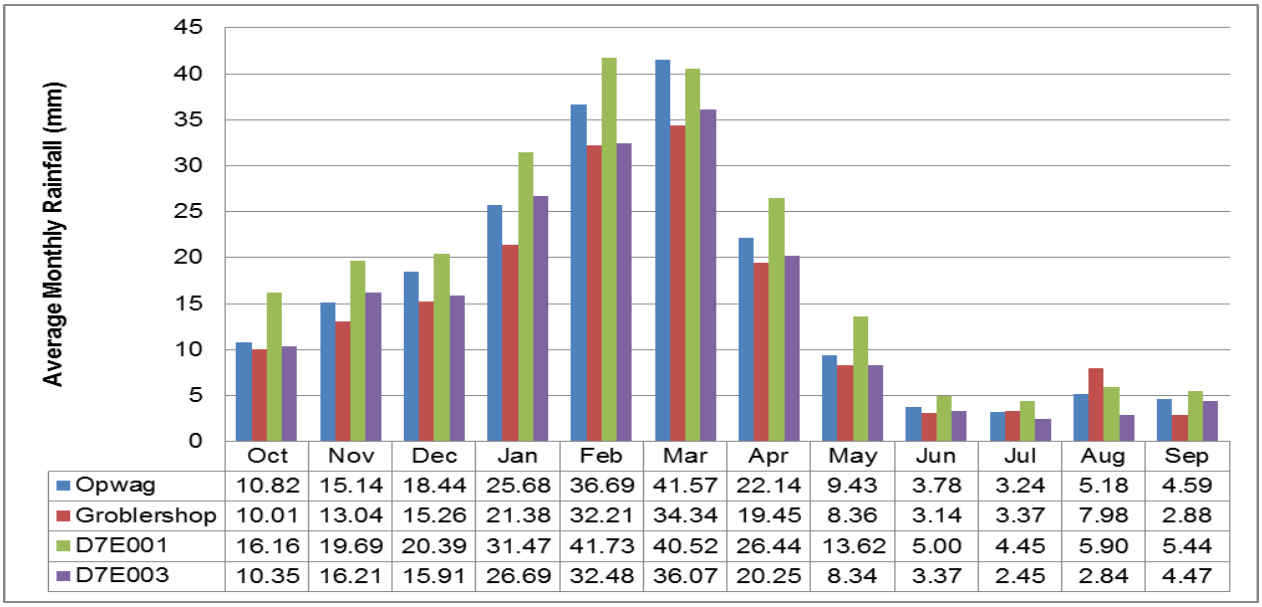
Figure 9: Geology Map

[22] *Council for Geoscience. 2016. Simplified Geology of the Northern Cape Province. Retrieved January 26, 2016, from Council for Geoscience: www.geoscience.org.za*

5.2 Climate[23&24]

5.2.1 Rainfall and Water Availability

Rainfall in the project area is scarce and generally occurs in late summer and early autumn between January and April (Figure 10). Average rainfall in the area varies between 170 and 240mm per annum (Figure 11), while evaporation is extremely high, due to the high temperatures, which can reach 35º - 40º C in summer.



	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Opwag	10.82	15.14	18.44	25.68	36.69	41.57	22.14	9.43	3.78	3.24	5.18	4.59
Groblershop	10.01	13.04	15.26	21.38	32.21	34.34	19.45	8.36	3.14	3.37	7.98	2.88
D7E001	16.16	19.69	20.39	31.47	41.73	40.52	26.44	13.62	5.00	4.45	5.90	5.44
D7E003	10.35	16.21	15.91	26.69	32.48	36.07	20.25	8.34	3.37	2.45	2.84	4.47

Figure 10: Monthly rainfall distribution for rainfall stations in the surrounding area.

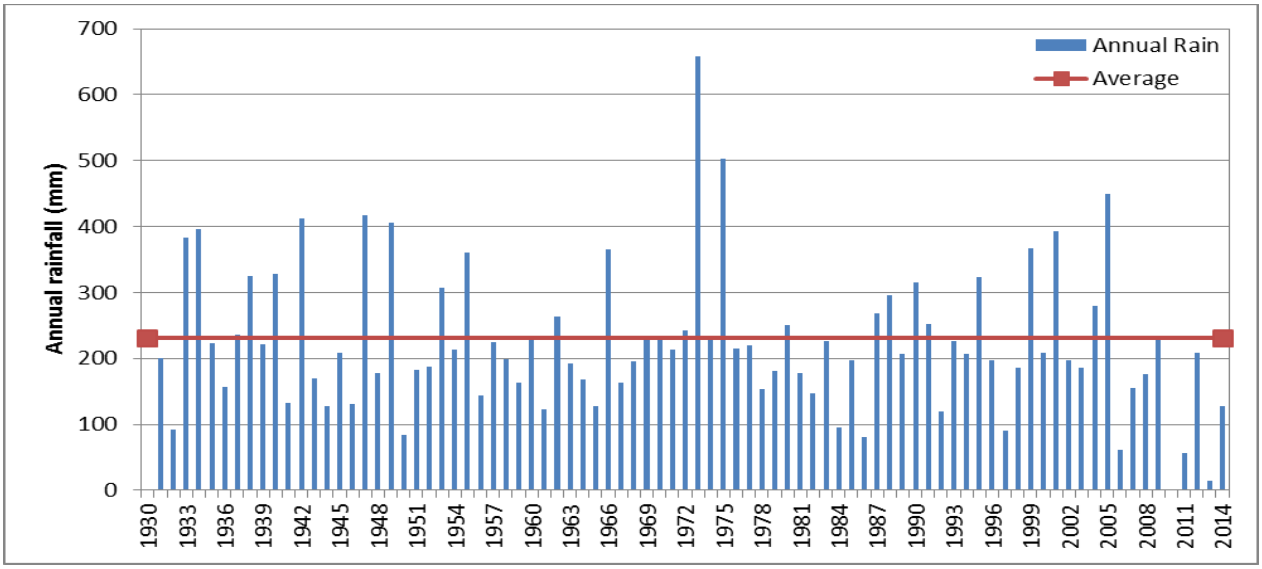


Figure 11: Annual Rainfall recorded at the D7E001 (Boegoeberg Dam) station

[23] *Schlechter, M., & Baxter, B. 2016. Final EIA Report: Proposed 75MW Photovoltaic (PV1) Solar Development on the Remaining Extent of the Farm Bokpoort 390, Northern Cape. Golder Associates. Ref 14/12/16/3/3/2/881.*
[24] *Schlechter, M., & Baxter, B. 2016. Final EIA Report: Proposed 75MW Photovoltaic (PV2) Solar Development on the Remaining Extent of the Farm Bokpoort 390, Northern Cape. Golder Associates. Ref 14/12/16/3/3/2/880.*

5.2.2 Temperature

Daily average summer temperatures range between 23^0 C and 37^0 C with winter temperatures ranging between 4° C and 20° C.

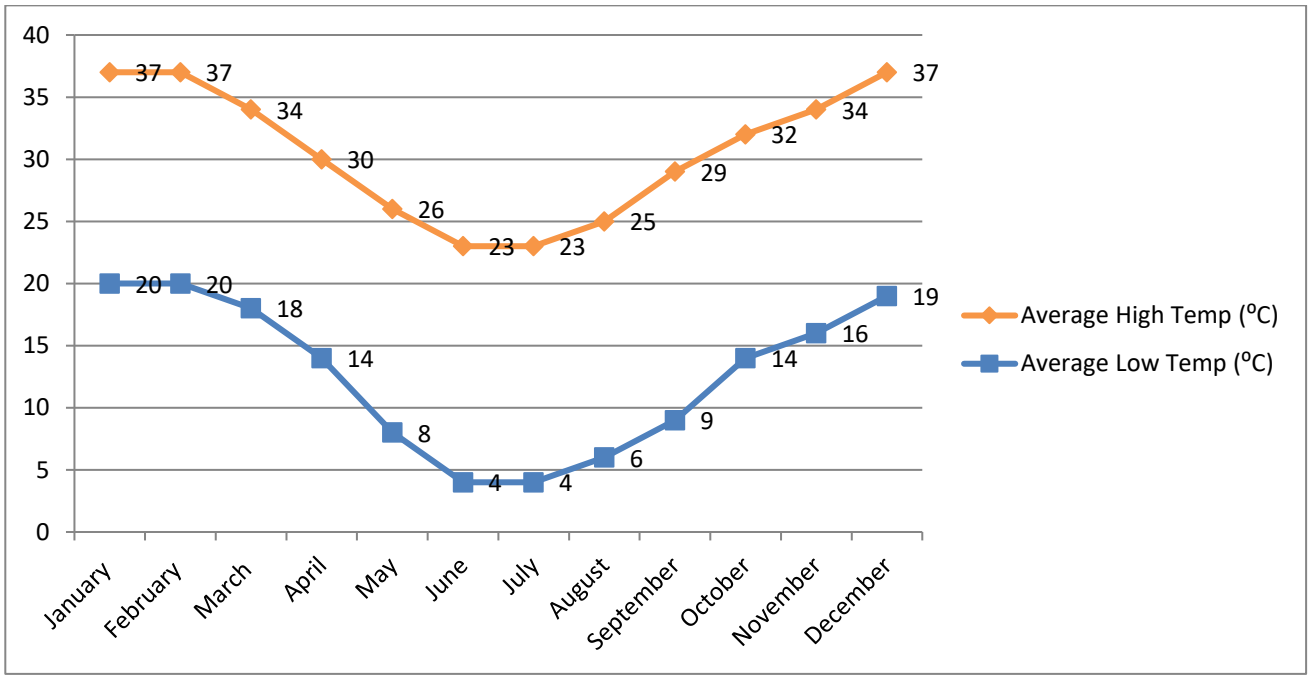


Figure 12: Average Temperature (°C) Graph for Groblershoop (World Weather Online, 2016)[25]

5.2.3 Evaporation

Monthly evaporation data was available for the Department of Human Settlement, water and Sanitation (previously Department of Water and Sanitation) station D7E001, located approximately 40km south east of the project site. The station has an approximate Mean Annual Evaporation (MAE) of 2 166.3mm calculated over a period of 1931-2008. Monthly mean, minimum and maximum evaporation depths are shown in Figure 13.

As illustrated in Figure 13, the highest evaporation occurs in the summer months of September to March. The average monthly evaporation values are shown in Table 16.

[25] *World Weather Online. (2016, January). Groblershoop Monthly Climate Average, South Africa. Retrieved January 2016 18, 2016, from World Weather Online: www.worldweatheronline.com*

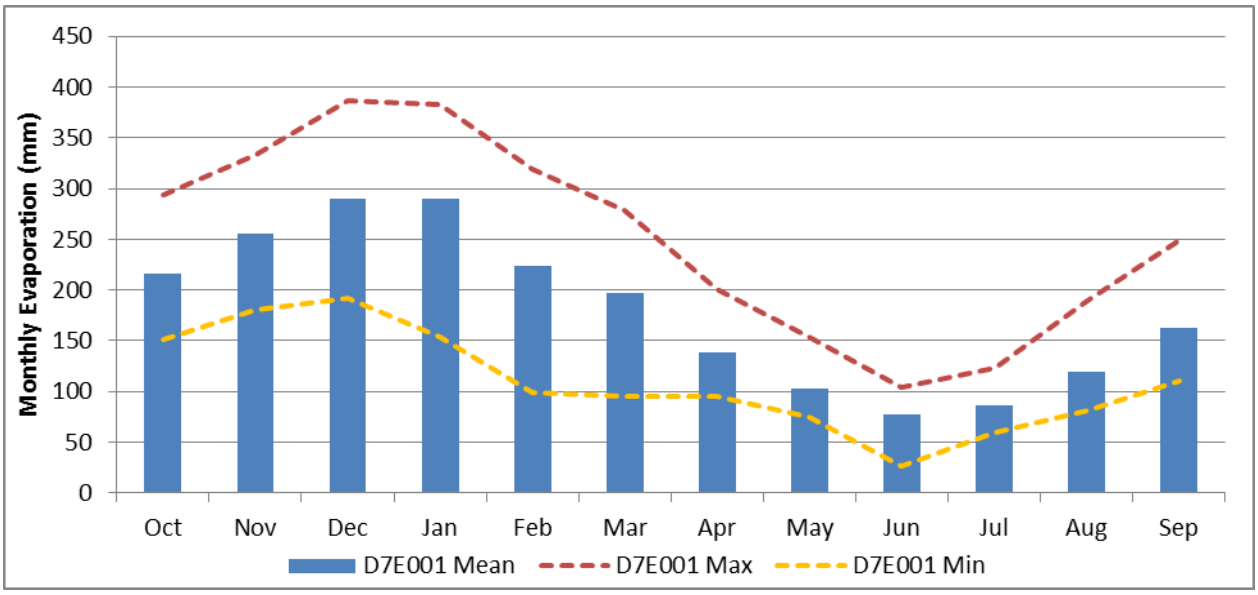


Figure 13: Monthly mean, minimum and maximum evaporation for station D7E001 (Boegoeberg Dam)

Table 16: Average monthly evaporation values for station D7E001

Month	Monthly Evaporation
October	216
November	255
December	290
January	290
February	223
March	197
June	139
July	103
August	77
September	87
Year	1 877

5.2.4 SITE-SPECIFIC DISPERSION POTENTIAL

Given the remote location of the proposed site, local meteorological measurements were not available. RHDHV (2010)[26] made use of site-specific modelled MM5 meteorological data for the period January 2005

[26] *SSI (2010). Air Quality Impact Assessment for a Proposed Concentration Solar Plant in the Norther Cape. Project Number: EO2.JNB.000674, 33 pp.*

– December 2009 from Lakes Environmental. Wind roses comprise of 16 spokes that represent the directions from which winds blew during the reference period.

The colours reflect the different categories of wind speeds. The dotted circles provide information regarding the frequency of occurrence of wind speed and direction categories. Based on an evaluation of the meteorological data provided, winds originated predominantly from the north-northeast (10.5% of the time) and north (9% of the time) (Figure 14). Gentle to moderate breezes prevailed over the monitoring period. Calm wind speeds, which are designated as wind speeds less than 0.5 m/s, occur infrequently (<4 % of the time).

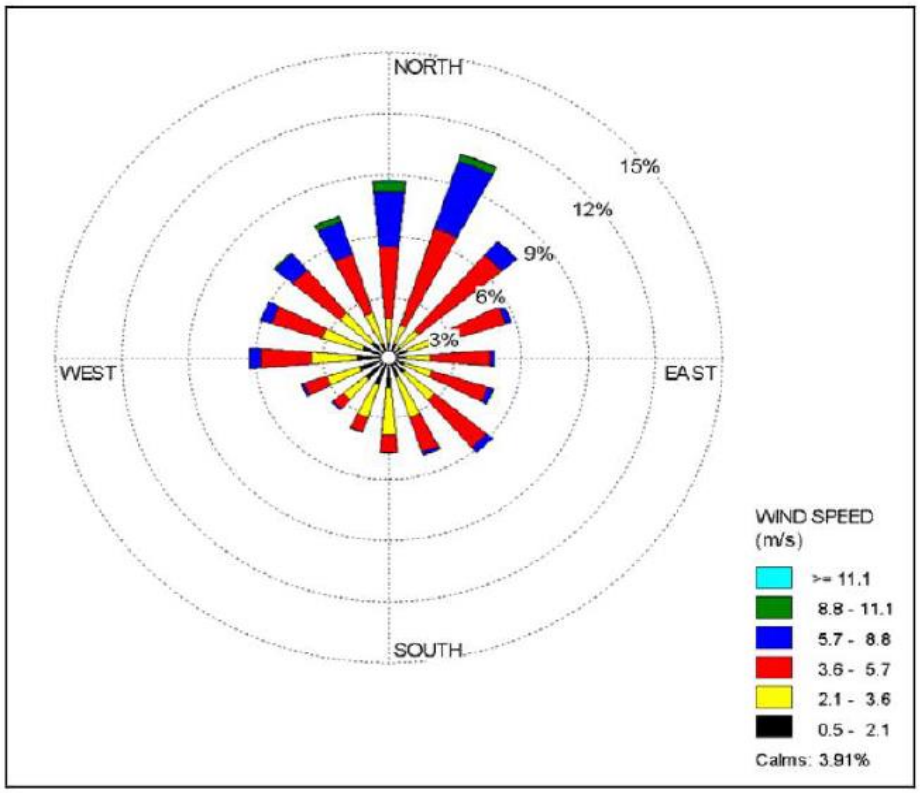


Figure 14: Period wind rose for study site, 2005 – 2009 MM5

A diurnal trend in the wind field is recorded at the proposed site (Figure 15). During the morning (06:00 – 12:00), moderate to fresh breezes prevail from the north-northeast to the north-north-west. During the afternoon (12:00 –18:00), on average gentler breezes blow from the north-westerly sector. The evening (18:00 -00:00) shows a more varied wind rose, but with gentle westerlies prevailing. During the night-time (00:00 – 06:00), average wind speeds increase, with winds prevailing form the north-north-east to east-north-east.

The seasonal variability in the wind field at the proposed site is shown in Figure 16. During the summer months (Dec, Jan and Feb), winds originate predominantly from the west. During autumn (Mar, Apr and May), a shift is observed with winds originating predominantly from the north-north-east and north-east. A similar pattern to the autumn months is observed during the winter months (Jun, Jul and Aug) but with a northerly shift and higher average wind speeds. During spring (Sep, Oct and Nov), winds originate from all sectors, with the highest frequency recorded from the westerly sector. Lowest average wind speeds occur during spring. Based on the prevailing meteorological conditions for the area, emissions released from the

proposed site will be transported predominantly in a south-south-westerly and southerly direction from the proposed site.

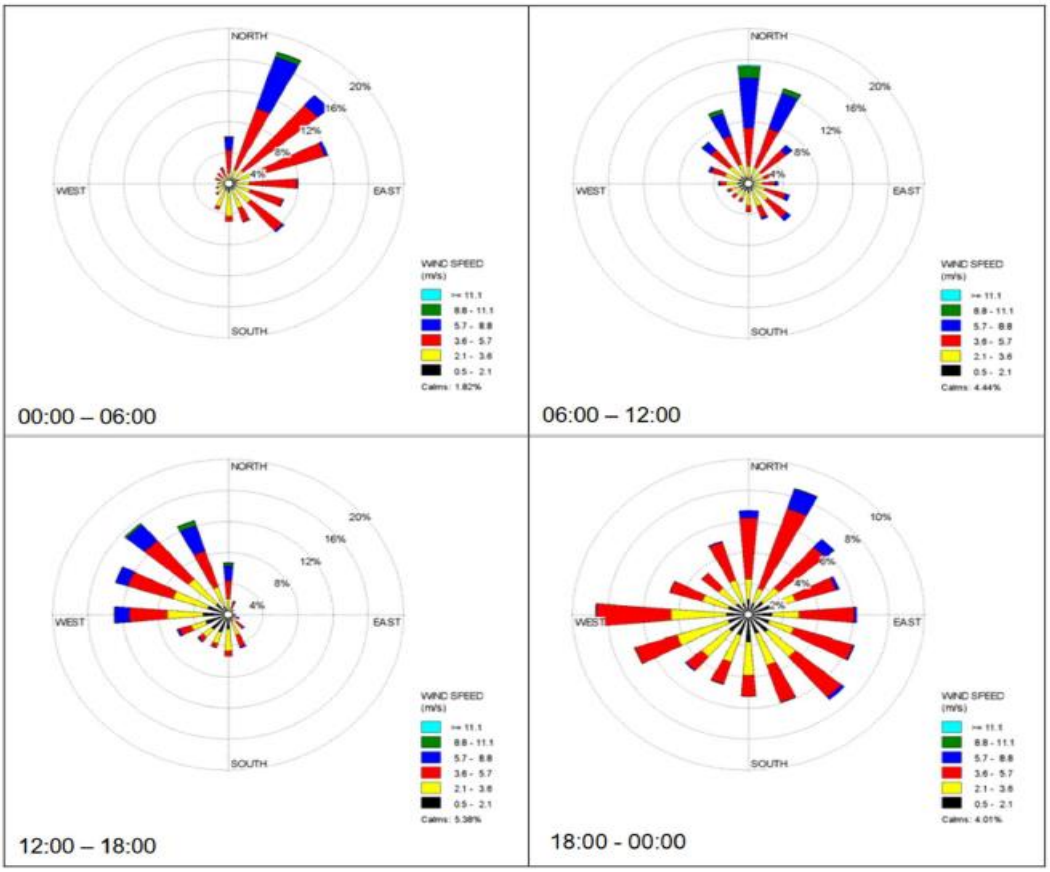


Figure 15: Diurnal wind rose for the study site, 2005 - 2009 MM5

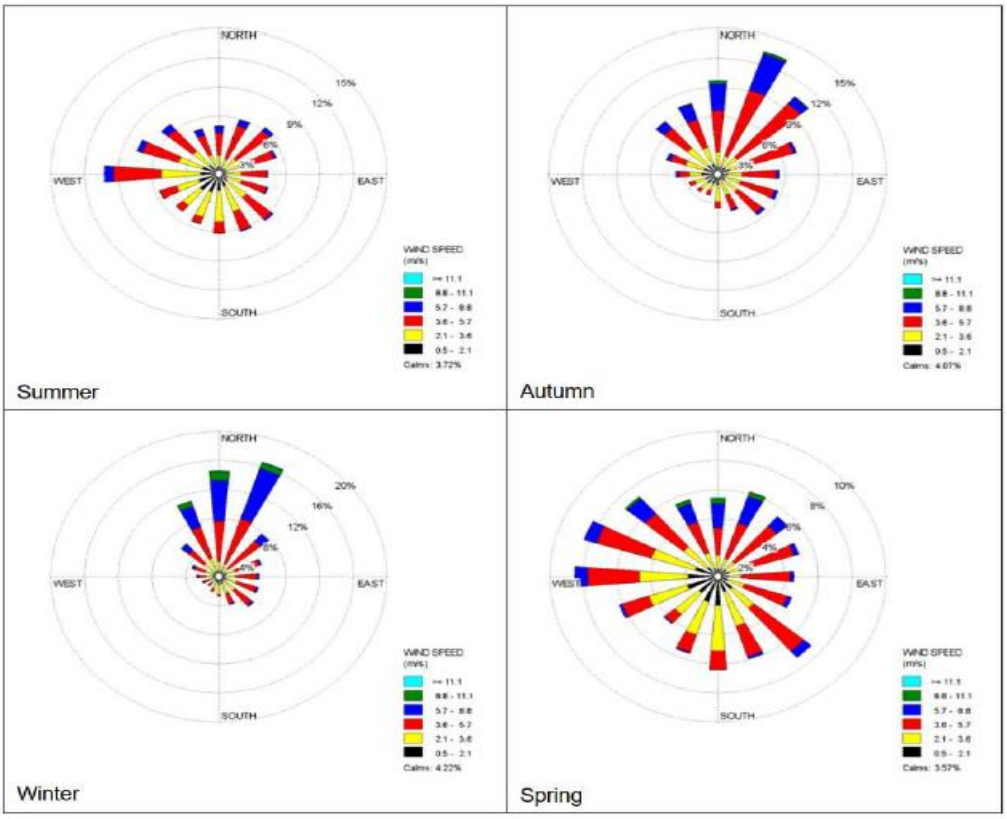


Figure 16: Seasonal wind rose, 2005 - 2009 MM5

5.2.5 *Atmospheric Stability*

Atmospheric stability is categorised into six classes (Table 17). The atmospheric boundary layer is generally most unstable during the day due to turbulence caused by the sun's heating effect on the earth's surface. The depth of this mixing layer depends mainly on the amount of solar radiation, increasing in size gradually from sunrise to reach a maximum at about 5 - 6 hours after sunrise, dependent on cloud cover. The degree of thermal turbulence is increased on clear warm days with light winds. During the night-time a stable layer, with limited vertical mixing, exists. During windy and cloudy conditions, the atmosphere is normally neutral.

Table 17: Atmospheric Stability Classes

Category	Classification	Typical Conditions
A	Very Unstable	Calm Wind, clear skies, hot daytime conditions
B	Moderately Unstable	Clear skies, daytime conditions
C	Unstable	Moderate wind, slightly overcast daytime conditions
D	Neutral	High winds or cloudy days and nights
E	Stable	Moderate wind, slightly overcast night-time conditions
F	Very Stable	Low winds, clear skies, cold night-time conditions

In general, the proposed site experiences neutral (Class D) to stable (Class E) atmospheric conditions (Figure 17). This is expected given the predominance of a high-pressure anticyclone over the interior of South Africa, which produces stable, clear conditions.

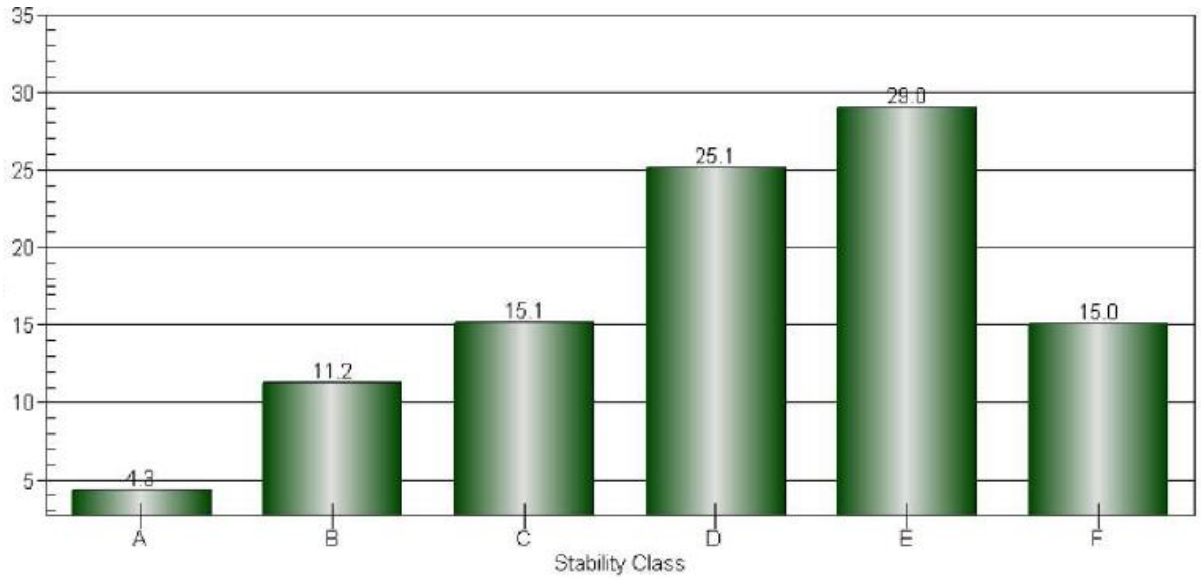


Figure 17: Stability class frequency distribution, 2005 – 2009 MM5

5.3 Air Quality

5.3.1 Sensitive Receptor

A sensitive receptor is a person or place where involuntary exposure to pollutants released by the proposed project could take place (e.g. residences, schools, medical facilities, etc.). Receptors surrounding the proposed site were identified by RHDHV (2010)[27] from satellite images of the area. The closest sensitive receptor is a neighbouring farmhouse, approximately 2 km south-west of the proposed site. Residential areas identified include:

- Wegdraai (17 km south-west of the site);
- Groblershoop (18 km south of the site);
- Sutterheim (19 km south of the site);
- Brandboom (24 km south-south-east of the site);
- Boegoberg (34 km south-south-east of the site); and
- Upington (80 km west-north-west of the site).

5.3.2 Existing Source of Air Pollution

RHDHV (2010) used satellite imagery to identify the following sources of air pollution in the area:

- Agriculture;
- Domestic fuel burning; and
- Veld fires.

The following sections, providing a qualitative description of the identified sources, were extracted from the RHDHV (2010) AQIA report.

[27] *SSI (2010). Air Quality Impact Assessment for a Proposed Concentration Solar Plant in the Norther Cape. Project Number: EO2.JNB.000674, 33 pp.*

5.3.2.1 Agriculture

Land-use along the Orange River is predominantly agricultural with crops such as grapes grown on the flood plains. The activities responsible for the release of particulate matter (PM) and gases to atmosphere include:

- Particulate emissions generated due to wind erosion from exposed areas;
- Particulate emissions generated due to the mechanical action of equipment used for tilling and harvesting operations
  - Tilling, harvesting and other activities associated with field preparation are seasonally based;
- Vehicle entrained dust on paved and unpaved road surfaces;
- Gaseous and particulate emissions due to fertilizer treatment; and
- Gaseous emissions due to the application of herbicides and pesticides.

5.3.2.2 Domestic Fuel Burning

It is anticipated that low income households in the area are likely to use coal and wood for space heating and cooking purpose. Biomass and coal smoke contain a large number of pollutants, including PM, carbon monoxide (CO), nitrogen oxides (NOx), sulphur oxides (SO3), formaldehyde, and polycyclic organic matter, including carcinogens such as benzo[a]pyrene[28].

Exposure to indoor air pollution (IAP) from the combustion of solid fuels has implications for acute respiratory infections (ARI) and otitis media (middle ear infection), chronic obstructive pulmonary disease (COPD), lung cancer (from coal smoke), asthma, cancer of the nasopharynx and larynx, tuberculosis, perinatal conditions and low birth weight, and diseases of the eye such as cataract and blindness[29].

Monitoring of pollution and personal exposures in biomass-burning households has shown concentrations are many times higher than those in industrialized countries. A typical 24-hr average concentration of PM10 in homes using biofuels may range from 200 to 5 000 µg/m3, depending on the type of fuel, stove, and housing. Significant temporal and spatial variations may occur within a house. Field measurements, for example, recorded peak concentrations of > 50 000 µg/m3 in the immediate vicinity of the fire, with concentrations falling significantly with increasing distance from the fire. Overall, it has been estimated that approximately 80% of total global exposure to airborne particulate matter occurs indoors in developing nations. Levels of CO and other pollutants also often exceed international guidelines[30].

5.3.2.3 Veld Fires

A veld fire is a large-scale natural combustion process. The size and intensity of a veld fire depends variables such as meteorological conditions, vegetation variables, particularly moisture content, and the density of consumable fuel per hectare (available fuel loading). The major pollutants from veld burning are PM, CO and volatile organics. NOx is emitted at rates of from 1 to 4 g/kg burned, depending on combustion temperatures. Emissions of SOx are negligible[31].

5.4 Topography

The proposed development is located on a terrain unit of plains with open low hills or ridges, changing to rolling or irregular plains with low hills or ridges in the extreme north of the site. It is at an altitude of around 1,000 meters. Slope is less than 2% across the site.

[28] *Ibid footnote 22*
[29] *Ibid Footnote 22*
[30] *Ibid footnote 22*
[31] *U.S Environmental Protection Agency, (1996). Compilation of Air Pollution Emission Factors (AP-42), 6th Edition, Volume 1, Available at URL: http://www.epa.gov/ttn/chief/ap42/*

5.5 Soils

The land type classification is a nationwide survey that groups areas of similar soil, terrain and climate conditions into different land types. There is predominantly one land type across most of the site, namely Ae4. A small part of the site in the extreme north east is on land type Af7. The soils of Ae4 are shallow to moderately deep, red, sandy soils overlying hard pan carbonate and sometimes rock. These soils fall into the Calcic and Lithic soil groups according to the classification of Fey (2010)[32]. Land type Af7 comprises deeper red sands and includes dunes. Soils are predominantly of the Coega soil form, with lesser coverage of shallow Plooysburg form. It should be noted that the land type classification presented in report as ***Appendix B1*** made use of the older South African soil classification system, which did not include the Coega and Plooysburg forms. These forms would have been classified, according to the older system, as Mispah and Hutton respectively.

The soils are classified as having low to moderate susceptibility to water erosion (class 5), and as highly susceptible to wind erosion (Ae4 = class 1b; Af7 = class 1a).

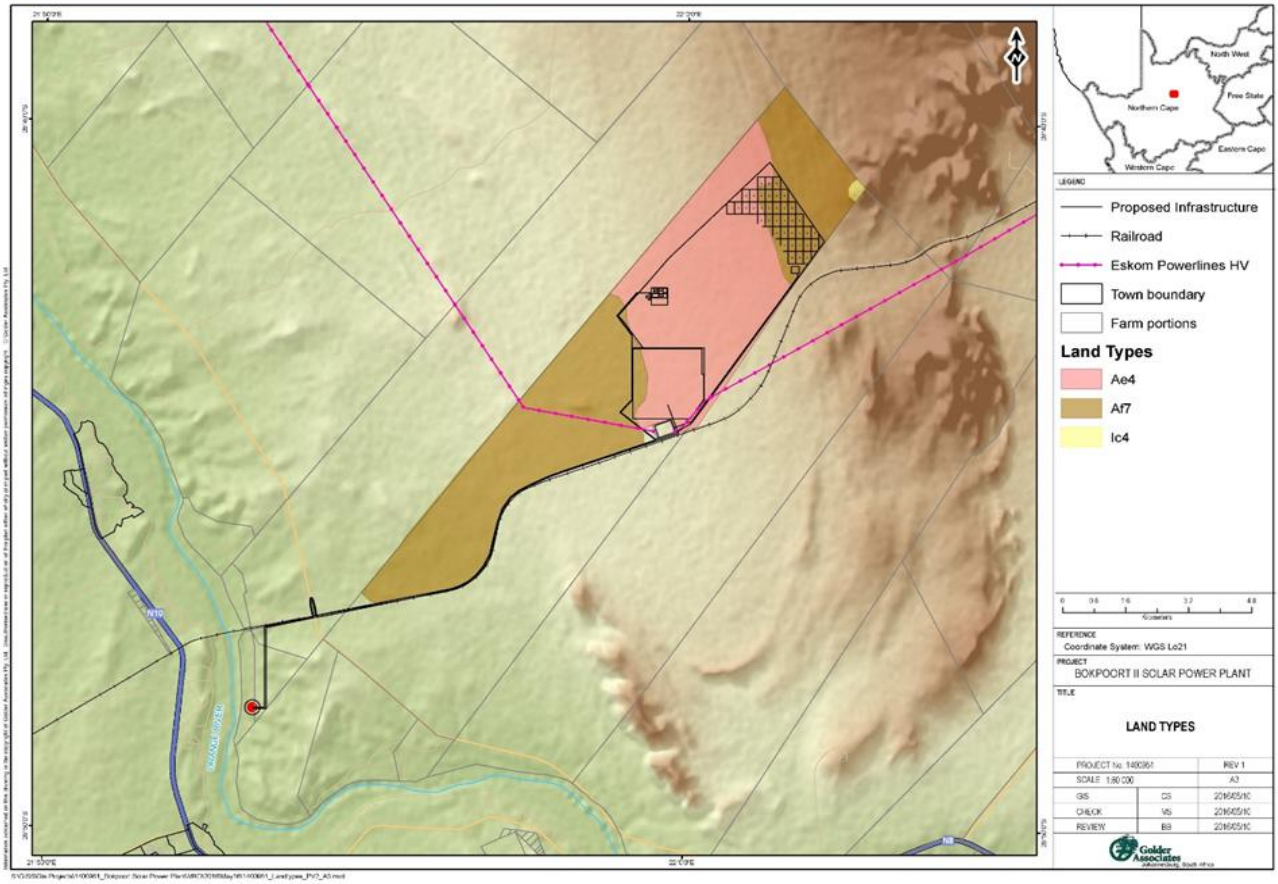


Figure 18: Land types[33]

[32] *Fey, M. 2010. Soils of South Africa. Cambridge University Press, Cape Town.*
[33] *Schlechter, M., & Baxter, B. 2016. Final EIA Report: Proposed 75MW Photovoltaic (PV2) Solar Development on the Remaining Extent of the Farm Bokpoort 390, Northern Cape. Golder Associates. Ref 14/12/16/3/3/2/880.*

5.6 Agriculture Capability

Land capability is defined as the combination of soil, climate and terrain suitability factors for supporting rainfed agricultural production. It is an indication of what level and type of agricultural production can sustainably be achieved on any land. The higher land capability classes are suitable as arable land for the production of cultivated crops, while the lower suitability classes are only suitable as non-arable grazing land, or at the lowest extreme, not even suitable for grazing.

The new land capability mapping divides land capability into 15 different categories with 1 being the lowest and 15 being the highest. Values below 8 are generally not suitable for production of any cultivated crop. Detail of this land capability scale is shown in Table 18.

The project area is classified with a predominant land capability evaluation value of 5, although it varies from 3 to 5 across the site. Agricultural limitations that result in the low land capability classification are predominantly due to the very limited climatic moisture availability. The very sandy soils, with very limited water holding capacity are a further limitation. These factors render the site unsuitable for any kind of mainstream cultivation without irrigation and limit it to low density grazing only. The long-term grazing capacity of the site is fairly low at 22 hectares per large stock unit.

Table 18: Details of the 2017 Land Capability classification for South Africa

Land capability evaluation value	Description
1	Very Low
2	
3	Very Low to Low
4	
5	Low
6	Low to Moderate
7	
8	Moderate
9	Moderate to High
10	
11	High
12	High to Very High
13	
14	Very High
15	

5.7 Ecology

5.7.1 Regional Vegetation types

The study area is located in a transitional area that includes elements of both the Savanna Biome and the Nama Karoo Biome. Two principal natural vegetation types are predicted for the study area (Mucina & Rutherford 2018)[34], namely Kalahari Karroid Shrubland comprising the largest extent of the site and Gordonia Duneveld that is situated in the northern part of the site (refer Figure 30).

[34] *MUCINA, L. & RUTHERFORD, M.C. (eds.). 2006. The vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. South African National Biodiversity Institute, Pretoria.*

The Kalahari Karroid Shrubland vegetation type occurs in the Northern Cape Province, forming part of the Nama Karoo Biome (Bushmanland Bioregion). The vegetation and landscape features are typically low karroid shrubland on flat, gravel plains. The conservation status is Least Threatened.

Gordonia Duneveld is part of the Savanna Biome (Kalahari Duneveld Bioregion), with vegetation and landscape features comprising characteristically parallel dunes about 3 – 8 m above the plains. The conservation status of this unit is regarded Least Threatened.

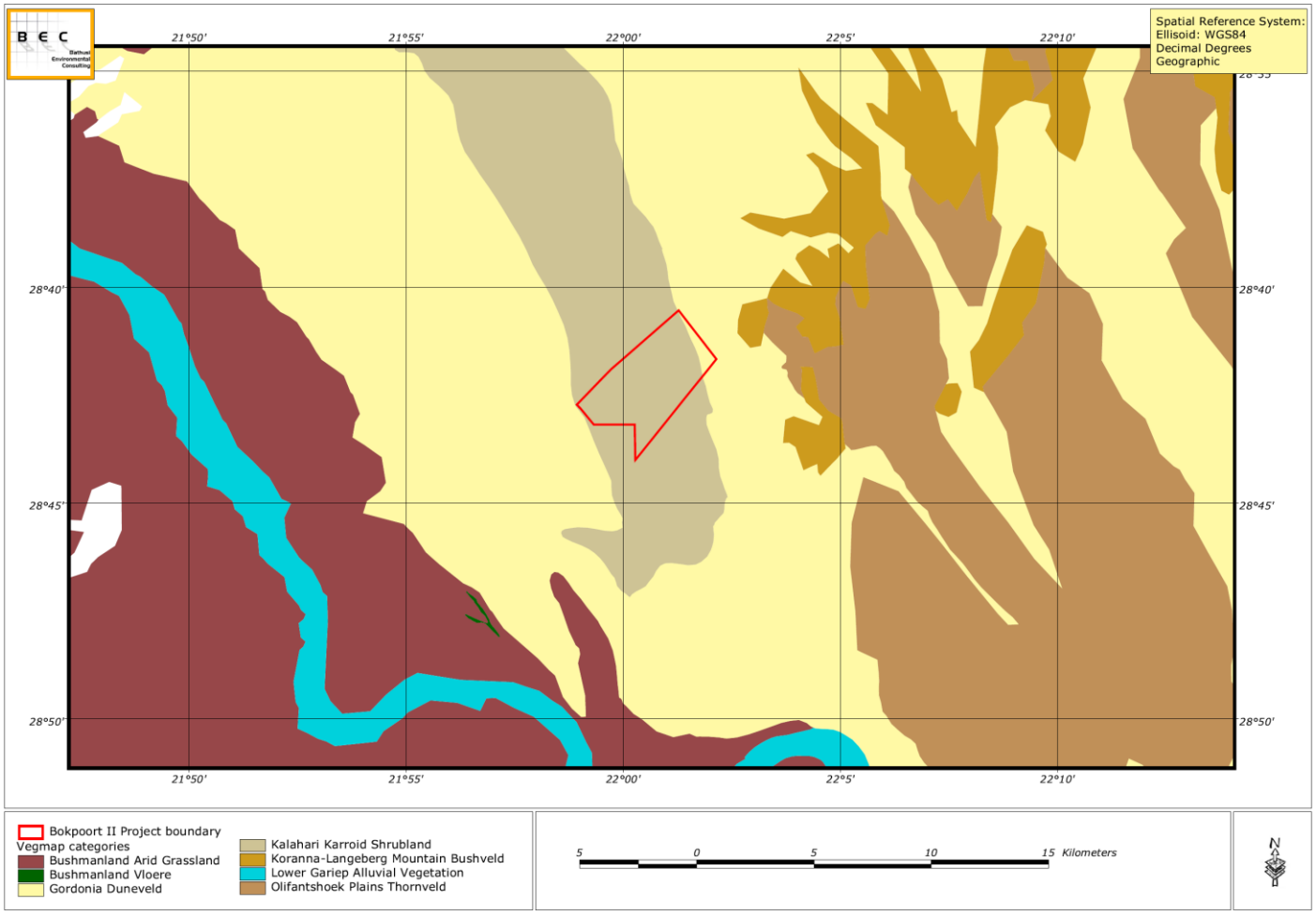


Figure 19: Regional ecological types in spatial relation to the study area

5.7.2 Alpha Diversity of the Study Area

A total of 112 plant species were identified during the site investigations (Appendix 1 of the Biodiversity Report included as ***Appendix B5*** of this report). The regional setting dictates the physiognomic dominance of the herbaceous component with 47 forb species (41.9 %) and 24 grass species (21.4 %). Trees and shrubs occur extensively throughout most of the study area (26 species 28.6 %) and apart from Acacia erioloba individuals are not particularly physically significant.

Taking the setting of the study area into consideration, the species composition of untransformed vegetation types is regarded representative of the regional vegetation. A total of 35 plant families are represented in the study area, dominated by Poaceae (grass family, 24 species, 21.4 %), Fabaceae (16 species, 14.3 %) and Asteraceae (daisy family, 12 species, 10.7 %).

5.7.3 Declared Invasive Species and Common Weeds

Table 19 denotes a list of declared alien and invasive species and common weeds that were recorded on the study site during the 2010 site investigation.

Table 19: List of common weeds and declared alien and invasive plant species within the study area

Species Name	Status/ Uses	Common Name
Acacia mellifera	Declared indicator of encroachment, medicinal uses, poison source	Black Thorn
***Berkheya* species**	Weed	--
Flaveria bidentis	Declared Invader - Category 1B (NEM:BA, 2004. AIP, 2016)	Smelter's bush
Gomphocarpus fruticosus	Medicinal uses, common weed	Milkweed
Prosopis glandulosa	Declared Invader - Category 1B in EC, FS, NE, WC. Category 3 in NC (NEM:BA, 2004. AIP, 2014)	Honey Mesquite
Rhigozum trichotomum	Declared indicator of encroachment	Three Thorn

5.7.4 Plants with Traditional Medicinal Uses

Table 20 denotes plant species with traditional medicinal and traditional uses that were recorded within the study site.

Table 20: List of traditional and medicinal uses within the study area

Species Name	Status/ Uses	Common Name
Acacia erioloba	Declining Status, Protected Tree (National Forest Act, 1998), edible parts, medicinal uses, firewood	Camel Thorn
Acacia mellifera	Declared indicator of encroachment, medicinal uses, poison source	Black Thorn
Adenium oleifolium	Poisonous parts	Sand Quick
Aptosimum procumbens	Medicinal uses (sheep)	
Boscia albitrunca	Protected Tree (National Forest Act, 1998), important fodder, traditional uses, traditional medicinal uses	Sheperd's Tree
Cadaba aphylla	Medicinal properties, potentially poisonous	Desert Spray
Ceratotheca triloba	Medicinal properties	Wild Foxglove
Croton gratissimus	Medicinal uses, larval food for *Charaxes candiope candiope*	Lavender fever-berry
Dicoma capensis	Medicinal uses	Koorsbossie
Gomphocarpus fruticosus	Medicinal uses, common weed	Milkweed
Grewia flava	Edible parts, weaving, traditional uses, declared indicator of encroachment	Velvet Raisin
Kleinia longiflora	Traditional uses	Sjambokbos
Momordica balsamina	Edible parts, medicinal uses	Balsam Pear
Monechma genistifolium	Medicinal uses	Medicinal uses, traditional uses

Species Name	Status/ Uses	Common Name
Pergularia daemia	Medicinal uses	Bobbejaankambro
Plinthus sericeus	None	--
Senna italica	Medicinal uses	Wild senna
Solanum supinum	Medicinal uses	
Tribulus terrestris	Medicinal uses	Common Dubbeltjie
Tribulus zeyheri	Medicinal uses, grazed but potentially poisonous	Devil-thorn Weed
Ziziphus mucronata	Edible parts, traditional medicinal uses, traditional uses	Buffalo-thorn

5.7.5 Broad-scale Habitat types

In spite of a relative homogenous appearance and high correlation to the regional types, with the exception of extensive mountain ranges to the north, a relative obvious physiognomic variability is noted in the study area with plains alternating with parallel dunes in the northern parts. It is highly likely that various smaller phytosociological differences are present within each of the identified habitat types, but for the purpose of this assessment, the observed ecological units are considered similar in major phytosociological, physiognomic and biophysical attributes. Many plant species occur across all of the habitat types, but many of the differences between units are ascribed purely on the basis of terrain morphology, soil characteristics or changes in the dominance and structure of the plant species. Surface water and rainfall in this part of the Kalahari is scarce and, together with substrate, is a major driving force of vegetation development.

Results of the photo analysis and site investigations revealed the presence of the following habitat types within the development footprint (Figure 20):

- Calcareous Low Shrub Plains;
- Open Shrub Duneveld; and
- Open Shrub Plains.

The extent and coverage of habitat types within the study area is presented in Table 21.

Table 21: Extent of habitat types within the study area

Habitat Type	Extent (ha)
Calcareous Low Shrub Plains	494.8 ha
Open Shrub Duneveld	288.0 ha
Open Shrub Plains	664.6 ha

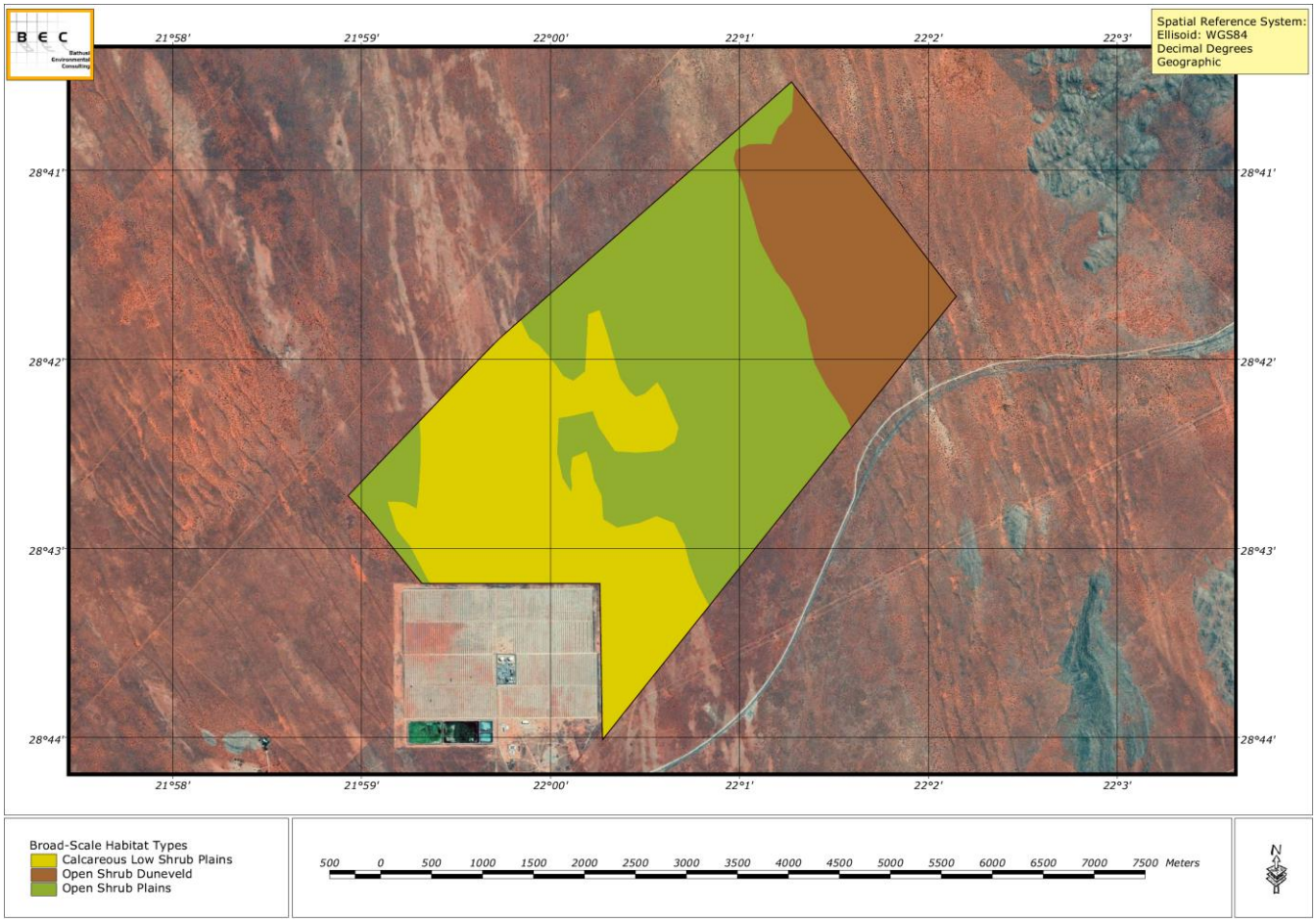


Figure 20: Broad-scale habitat types of the study area

5.7.6 Calcerous Low Shrub Plains

The topography of these areas are characterised by relative flat or slightly undulating plains where the substrate comprises whitish calcareous and compact sandy soils (grey to brown, not red) - Photograph 1. The vegetation is characterised by low shrubs and grasses; tall shrubs and trees are generally absent from this unit, or occur at extremely low intervals. Prominent species include the grasses *Enneapogon desvauxii, Eragrostis obtusa, Eragrostis truncata, Fingerhuthia africana, Stipagrostis ciliata*, the shrub *Salsola etoshensis* and the forbs *Pentzia calcarea, Eriocephalus spinescens, Monechma genistifolium* subsp. *australe, Geigeria* species. The shrubs *Rhigozum trichotomum* and *Lycium horridum* were observed in this unit.

The status of these areas appears to be relative degraded due to grazing pressure from sheep and other livestock; a moderate ecological integrity status is therefore ascribed.

Photograph 1: Example of Calcerous Low shrub plains

5.7.7 Open Shrub Duneveld

The major physiognomic attribute of this unit is the presence of low dunes with characteristic crests, slopes and streets with a floristic composition that largely conforms to an open tree savanna. Each of these units could be described as a variation of this unit on the basis of distinctive habitat attributes and species composition, but for the purpose of this investigation, they are considered holistically as they always occur in association with each other.

The physiognomy conforms to an open tree savanna (Photograph 2). Dominant species include the tree *Acacia mellifera* and the grass *Schmidtia kalahariensis*. Other prominent woody species are *Acacia haematoxylon, Parkinsonia africana, Rhigozum trichotomum, Boscia albitrunca* and *Acacia erioloba* and occasionally *Lycium bosciifolium*. Besides *Schmidtia kalahariensis,* the grass layer is characterised by *Eragrostis lehmanniana, Centropodia glauca, Stipagrostis amabilis, Brachiaria glomerata Stipagrostis obtusa* and *S. ciliata*. Herbs that are found in this unit include *Hermannia tomentosa, Hermbstaedtia fleckii, Requienia sphaerosperma, Dicoma capensis, Momordica balsamina* and the climber *Pergularia daemia*.

The presence of the grass species *Schmidtia kalihariensis* is generally accepted as an indicator of high utilisation pressure. This habitat type is representative of the Gordonia Duneveld vegetation type and is in a relatively good condition. During subsequent visits, it appeared to be moderately degraded due to livestock grazing pressure. A moderate ecological integrity status and moderate-high sensitivity is therefore ascribed to this unit due to the association with dune habitat.

Photograph 2: Examples of open shrub duneveld habitat

5.7.8 Open Shrub Plains

This habitat type comprises the largest part of the study area. Biophysical attributes include open plains (flat or slightly undulating) with high shrubs and scattered trees on deep sandy, red soils or gravel plains and a well-developed herbaceous layer (Photograph 3).

The species diversity is relative low; only 24 species were observed during the survey period. Prominent tall woody species in this undulating landscape are *Acacia erioloba, A. mellifera, Parkinsonia africana, Grewia flava* and *Boscia albitrunca*. Low shrubs include *Lebeckia linearifolia, Lycium bosciifolium, Rhigozum trichotomum* and *Salsola etoshensis.* Conspicuous grass species include *Schmidtia kalahariensis*, *Eragrostis lehmanniana* and *Stipagrostis ciliata*. Prominent forb species include *Monechma genistifolium* subsp. *genistifolium* and *Indigofera* species.

This habitat type is representative of the regional vegetation type Kalahari Karroid Shrubland which typically forms bands alternating with bands of Gordonia Duneveld. Due to similar grazing pressures in this vegetation community, a moderate floristic status is ascribed to this unit.

Photograph 3: Examples of open shrub plains

5.8 Faunal Attributes of the Study Area

5.8.1 Invertebrates

Invertebrate species previously recorded within the study area in 2010 were restricted to butterflies only (refer to Table 11 in the Biodiversity Assessment – ***Appendix B5***). All species are common and ubiquitous species of the region, nevertheless the butterfly species richness is likely a factor of the largely untransformed and non-fragmented nature of the Study Area.

The invertebrates observed in the study area during the field investigation attested to a healthy, functioning ecosystem on the microhabitat as well as source-sink population dynamics scales. A total of 12 butterflies were observed in the study area; most of these species are common and widespread; if not in Southern Africa then in the drier western regions of the subcontinent. It is highly likely that many other species will complement the observed assemblage of butterflies should the study be repeated in early summer (the only flight time of some Lepidoptera groups, notably Lycaenidae). The drier western regions of South Africa have significantly fewer butterflies than the wetter east; consequently, the number of species observed during the field survey (given timing of the survey as well geographic location of the study area) confirms the untransformed and unfragmented nature of the study area.

Two invertebrate species of conservation concern (that have not yet been observed) could potentially occur within the study area, these and their likelihood of presence based on habitat suitability are summarised in Table 22 below.

Table 22: Butterfly species of conservation concern recorded in the region of the study area[35]

Species	Common name	Conservation Status (IUCN)	Comment, PoO
Alfredectes browni	Brown's Shieldback	DD	**Possible** – This katydid species is understudied, being known only from three specimens, but occurs in a wide range of habitats from grasses along highly disturbed roadsides, to low trees, to high elevation fynbos vegetation so could occur within the study area
Lepidochrysops penningtoni	Pennington's Blue	DD	Unlikely – Considerable uncertainty exists around this species' taxonomy and distribution and it is likely that the species will fall into the category of Least Concern with further information as it occupies remote habitats and does not face any major threats. Its strongly seasonal appearance has probably led to it being under-recorded It is thought to be endemic to the Northern Cape; however, it prefers vegetation consisting of *Mesembryanthemum* species and other low shrubs (succulent Karoo) which has not been recorded within the study area

5.8.2 Amphibians

No amphibian species have been recorded within the study area or in the immediate surrounds of the study site. Taking cognisance of the absence of surface water within the proposed development footprint, it is regarded unlikely that any of these species will occur on site; however, some frog species are expected to occur in the vicinity of the abstraction point in the Orange River.

5.8.3 Reptiles

Seven reptile species were observed during the previous baseline fieldwork in 2010, confirmed species (Southern Rock Agama, Cape Cobra, Common Barking Gecko, Spotted Sand Lizard, Striped Skink, Serrated-tent Tortoise and Puff Adder) as well as other species whose distributions overlap with the study area and therefore could potentially occur.

5.8.4 Mammals

A total of fifty-one (51) mammal species are considered potentially occupants of the study area. Fourteen (14) of these have been confirmed during field studies. These and details of their conservation status/ level of protection afforded to them are listed in Table 15 of the Biodiversity Assessment – ***Appendix B5***; species that have been confirmed present during fieldwork are provided in Table 23 below.

[35] *Bathusi Environmental Consulting. 2010. Biodiversity Impact Assessment for the proposed Concentrated Solar Thermal Power Plant (Siyanda District, Northern Cape Province) on a portion of the Farm Bokpoort 390.*

Table 23: Confirmed mammal taxa in the region

Scientific Name	Common Name	Conservation Status		
		IUCN - Regional status	NEMBA TOPS List	Northern Cape NCA
Canis mesomelas	Black-backed Jackal			
Otocyon megalotis	Bat-eared Fox		Protected	Specially Protected
Caracal caracal	Caracal			
Atilax paludinosus	Water Mongoose			Protected
Cynictis penicillata	Yellow Mongoose			Protected
Galerella sanguinea	Slender Mongoose			Protected
Hystrix africaeaustralis	Porcupine			
Lepus capensis	Cape Hare			Protected
Lepus saxatilis	Scrub Hare			Protected
Ictonyx striatus	Striped Polecat	Data Deficient		Specially Protected
Mellivora capensis	Honey Badger	Near Threatened		Specially Protected
Orycteropus afer	Aardvark		Protected	
Pedetes capensis	Springhare			

5.9 Avifauna

5.9.1 Bird Microhabitats

The site visit in December 2019 confirmed that the main vegetation types and avifaunal micro-habitats that were originally identified in the initial avifaunal impact assessment report[36] remain largely unchanged. The micro-habitats include scattered kraals, reservoirs and associated water troughs for livestock farming, thornveld/scrubland, open grassy scrubland, gravel plains, and duneveld.

5.9.2 Avifaunal Community

The initial Bird Impact Assessment Report[37] detailed the locations of three Verreaux's Eagle and one Martial Eagle nests (Figure 21). These sites were revisited by the avifaunal specialist in December 2019 to confirm their status. The three Verreaux's Eagle nests are close together and located approximately 4 km to the east of the project site and represent a primary nest and two alternative nests from a pair of Verreaux's Eagle. The pair of Verreaux's Eagle were observed perched next to the identified nesting site and these nests can be considered to still be active.

The Martial Eagle nest located approximately 1.55 km from the project site appeared to no longer be active during the December 2019 site visit. In 2015, the nest consisted of a stick structure placed on top of a sociable weaver nest in a transmission line tower with a lot of white-wash below. During the December 2019 site visit almost no stick structure remained, no new sticks had been added and significantly less white-wash was present below, therefore it appeared as if the nest had not been re-used for a few seasons. Martial

[36] *Pearson, A. 2016. Avifaunal Impact Assessment Report: Bokpoort II Solar Farm.*
[37] *Ibid 34*

Eagles exhibit strong fidelity to nesting sites[38] but a breeding pair may alternate breeding attempts between multiple nests in their breeding territory[39], which range in size from 100 – 800 km^2 in South Africa[40]. Martial Eagle was not recorded in the project area over three months of monitoring by Jeal[41], nor has it been recorded in the project area or immediate surrounds by the SABAP2 project. The project area therefore many not constitute an important foraging area for these birds.

[38] *Herholdt, J.J., Mendelsohn J.M. 1995. Survival and nest-site fidelity in the Martial Eagle in the Kalahari Gemsbok National Park, South Africa. J. Afr. Raptor Biol. 10:33-34.*

[39] *Machange, R.W., A.R. Jenkins, and Navarro, R.A. 2005. Eagles as indicators of ecosystem health: is the distribution of Martial Eagle nests in the Karoo, South Africa, influenced by variations in land-use and rangeland quality? Journal of Arid Environments 63(1): 223 – 243.*

[40] *Hockey, P.A.R., Dean, W.R.J. and Ryan, P.G. (eds). 2005. Roberts - Birds of southern Africa, VIIth ed. The Trustees of the John Voelcker Bird Book Fund, Cape Town.*

[41] *Jeal, C. 2017. The impact of a 'trough' Concentrated Solar Power facility on birds and other animals in the Northern Cape, South Africa. Percy FitzPatrick Institute of African Ornithology, University of Cape Town. MSc. Thesis.*

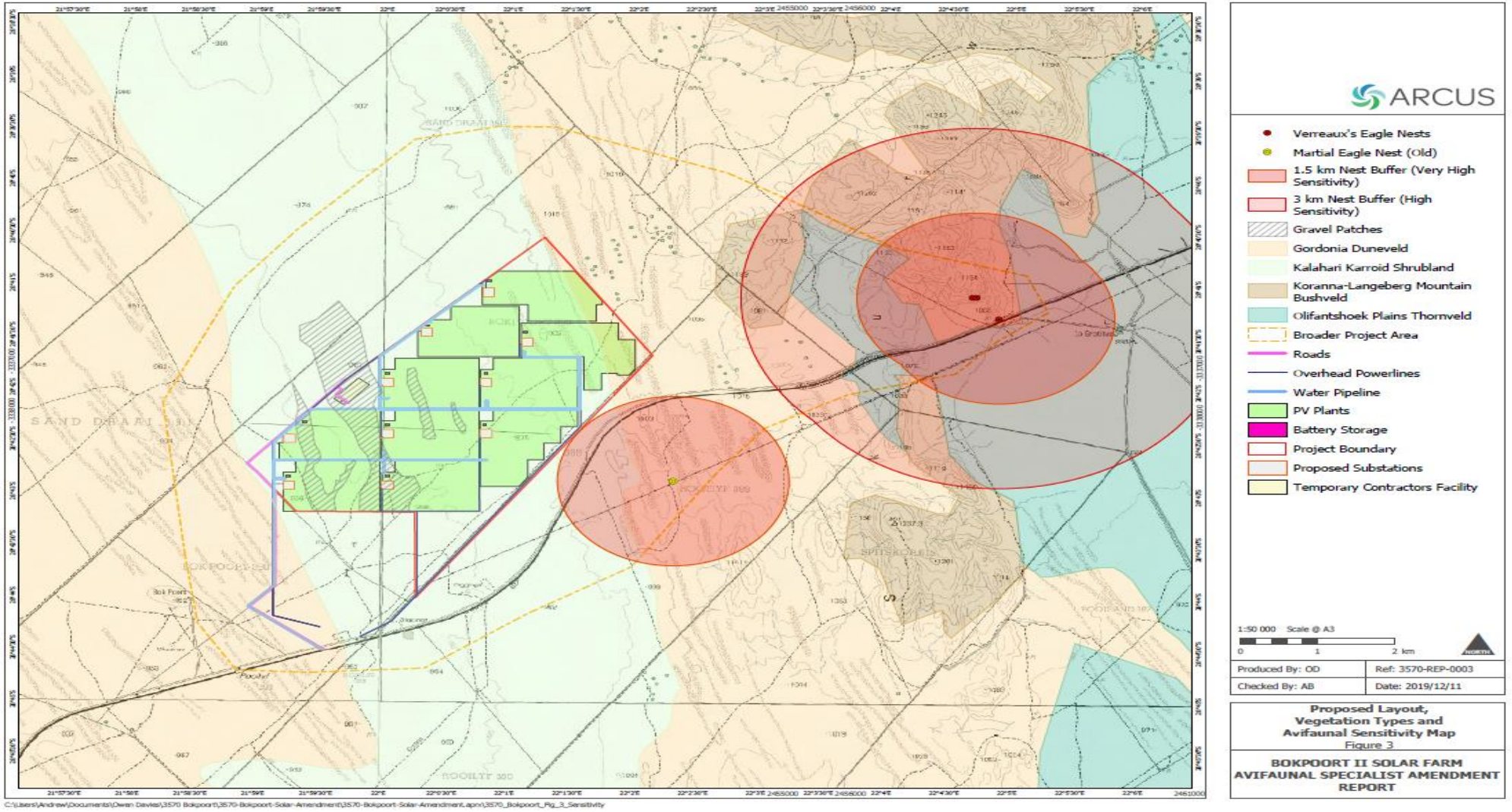


Figure 21: Locations of three Verreaux's Eagle and one Martial Eagle nests

5.9.3 Avifaunal Sensitivity Zones

5.9.3.1 High Sensitivity Zones

High sensitivity zones were related to the identified eagle nest sites in the broader study area. These include a 3 km circular area around the Verreaux's Eagle primary and alternative nest sites and a 1.5 km circular area around the previously used, but currently inactive Martial Eagle nest site. As some areas within these buffers are already altered and disturbed (e.g. by existing transmission lines, roads and a major railway line), other project infrastructure (e.g. PV panels, battery storage, pipelines and power lines) are allowed within the buffer areas if all the mitigations recommended are implemented.

5.9.3.2 Medium Sensitivity Zones

Medium Sensitivity Zones are areas identified on the project site that are currently important for avifauna, and/ or support important species and/or support high abundances of birds at certain times. Two such types of zones were identified associated with gravel plains (which support important species such as coursers and bustards) and artificial water points. These areas are not sufficiently sensitive so as to preclude development and it is understood that should the project proceed these areas within the project site will be completely destroyed/removed. This has been taken into account when conducting the impact assessment for habitat destruction and disturbance.

5.9.3.3 Undetermined Sensitivity Zones

Undetermined Sensitivity Zones are all the remaining areas of the project site not buffered in Figure 21 or related to the features discussed above. These areas show no obvious avifaunal features, patterns or sensitivities and are preferred for infrastructure placement. However, considering the general avifauna of the area and broader project area, it is likely that these zones are in fact of moderate sensitivity.

5.10 Bats

To date, there is little empirical data and very few peer reviewed experimental studies that have investigated the impacts of solar facilities on bats. Studies concerning landscape-scale impacts are also not available.

Under laboratory conditions, bats demonstrated drinking behaviour over smooth artificial plates as they confused these surfaces with water sources[42]. This raised the concern of a risk of bats colliding with smooth PV panels as they may confuse it with water, possibly causing injuries and/ or fatalities. Greif *et al.*[43] investigated how bats interact with smooth vertical and horizontal surfaces. They confirmed the drinking behaviour over smooth horizontal surfaces and found bats mistake smooth vertical surfaces for open flight paths resulting in collision. The risk of injury or fatality by collision was thus with vertical surfaces rather than horizontal. Collision of bats with solar panels has not been investigated and is not confirmed. Given that PV arrays are typically tilted and not oriented vertically, risk of collision with PV panels cannot be inferred from these studies and is typically assumed to be low[44].

Additionally, a field experiment recorded bats leaving an area with artificial surfaces when they learnt after a few attempts that drinking from the surfaces was not possible[45]. If there in fact is a risk of collision, over time bats should learn that PV panels are not water sources and search elsewhere for water. With enough time, collision risk should then be reduced to zero.

[42] *Greif, S. & Siemers, B. M. (2010). Innate recognition of water bodies in echolocating bats. Nature Communications, 2(1), 107.*
[43] *Greif, S., Zsebok, S., Schmieder, D., & Siemers, B. M. (2017). Acoustic mirrors as sensory traps for bats. Science, 357, 1045-1047.*
[44] *Taylor, R., Conway, J., Gabb, O., & Gillespie, J. (2019). Potential impacts of ground-mounted photovoltaic solar panels. BSG Ecology. Accessed from https://www.bsg-ecology.com/potential-ecological-impacts-ground-mounted-photovoltaic-solar-panels-uk/*
[45] *Russo, D., Cistrone, L., & Jones, G. (2012). Sensory ecology of water detection by bats: a field experiment. PLoS ONE, 7(10), e48144.*

PV panels reflect horizontally polarized light and attract polarotactic insects (insects attracted to polarized light) as they perceive the panels to be water sources used for breeding purposes[46]. It may be assumed that the attraction of insects to PV panels would in turn attract insectivorous bats to forage around the panels (Harrison et al. 2017). However, there is no evidence to confirm the attraction of bats to the panels or collision by bats while foraging in the area of a PV facility.

PV panels are also more absorptive than reflective of sunlight, therefore, there is a risk of heat related injuries or fatalities associated with CSP technology that is less applicable to PV panels[47]. The South African Bat Assessment Association (SABAA) website notes that bat fatalities have occurred at CSP facilities in South Africa (no further information of cause or location is provided) and mentions there to be no evidence that PV farms constructed on the ground in fields pose a direct fatality risk to bats.

Drewitt and Langston[48] identified habitat loss/ fragmentation, disturbance, displacement and barrier effect as negative impacts of both CSP and PV developments on avifauna. These impacts are also applicable to bats. The development footprint of the proposed amendment remains the same as was previously approved. Thus, the impact of habitat loss, disturbance, displacement and barrier effect remain the same, irrespective of the technology, as when the development was granted authorisation.

Three bat species were confirmed *via* active monitoring conducted in 2015[49] [50] and some unidentified species were also detected. The confirmed species and those expected to occur within the region are listed in Table 24. The African straw-coloured fruit bat (Eidolon helvum) was not included in the table of bat species potentially occurring within the study area of the previous BA reports. According to the Bat Study ***(Appendix B7)*** it has been recorded within the central plateaus of South Africa and the site is located within this species modelled distribution range as per Monadjem et al. (2010)[51]. This omission does not influence the impact assessment as a result of the additional scope of this BA.

[46] *Horvath, G., Blaho, M., Egri, A., Kriska, G., Seres, I., & Robertson, B. (2010). Reducing the maladaptive attractiveness of solar panels to polarotactic insects. Conservation Biology, 24(6), 1644-1653.*
[47] *Pimentel, D., Rodrigues, G., Wang, T., Abrams, R., Goldberg, K., Staeker, H., Ma, E… Boerke, S. (1994). Renewable energy: economic and environmental issues. BioScience, 44, 536-547.*
[48] *Drewitt, A. L. & Langston, R. H.W. (2006). Assessing the impacts of wind farms on birds. Ibis, 148, 29-42.*
[49] *Schlechter, M., & Baxter, B. 2016. Final EIA Report: Proposed 75MW Photovoltaic (PV1) Solar Development on the Remaining Extent of the Farm Bokpoort 390, Northern Cape. Golder Associates. Ref 14/12/16/3/3/2/881.*
[50] *Schlechter, M., & Baxter, B. 2016. Final EIA Report: Proposed 75MW Photovoltaic (PV2) Solar Development on the Remaining Extent of the Farm Bokpoort 390, Northern Cape. Golder Associates. Ref 14/12/16/3/3/2/880.*
[51] *Monadjem, A., Taylor, P. J., Cotterill, F. P. D., & Schoeman, M. C. (2010). Bats of southern and central Africa: a biogeographic and taxonomic synthesis. Johannesburg, SA: Wits University Press.*

Table 24: Bat species confirmed and potentially occurring within the project area

Species	Common Name	Likelihood of occurrence	Conservation Status	Possible roosting habitat on site
Sauromys petrophilus	Roberts's flat-headed bat	**Confirmed**	Least Concern	Roosts in narrow cracks and under slabs of exfoliating rock. Closely associated with rocky habitats. May be roosting in the Koranna-Langeberg Mountain Bushveld
Tadarida aegyptiaca	Egyptian free-tailed bat	**Confirmed**	Least Concern	Roosts during the day in rock crevices, under exfoliating rocks. May be roosting in the Koranna-Langeberg Mountain Bushveld
Cistugo seabrae	Angolan wing-gland bat	Possible	Near Threatened	It is restricted to the arid western parts of southern Africa, typically in desert and semi-desert conditions. Not a common bat
Eptesicus hottentotus	Long-tailed serotine	Possible	Least Concern	It is a crevice dweller roosting in rock crevices, expansion joints in bridges and road culverts
Neoromicia capensis	Cape serotine	**Confirmed**	Least Concern	Roosts under the bark of trees, and inside the roofs of buildings. The Olifantshoek Plains Thornveld may offer such roosting space.

5.11 Surface Water[52&53]

The PV Development projects is situated in the Lower Orange Main Stem Catchment (116539) (Figure 22), the largest river in a South African Context. The site is thus located in the Orange River Water Management Area (WMA).

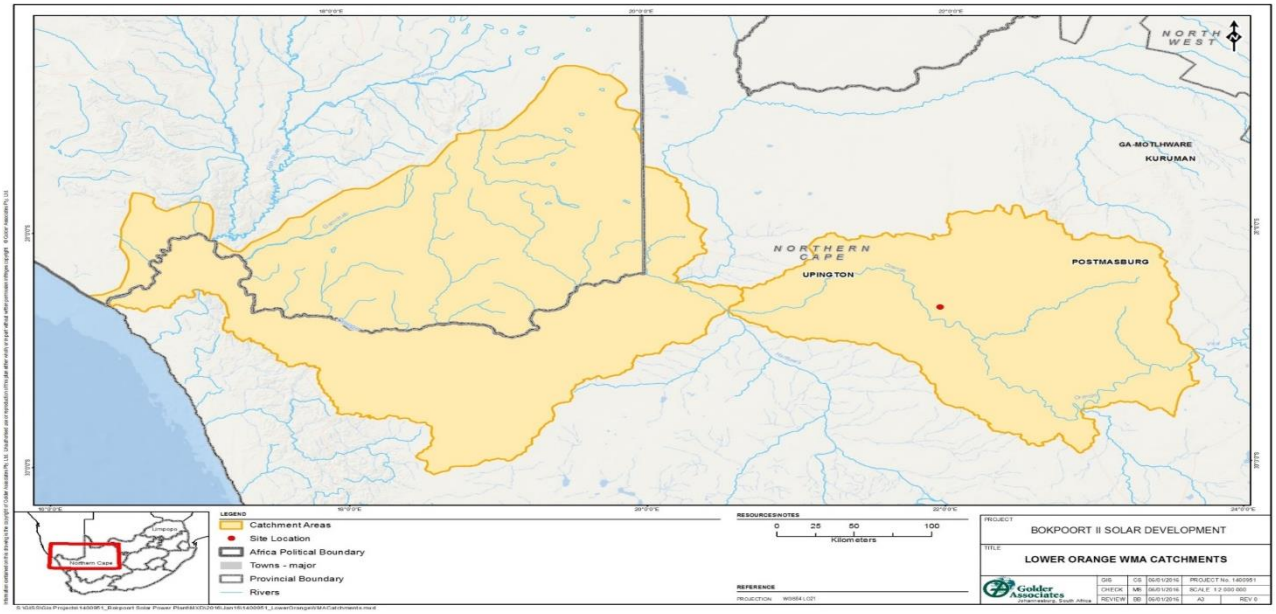


Figure 22: Lower Orange Main Stem catchment area

[52] *Dateling, J; Boyd, L. 2016. Surface Water Baseline and Impact Assessment Report for the Proposed 75 MW PV1 Solar Facility (Proposed Bokpoort II Solar Development) near Groblershoop, Northern Cape. Golder Associates, Report No.: 1400951-300592-9*
[53] *Dateling, J; Boyd, L. 2016. Surface Water Baseline and Impact Assessment Report for the Proposed 75 MW PV2 Solar Facility (Proposed Bokpoort II Solar Development) near Groblershoop, Northern Cape. Golder Associates, Report No.: 1400951-300593-10*

5.11.1 Water Quality

There are two Department of Water and Sanitation (now Department of Human Settlements, Water and Sanitation) monitoring points in the Orange River: D7H8, upstream of the site and D7H5, downstream of the site at Upington. The water quality at both points is good when compared against the interim Resource Water Quality Objectives (RWQOs) developed as part of the Water Resources Planning project for the Upper and Lower Orange River in 2009. The water is however slightly alkaline, and nitrate and orthophosphate exceed the limits set which would lead to eutrophication in the river. The water quality requirement for the proposed project may however be stricter than that abstracted so that some kind of treatment may still be needed.

Table 25: Water quality in the Orange River at DHSW&S monitoring points compared against the interim RWQOs

Parameter	Units	Interim RWQO*	Upstream (D7H8)			Downstream (D7H5)		
			5	50	95	5	50	95
pH		7.1-8.4	7.26	8.13	8.55	7.19	8.14	8.45
Electrical Conductivity	mS/m	70	18.47	26.40	47.64	21.10	32.30	55.83
Total Dissolved Solids	mg/L	400	145.00	197.22	317.46	151.95	228.00	374.19
Calcium	mg/L	80	18.50	23.70	33.75	19.24	25.71	35.69
Chloride	mg/L	100	5.00	13.49	40.93	7.68	17.85	48.09
Fluoride	mg/L	0.7	0.12	0.20	0.34	0.16	0.23	0.41
Potassium	mg/L	15	1.26	1.92	4.26	1.40	2.24	4.29
Magnesium	mg/L	30	6.87	9.70	16.89	7.26	11.40	20.67
Sodium	mg/L	70	7.20	13.50	33.44	9.44	18.10	44.14
Ammonia	mg/L	0.015	0.02	0.04	0.12	0.02	0.03	0.11
Nitrate	mg/L	0.2	0.02	0.24	0.67	0.02	0.18	0.81
Orthophosphate	mg/L	0.02	0.01	0.02	0.06	0.01	0.02	0.08
Silica	mg/L	20	3.22	6.80	8.55	2.60	6.71	8.63
Sulphate	mg/L	80	7.21	20.10	59.61	8.60	23.90	64.65
Total Alkalinity	mg/L	300	73.70	92.20	113.76	70.47	104.70	139.27

*the stricter of the RWQOs set at the two points has been chosen

The Orange River's water quality is categorised as Moderately Transformed (Class C) due to existing agricultural activities along the river banks. The Orange River's major inflow of water is from the Vaal River which has high nutrient levels which sometimes result in algal blooms. Slow water flow rates also cause siltation and turbidity of the water which leads to water quality degradation within the river.

5.11.2 Aquatic Ecosystems

The site is located within the D73D quarternary catchment. This catchment is comprised of a reach of the lower Orange River from Kheis (near Groblershoop) at its upstream end to Lambrechtsdrift (located between Groblershoop and Upington) at its downstream end, as well as a number of ephemeral / episodic watercourses that form tributaries of the Orange. The DHSWS WRiall500 rivers database shows no significant drainage in the vicinity of the development site, with only one watercourse to the east of the Orange River.

When the study area drainage context is examined, a large-scale absence of drainage features in parts of the wider study area is present. Apart from the Orange which is a large regional river, drainage is largely limited to the wider Orange River valley, especially in the areas to the north and east of the river (in which the study area is located). Drainage only occurs within an area of about 4.5km of the river channel, an area which is largely characterised by rugged, incised topography, beyond this corridor no or very limited drainage occurs. Limited surface water drainage occurs in areas characterised by higher-lying, rockier terrain, such as the mountainous terrain (Skurweberg Hills) located to the east and north-east of the site.

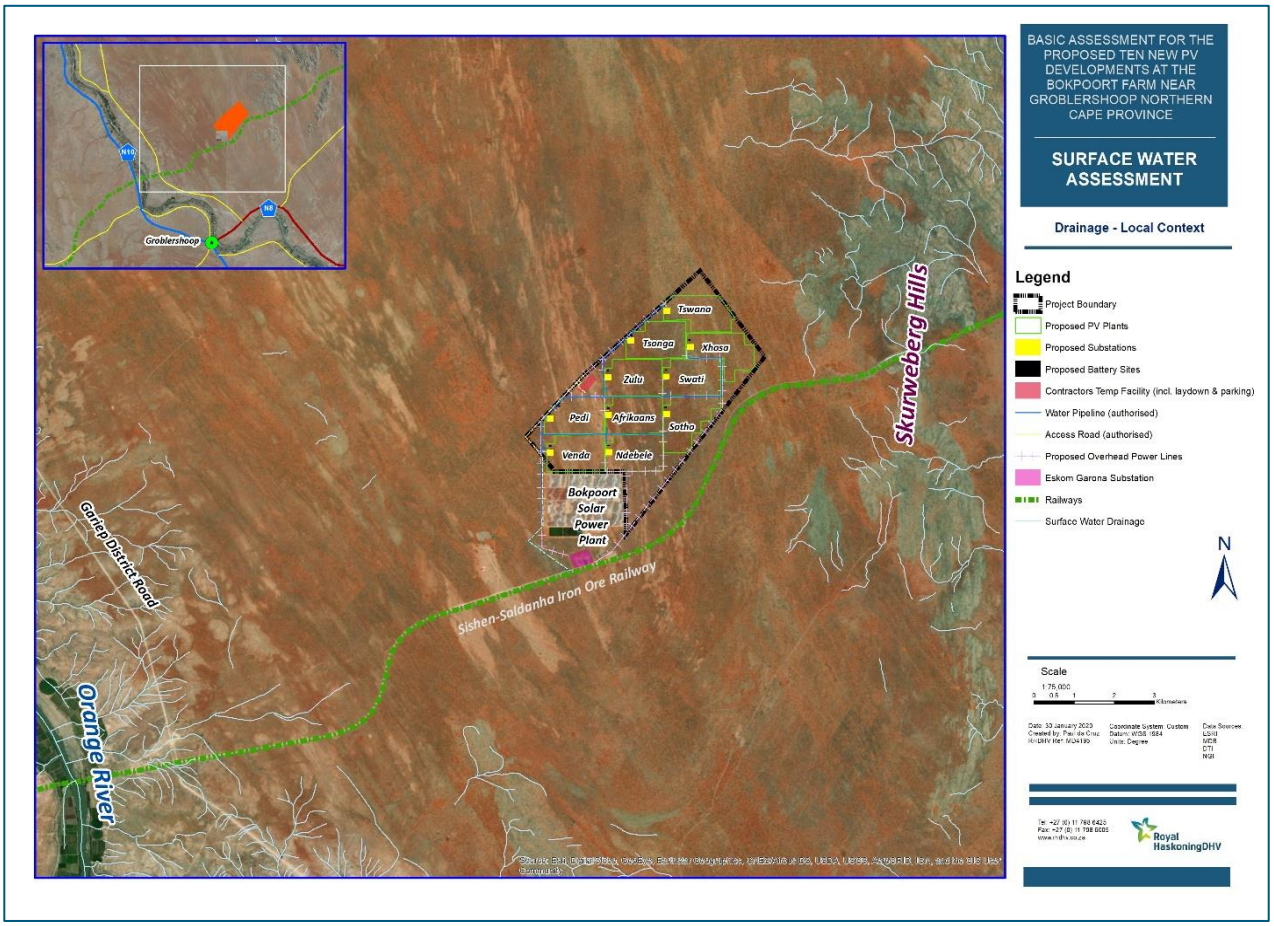


Figure 23: Local Drainage Context

The 1:50,000 scale topo-cadastral maps indicate that there are no drainage or surface water features on the development site. A site visit confirmed that no surface water features are located on the site of the proposed development. Of the two primary landforms located on the development site, the calcrete gravel plains are extremely flat, with no linear surface water drainage features present. Pans can occur in such very flat terrain where no linear drainage occurs, but there are no pans that occur on the site.

The closest surface water features to the development site are located 900 m – 1 km to the east and north-east of the development site's north-eastern boundary where the underlying geology changes and a concomitant change in topography from Duneveld to rocky hills is encountered.

5.12 Groundwater

5.12.1 Geology and Hydrogeological Setting

The general geology of the site mainly comprises red-brown, coarse-grained granite gneiss; and quartz-muscovite schists, quartzite, quartz-amphibole schists and greenstones of the Groblershoop formation, Brulpan group. Calcrete is also found especially on the south eastern part of the area.

The aquifer vulnerability and classification maps of South Africa classifies this area as underlain by a least vulnerability, this means that this aquifer is only vulnerable to conservative pollutants in the long term when continuously discharged or leached[54]. The metamorphic rocks represent fracted aquifer types with a moderately-yielding aquifer system of variable water quality.

5.12.2 Hydrocensus

Previously, during April 2010, GCS conducted a hydrocensus. The aim of this hydrocensus survey was to establish the extent of groundwater usage in the area. During this hydrocensus seven (7) boreholes were located. From the hydrocensus survey conducted in April 2010 it was established that the communities living on the farms rely on municipal water for domestic water supply and the farms located in proximity to the Orange River use water from the Orange River for water supply. Groundwater is utilised in farms located further away from the Orange River. Groundwater abstraction on the farms are mainly used for domestic purpose and animal (cattle and sheep) farming. Most of the boreholes were equipped with windmills and therefore no water level measurements could be taken. The water quality indicated pH ranging from 7.36 to 8.06; and the total dissolved solids (TDS) ranging from 420 to 490 mg/l.

During the hydrocensus conducted in November 2019, five (5) boreholes were identified within a ~4 km radius of the study area and an additional borehole was located approximately 10 km from the study area and was included in the hydrocensus. Therefore, in total six (6) hydrocensus boreholes were identified, of which three (3) were accessible for groundwater level measurements. The results of the hydrocensus is summarised in Table 26 and the spatial distribution with respect to the study area is shown in Figure 24. Borehole Bok BH3 previously had a submersible pump installed and was utilized for domestic water supply for farm owner's house and farm village workers but this borehole is now dry. Similarly, borehole Bok BH6 previously had a windmill installed and was utilized for livestock watering but this borehole is now dry. Boreholes Bok BH1 and Bok BH2 are used for monitoring purposes around the evaporation ponds of the operational CSP.

[54] *Department of Water and Sanitation (DWS) (2013). Aquifer Vulnerability Map of South Africa.*

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Table 26: Hydrocensus data collected during November 2019

Locality ID	Latitude	Longitude	Surface Elevation	Borehole Status	Pump Type	Water Use Application	Collar Height	Groundwater Level (mbch)	Groundwater Elevation (m amsl)
Bok BH1	-28.73413	21.98887	960	Monitoring Borehole	-	Other	0.65	27.9	931.45
Bok BH2	-28.73262	21.98705	953	Monitoring Borehole	-	Other	0	25.65	927.35
Bok BH3	-28.73661	21.97039	944	Not Operational	-	-	Dry		
Bok BH4	-28.71334	22.00186	953	Not Equipped	-	-	0.15	38.55	914.3
Bok BH5	-28.71084	21.99989	958	Operational	Windmill	Stock	Not measured		
Bok BH6	-28.76924	21.93739	890	Not Operational	-	-	Dry		

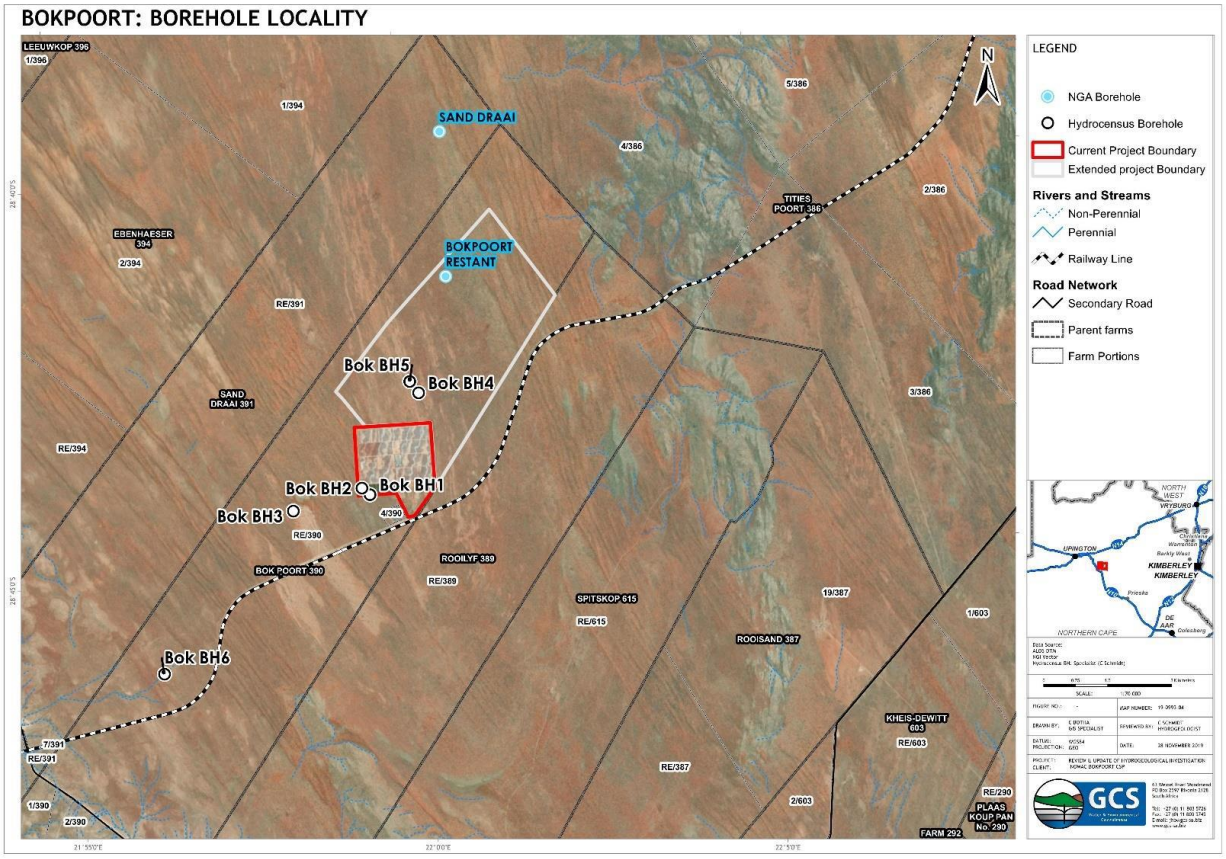

Figure 24: Borehole locality map

Similar to the hydrocensus conducted during April 2010, the November 2019 hydrocensus survey indicated that groundwater is mainly used for small-scale livestock watering purposes (goat and sheep farming).

5.12.3 Groundwater Level and Flow

Groundwater elevation recorded during the 2019 hydrocensus survey range between ~914 and ~931 m above mean sea level (m amsl), with depth to water varying from ~25 m below ground level (m bgl) and ~38 m bgl.

From the hydrocensus survey measured water level data, a correlation of ~ 68% exists between the topography and groundwater elevation (Figure 25). The relatively poor correlation is likely depictive of two (2) distinctive aquifer systems (the upper weathered aquifer and the deeper fractured aquifer).

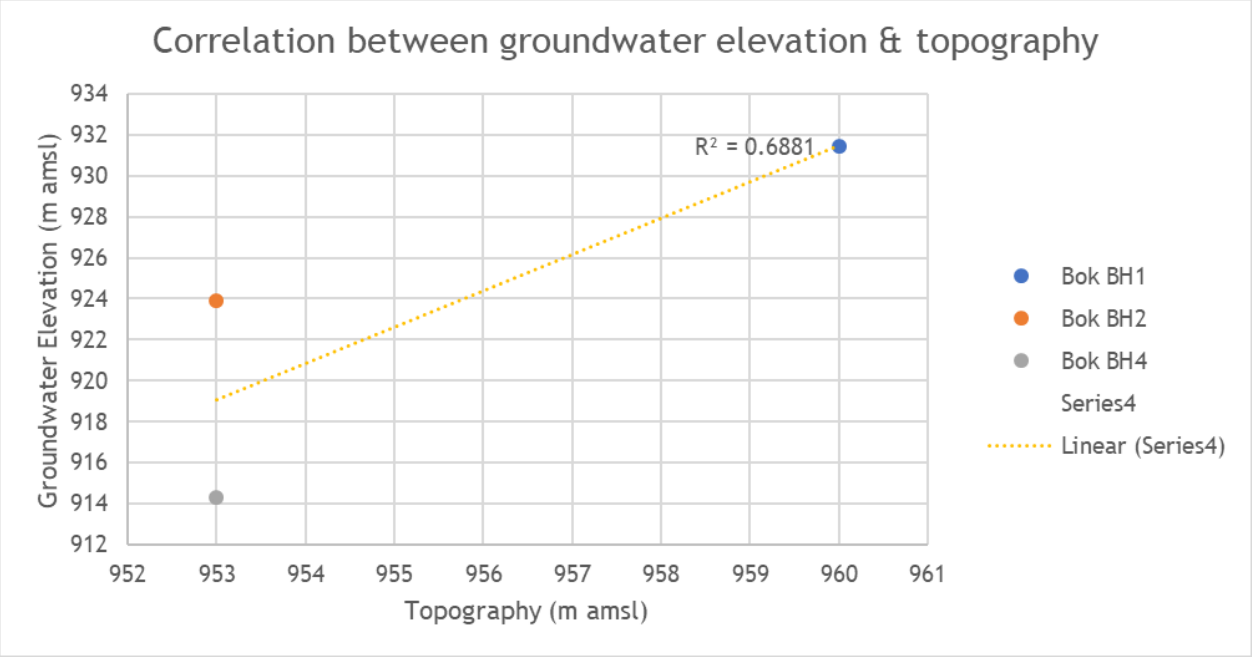

Figure 25: Topography and groundwater head correlation

5.12.4 National Groundwater Archives and National Register of Water Use Databases

The National Groundwater Archive (NGA) and National Register of Water Use (WARMS) was accessed to obtain any existing groundwater data. Within a 5 km radius of the study area two (2) boreholes within the NGA were found, however, no registered boreholes on the WARMS database were found. Limited information for the two (2) NGA boreholes is available.

5.12.5 Groundwater Quality

Summary of the groundwater quality results are presented in Table 6-1 of ***Appendix B2***; while the laboratory certificates of analyses are presented in ***Appendix B2***. Boreholes Bok BH1 and Bok BH2 indicate water with neutral pH, electrical conductivity (EC) ranging from ~67 to ~105 mS/m, total hardness ranging from hard to very hard and low manganese concertation were recorded. Borehole Bok BH3 indicate very hard water with neutral pH, elevated EC and total dissolved solids (TDS), elevated nitrate concentration and low chromium concentration was recorded.

5.12.6 Hydrogeological Characterisation

The following water types are observed in and surrounding study area (Figure 26):

- Sample sites Bok BH1 and BH2 indicate predominantly Ca-Mg-HCO_3 type water; and
- Sample site Bok BH3 indicate predominantly Ca-Mg-Cl type water.

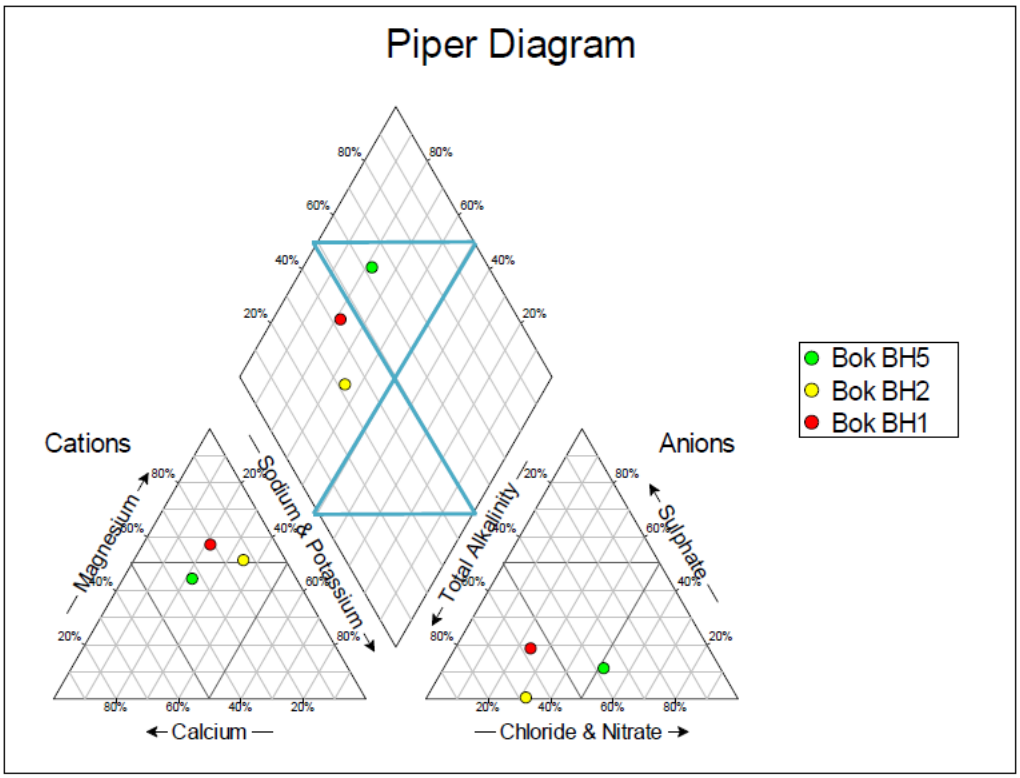

Figure 26: Piper diagram

5.12.7 Groundwater Quality Compared to Water Criteria Guidelines/ Standards

Groundwater in the area is mostly used for livestock watering and is therefore compared to the Department of Water Affairs (DWA) South African Water Quality Guidelines Volume 5 for Livestock Watering Use[55]. Additionally, the water quality will also be compared to the Department of Water Affairs (DWA) South African Water Quality Guidelines Volume 1 for Domestic Use[56] and South African Bureau of Standards (SABS) SANS 241-1:2011 Drinking Water Standards.

Comparison of the groundwater quality to the relevant guidelines is summarized in Table 27 (Livestock Watering Use) and Table 28 (Drinking/ Domestic Use).

[55] *Department of Water Affairs and Forestry. 1996. South African Water Quality Guidelines (second edition). Volume 4: Agricultural Use: Irrigation.*
[56] *Department of Water Affairs and Forestry. 1996. South African Water Quality Guidelines: Domestic Uses.*

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Table 27: Livestock watering use compliance and risk status

Sample ID	Compliance Status				Livestock Health Risk Status
	General Parameters	Anions	Nitrogen-species	Cations and metals	
Bok BH1	Yes	Yes	Yes	Yes	None: based on all parameters analysed, the water adheres to SAWQG Target Values for Livestock watering
Bok BH2	Yes	Yes	Yes	Yes	
Bok BH3	Yes	Yes	Yes	Yes	

Note: Red indicates an exceedance of the DWA SAWQG Target Value for Livestock Watering use

Table 28: Drinking/ domestic use compliance and risk status

Sample ID	Compliance Status				Risk Status	
	General Parameters	Anions	Nitrogen-species	Cations and metals	Health	Aesthetic
Bok BH1	No (TDS, turbidity)	Yes	Yes	No (Ca and Mn)	TDS, Ca and Mn: No health effects are likely Turbidity: Water carries an associated risk of disease due to infectious disease agents and chemicals adsorbed onto particulate matter	TDS: Water has a noticeable salty taste but is well tolerated No effects on plumbing or appliances Turbidity: Severe aesthetic effects (appearance, taste and odour) Ca: No health effects. Increased scaling problems Lathering of soap impaired Mn: Threshold for significant staining and taste problems
Bok BH2	No (turbidity)	Yes	Yes	No (Mn)	Mn: No health effects are likely. Turbidity: Water carries an associated risk of disease due to infectious disease agents and chemicals adsorbed onto particulate matter.	Mn: Increasingly severe staining and taste problems. Turbidity: Severe aesthetic effects (appearance, taste and odour).
Bok BH3	No (EC, TDS and turbidity)	No (Cl)	No (Nitrate as N and as NO3)	No (Ca and total Cr)	TDS/EC: Consumption of water does not appear to produce adverse health effects in the short term Turbidity: Water carries an associated risk of disease due to infectious disease agents and chemicals adsorbed onto particulate matter Cl and Ca: No health effects Nitrate as N: Methaemoglobinaemia occurs in infants. Occurrence	TDS/EC: Water has a marked, salty taste and some effects on plumbing and appliances, such as Increased corrosion or scaling, may be Expected Turbidity: Severe aesthetic effects (appearance, taste and odour) Cl: Water has a distinctly salty taste Likelihood of noticeable increase in corrosion rates in domestic appliances

Sample ID	Compliance Status				Risk Status	
	General Parameters	Anions	Nitrogen-species	Cations and metals	Health	Aesthetic
					of mucous membrane irritation in adults Cr: Danger of kidney damage with long-term exposure. Brief exposure, for less than one week should not cause any noticeable damage. Exposure should not exceed one week	Ca: Severe scaling problems Lathering of soap severely impaired

Note: Red indicates an exceedance of the SANS 241:2011 and/ or DWA SAWQG Target Value for Domestic Use

5.13 Heritage

5.13.1 Stone Age

Stone Age lithics dating to the Middle Stone Age are found only as low-density surface scatters, which is confirmed by similar findings in the larger region by other researchers[57] [58] [59] [60] [61]. They are commonly found on the pebble plains where source material is readily available. The density of artefacts is less than 1/50 m^2. The tools are mostly made from banded iron stone (jaspelite), although some quartzite and hardened shale flakes were also noted. Cores, flakes and tools are found. The tools are very rough and informal and only a few that can be described as typical, i.e. blades and scrapers, were identified.

The low density of the lithic scatters is, on archaeological grounds, viewed to be of low significance and require no further action.

[57] *Dreyer, C. 2014. First phase archaeological and heritage investigation of the proposed PV energy developments at the farm Sanddraai 391 near Groblershoop, Northern Cape Province. Bloemfontein: Unpublished report.*

[58] *Dreyer, C. 2015. First phase archaeological and heritage impact assessment of the proposed Bokpoort II 300MW combined 2 x 75 PV and 150 MW CSP Tower Solar development on the remainder of the farm Bokpoort 390, Groblershoop, Northern Cape Province. Bloemfontein: Unpublished report.*

[59] *Morris, D. 2014b. Proposed Kheis Solar Park Phases 1-3 on Portions 7 and 9 of the Farm Namakwari 656 and east of Grootdrink in Northern Cape: Heritage Impact Assessment. Kimberley: Unpublished report.*

[60] *Van der Walt, J. 2015. Archaeological impact assessment for the proposed Grootsrink Solar PV facility east of Upington, Northern Cape Province. Unpublished report.*

[61] *Van Schalkwyk, J.A. 2019. Phase 1 Cultural Heritage Impact Assessment: prospecting right application with bulk sampling on various portions of the farms Zonderhuis 402, Onder Plaats 401 and Namakwari 656, Siyanda District Municipality, Northern Cape Province. Pretoria: Unpublished report 2019/JvS/102.*

Photograph 4: Some identified tools and flakes

5.13.2 Iron Age

No sites, features or objects of cultural significance dating to the Iron Age were identified in the study area.

5.13.3 Historic period

Apart from current farming related features such as water troughs, no sites, features or objects of cultural significance dating to the historic period were identified in the study area.

5.14 Palaeontology

The Precambrian metamorphic and igneous basement rocks of the Namaqua-Natal Metamorphic Province in the study area are entirely unfossiliferous[62]and therefore not assessed further.

Late Caenozoic calcretes of the Kalahari Group may contain trace fossils such as rhizoliths, termite and other insect burrows, or even mammalian trackways. Mammalian bones, teeth and horn cores (also tortoise remains, and fish, amphibian or even crocodiles in wetter depositional settings) may be occasionally expected within Kalahari Group sediments and calcretes, notably those associated with ancient alluvial gravels and pans[63]. However, these fossil assemblages are generally sparse, low in diversity, and occur over a wide geographic area, so the palaeontological sensitivity of the calcretes within the study region is rated as low. This applies equally to the thin veneer of other surface deposits (rocky scree, stream alluvium etc) within this highly-arid region.

Alluvial gravels of the Orange River of Miocene and younger age are locally highly fossiliferous[64] [65] [66] [67] and extensive references therein) but, these are not mapped within the study area. Younger silty alluvial deposits may contain a range of terrestrial and freshwater fossils and subfossils. Freshwater snails are mentioned in

[62] *Almond, J.E. and Pether, J. 2008. Palaeontological heritage of the Northern Cape. Interim SAHRA technical report, 124 pp. Natura Viva cc, Cape Town.*
[63] *Almond, J.E. 2008. Fossil record of the Loeriesfontein sheet area (1: 250 000 geological sheet 3018). Unpublished report for the Council for Geoscience, Pretoria, 32 pp. Natura Viva cc, Cape Town.*
[64] *Hendey, Q.B. 1984. Southern African late Tertiary vertebrates. In: Klein, R.G. (Ed.) Southern African prehistory and paleoenvironments, pp 81-106. Balkema, Rotterdam.*
[65] *Schneider, G. & Marais, C. 2004. Passage through time – the fossils of Namibia. 159 pp. Gamsberg MacMillan, Windhoek.*
[66] *Ibid Footnote 63*
[67] *Almond, J.E. 2009. Contributions to the palaeontology and stratigraphy of the Alexander Bay sheet area (1: 250 000 geological sheet 2816), 117 pp. Unpublished report for the Council for Geoscience. Natura Viva cc, Cape Town.*

particular by Moen[68] (2007). Stream gravels close to the west bank of the Orange River in the Groblershoop area were examined without success for palaeontological remains by Almond (2012)[69].

5.15 Traffic

5.15.1 Access to Site

Access to the proposed site is *via* a private Transnet Service Road (gravel), running adjacent to the Sishen-Saldanha railway line. The Transnet Service Road is accessed *via* the Gariep Road, currently a gravel road, from either the N8 or N14. The road also provides access to farms located further north. This road was upgraded (widened to 8m and gravelled) during the construction of Bokpoort I and meet the requirements for the proposed PV facilities. Permission for use of the road was obtained during the application for construction for Bokpoort I, however, permission will have to obtained once again for the construction of the PV solar facilities.

5.15.2 Road Network and Intersections

The N14, N10 and N8 are the National roads in the region and are the main link between the economic centers of Gauteng and Namibia. Access to the site is *via* the Gariep Road the Transnet Service Road. Details of the road network are given in Table 29[70].

Table 29: Overview of road network

Road	Ownership	Geometry	Discussion	Layout
Gariep Road (MR874)	Northern Cape Department of Transport	Gravel road 2 lanes (one per direction) 10m wide Speed 60km/ hr Longitudinal profile: Flat	The road runs parallel and to the east of the Orange River serving as access to the farms along the Orange River. The road links the N14 with the N8. Major dust issues have been noted by farmers due to the increase of construction vehicles during the construction of Bokpoort I. The road is aligned through the southern sections of the farm Bokpoort Condition: Fair	

[68] *Moen, H.F.G. 2007. The geology of the Upington area. Explanation to 1: 250 000 geology Sheet 2820 Upington, 160 pp. Council for Geoscience, Pretoria.*
[69] *Almond, J.E. 2012. Proposed upgrading of four road bridges along the N10 between Groblershoop & Lambrechtsdrift, Northern Cape. Recommended exemption from further palaeontological studies & mitigation, 10 pp. Natura Viva cc, Cape Town.*
[70] *Van Wyk, L; Reutener, I. 2016. Bokpoort II Solar Farm: Photovoltaic Facility 1 Site Traffic Assessment Groblershoop.*

Road	Ownership	Geometry	Discussion	Layout
Transnet Service Road (Loop 16 Access Road)	Transnet	Gravel road 2 lanes (one per direction) 10m wide Speed 60km/hr Longitudinal profile: Flat	Private Transnet Service Road to serve the Sishen-Saldanha Railway line. The road is the main access to the Bokpoort Farm Condition: Fair Road was regravelled during the construction of Bokpoort I	

The intersections are currently all unsignalized intersections and operating at a good Level of Service (LOS) with sufficient spare capacity[71].

Details of the LOS classifications are provided in Table 30.

Table 30: LOS classifications

LOS Category	Description
A	Free flow
B	Reasonably free flow
C	Stable flow, at or near free flow
D	Approaching unstable flow
E	Unstable flow, operating at capacity
F	Forced or breakdown flow

Details of the LOS expected at the Gariep Road and Transnet Service Road intersection are provided in Table 31. A Sidra Intersection analysis was done for the Gariep/ Transnet Service Road intersection before construction, during construction and during operation (refer to Appendix A: Traffic Data of the Traffic Report **– *Appendix B11***).

[71] *Van Wyk, L; Reutener, I. 2016. Bokpoort II Solar Farm: Photovoltaic Facility 1 Site Traffic Assessment Groblershoop.*

Table 31: Overview of Gariep Road/ Transnet Service Road intersection

Intersection	LOS	Discussion	Layout
Gariep Road/Transnet Service Road	Existing A During Construction (Phased Construction): A Southern approach: A During Construction (Simultaneous Construction): A Southern approach: D During Operation: A	Sight distance: Fair, after bridge over rail Dedicated right turning lanes: None Safety: Poor Very little traffic currently on road The approach to the intersection is poor, with poor visibility and geometry	

5.15.3 Non-Motorized Transport

No pedestrians or cyclists were noted on any of these roads (Gariep Road, N14, N10, N8) during the site visit (19 November 2019). No cyclists or pedestrians are allowed on the National roads (N14, N10, N8). Workers and staff working on the farms along the Gariep Road, mostly live on the farms. This is similarly the case with the Transnet Service Road. There are no towns or settlements along these two roads, apart from the farms along the Gariep Road. No dedicated non-motorized transport facilities are provided or required.

5.15.4 Accident Hotspots

As per the original 2016 investigation, the Gariep Road is an accident hotspot and has seen a number of fatal accidents due to speeding, overtaking and poor visibility caused by dust generated by the vehicles using the road.

5.15.5 Railway Lines

The Sishen-Saldanha railway line runs adjacent to the farm Bokpoort 390 RE. The railway line could potentially be used for transport of materials to site, but it is highly doubtful if a special train will be scheduled to this site due to lack of rolling stock from Transnet's side. Rail was not used during the construction of Bokpoort I, and therefore it is assumed that it is highly unlikely that the Sishen-Saldanha railway line will be used during the construction of the proposed PV plants

5.15.6 Proposed Refuse Sites

The proposed refuse sites and haul distance include:

- Holfontein (hazardous waste) (814 km *via* N8); and
- Local Municipality (general waste) at Groblershoop (35 km).

5.15.7 Haul Routes

The shortest haul route from Gauteng is *via* the N8 as shown in Table 32 (Figure 27).

Table 32: Haul distance from Gauteng

Road Distances from Gauteng	Length (km)
Johannesburg CBD to Bokpoort via N8 and R59	794
Johannesburg CBD to Bokpoort via N8 and N12	795
Johannesburg CBD to Bokpoort via N14 via Upington and then N10	908
Johannesburg CBD to Bokpoort N14 (Gariep Road) – not allowed	811

The Gariep Road from the N14 is not recommended as a haul route due to the road safety and dust issues. This route is however 97 km shorter than the alternative *via* the N10 when travelling from Upington. This should be noted in the construction tender.

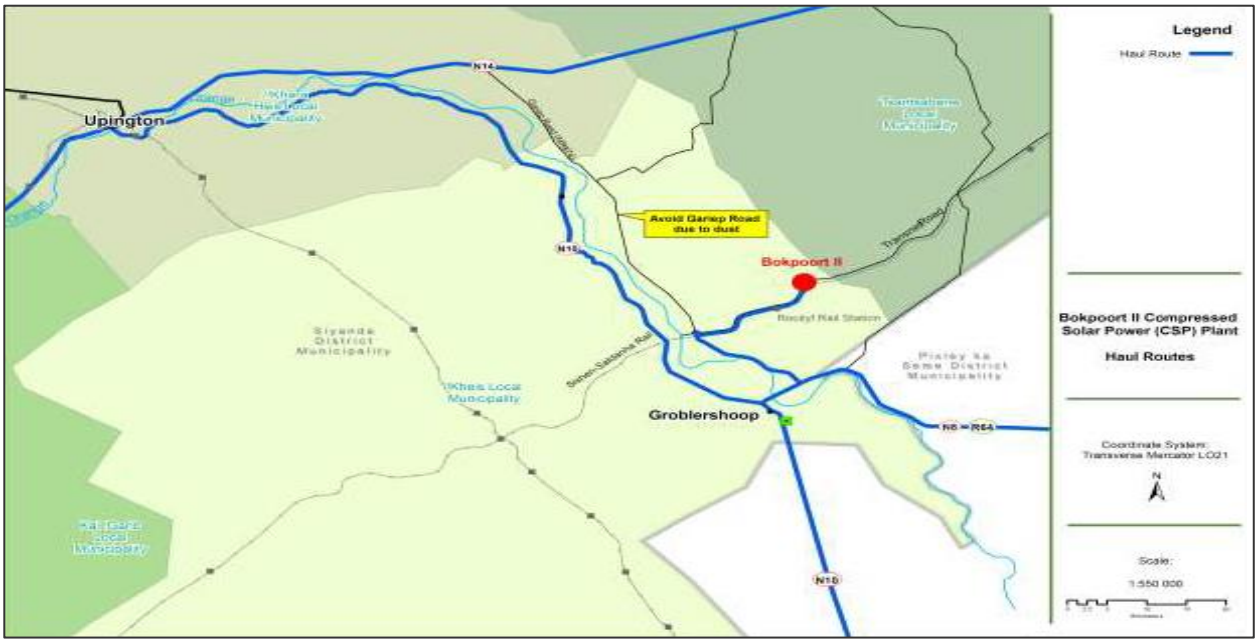

Figure 27: Haul routes

5.15.8 Traffic Counts

The major intersections were counted on 9 - 10 March 2016 as well as on 19 November 2019. The traffic volumes are summarized in Table 33 and Table 34 below.

Table 33: Traffic volumes 2016 (peak hour)

Intersection	Morning peak hour Volumes	Afternoon peak hour volumes	Daily volumes
N14/ Gariep	168	157	16800
Gariep/ Transnet	36	46	265
N8/ Gariep	257	274	1340

Table 34: Traffic volumes 2019 (peak hour)

Intersection	Morning peak hour Volumes
Gariep/ Transnet	13

5.15.9 Road Hierarchy

The road hierarchy is shown in Table 35 below. Traffic calming and parking is typically not allowed along the Mobility Corridors (Class 1, 2, 3), but is allowed along the Access Routes (Class 4, 5).

Table 35: Road hierarchy

Road	Class	Speed (km/ hr)
N14, N10, N8	Class 1, National Road	120
Gariep Road	Class 3, Minor arterial	80
Transnet Service Road	Class 5, Local access road	60

5.15.10 Public Transport Infrastructure

There are no dedicated public transport loading/ pick-up bays along the Gariep Road and the Transnet Service Road. There are no scheduled public transport routes along these two roads. Minibus-taxis transport construction staff to Bokpoort I from the adjacent residential areas. The developer will have to provide transport to site for the construction staff.

5.15.11 Dust

Due to the nature of the Gariep Road (calcrete) and the speed at which vehicles travel, a large amount of dust is generated by vehicles travelling on the road. The dust generated has an impact on the farming production rates. This is especially evident for farms where the Gariep Road is close to vineyards (within 1 km). Various complaints were received during the construction of Bokpoort I from farmers regarding dust generated by construction vehicles. The dust generation is a factor at the Gariep/ Transnet Service Road intersection as it affects the decision time for vehicles turning toward the proposed PV plants.

5.16 Visual

5.16.1 Landscape Physical Characteristics and Land Use

The visual assessment investigates any changes to the visual baseline in the area that may have occurred since the undertaking of the original visual studies (in 2016), which if affected, could affect the experiencing of visual impacts associated with the proposed development.

The land use in the study area has changed little in the four year-period since the original visual reports were compiled. Away from the Orange River corridor the predominant land use in the wider study area and including the majority of the Bokpoort Farm remains livestock rearing, predominately sheep. The Orange River valley/ corridor is predominated by the presence of irrigated agriculture, with the establishment of grape (sultana) vineyards evidently becoming more common. Game farming and hunting still occur in the Kalahari Oryx Game Farm located to the north and north-west of the Bokpoort Farm. The Bokpoort (1) CSP plant remains the only energy generation-industrial facility in the wider area with no other solar or wind power generation facilities having been constructed to date. There appears to have been little to no growth

in settlements in the study area, with Groblershoop remaining a small rural town along with a handful of smaller settlements located close to the Orange River corridor.

5.16.2 Visual Receptors

The original visual reports listed the number of structures within a 10 km radius of the site. As the area beyond 10 km of the development site would be very unlikely to be subject to any form of visual exposure to the development (Figure 28), the focus is on a 10 km radius of the development site. All *sensitive* receptor locations in the 10 km radial area are presented in Table 36.

Table 36: Static sensitive receptor locations located within a 10 km radius of the proposed development site

Distance (radius around infrastructure)	Receptor Type	Receptor Name	Closest Distance to Proposed Development	Receptor located Within Viewshed
0 - 5 km	Farmstead (main homestead and smaller household)	Bokpoort Farmstead	1,97km	Yes
5 - 10 km	Two Farmsteads	Eben Haeser Farmstead	7.71km	No
	Farmstead (main homestead and smaller household)	La Gratitude Farmstead	6.25km	No
	Farmstead (main homestead and 3 smaller households)	Tities Poort Farmstead	7.9km	No
	Farmstead (main homestead and 2 smaller households)	Dinas Rus Farmstead	9.34km	No
	Farmstead (2 households)	Bloubos Farmstead	10.38km	No
	Farmstead (3 households)	Hoekvalkte Farmstead	10.58km	No

The original reports listed seven (7) structures as being located within a 5 km radius around the site, all of which were listed as households. However only two are non-industrial or non-power generation-related, being the Bokpoort Farmstead and an associated farmworker's dwelling. The remainder are located either at the Bokpoort CSP Plant or at the Eskom Garona Substation. As such these other structures and the people working within them are unlikely to display any degree of visual sensitivity and accordingly only one sensitive receptor location exists within a 5 km radius of the development footprint.

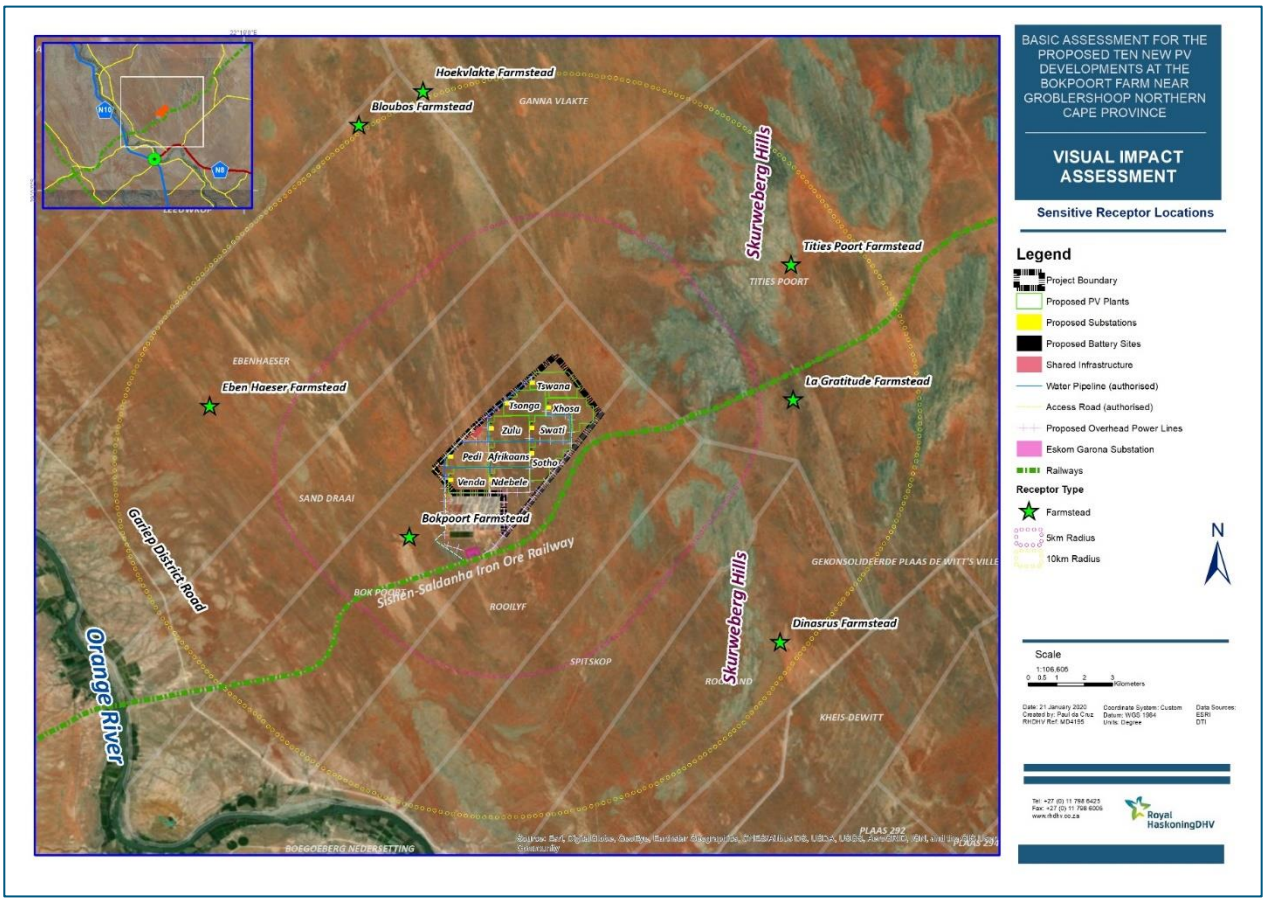

Figure 28: Location of sensitive receptor locations within a 10km radius of the proposed development

Within a 5 – 10 km radius, the original report identified a further fifteen (15) structures. The assessment completed for this addendum report identified six (6) sensitive receptor locations within the 5 – 10 km radius[72]. All of these are farmsteads, with each farmstead typically consisting of a number of households.

There are no public access transient receptor locations (i.e. roads or rail) located within the 0 - 5km radial area of the development site. The Transnet Service Road is located within the radial area however this is a non-public access road and access is limited to employees of Transnet, and for the stretch of the road from the Gariep Road to the Bokpoort CSP Plant, to people working at the solar power plant. This road is thus not considered as a route on which potential sensitive receptors could travel. The Transnet Railway is not a passenger railway, only transporting iron ore (raw materials) from Sishen to Saldanha. As such the railway can also not be considered to be a transient receptor location.

Only a short stretch of the Gariep Road enters the 10 km radial area. This is the primary and only public access road located on the eastern side of the Orange River corridor in the area and which is located within the area surrounding the proposed development. The road runs from the N8 east of Groblershoop north-westwards, running largely parallel to the course of the river, in the direction of the small settlement of Gariep and eventually linking to the N14 National Road and Olifantshoek to the north. The road also provides access to the only other road bridge across the Orange River between Groblershoop and Upington. As such

[72] *The Hoekvalkte and Bloubos Farmsteads are located just outside of the 10km radial area but have been included in this assessment.*

the Gariep Road is an important public route that carries local traffic in the area to the north-east of Groblershoop.

5.17 Social

A socio-economic impact assessment was undertaken during November 2015 to February 2016 in support of the 75 MW Photovoltaic PV 1 and PV 2 solar facilities by Smith and de Waal[73].

5.17.1 Administrative Setting

The proposed project area is located in Ward 3 of the !Kheis Local Municipality (LM), ZF Mgcawu District Municipality (DM), Northern Cape Province. The ZF Mgcawu DM, which is classified as a category C municipality forms the mid-northern section of the province on the frontier with Botswana. It covers an area of more than 100 000 square kilometres (almost 30% of the entire province). The DM comprises six local municipalities namely: Mire; Kai! Garb; Kara Hails; Tsantsabane, !Kheis and Kgatelopele. Upington is the district municipal capital.

The !Kheis Local Municipality, formerly the Groblershoop Municipality, includes the settlements of Boegoeberg, Gariep, Grootdrink, Kleinbegin, Opwag, Topline and Wegdraai, was established from the. These settlements were previously part of the Siyanda and Karoo District Municipalities, who administrated these settlements and provided them with services up until the demarcation in November 2000. From December 2000, the !Kheis Municipality took over services and personnel and total service provision commenced on 1 July 2001[74].

The IFCs Performance Standard 7 provides criteria for the identification of indigenous people and requires that project proponents implement culturally appropriate measures to mitigate the impacts of a project on indigenous people.

The South African government has acknowledged the Khoi and San as the original indigenous people of South Africa. The presence of Khoisan people in the municipality triggered further investigation into the presence of an indigenous population in the Bokpoort II project area. socio-economic impact assessment confirmed that there is no evidence of the presence of any indigenous people residing or utilising the project area and immediate surrounds.

5.17.2 Population Demographics

According to available socio-economic baseline information, the total population of the !Kheis LM increased from 14 950 in 1996 to 16 539 in 2001 and 16 637 in 2011. The Census of 2011 indicated 60.3% of the population to be of working age, 4.7% to be older than 65 and 35% to be younger than 16. The average population density in the Municipality is one person per square kilometre.

In 2011, Ward 3 of the !Kheis LM had a population of 2 510 and the population of ZF Mgcawu DM was 157 318. Groblershoop, 22 km to the south, is the closest town to the proposed project area and it had a total population of 4 938 in 2011.

There were 4 146 households in the LM of which 1 209 were defined as agricultural households in the 2011 Census. The average household size was nearly four people per household and 33% of the households were headed by females.

[73] *Smith, T; de Waal, D. 2016. Socio-economic Impact Assessment for the proposed 75 MW Photovoltaic (PV1) Solar Facility (Bokpoort II Solar Development).*
[74] *ZF Mgcawu District Municipality Integrated Development Plan (IDP) 2016 - 2017.*

Formal dwellings (66.3%) dominated the types of dwellings found in the municipality, but only 16.7% had piped water inside their dwellings, 64% used electricity for lighting and 27% had flush toilets connected to a reticulated sewerage system. The next most available sanitation system was flush toilets with a septic tank. A quarter (25%) of the population of the LM and 7% of Ward 3 did not have access to any sanitation system. The sanitation and sewerage systems in Ward 3 and the !Kheis LM are still inadequate.

There is a strong reliance on wood for cooking fuel, which is not sustainable and can lead to the overexploitation of especially camel thorn (*Acacia Erioloba*) trees in the area.

There was an influx of people and heavy equipment during the construction of the Bokpoort I facility on the Remaining Extent of the Farm Bokpoort 390 to the south of the Bokpoort II project area. Construction has been completed and the Bokpoort I facility is currently being commissioned.

5.17.3 Levels of Education

There is a school in Groblershoop and several farm schools in the regional area. Education levels are relatively low - 13.5% of the municipal population above the age of 20 has no formal schooling. Only 4.5% of the population over the age of 20 received a high school education and only 14% of this group achieved Matric qualifications. The dominant language spoken in the Municipality is Afrikaans (93%).

5.17.4 Economic Activities

The regional Gross Value Added (GVA) for 2010 is depicted in Table 37. The GVA consists of mainly mining and quarrying (18%), Agriculture, forestry and fishing (15%) in ZF Mgcawu DM and Agriculture, forestry and fishing (33%) and Wholesale and retail trade, catering and accommodation (19%) in the !Kheis LM.

Table 37: Contribution to GVA (2010)[75]

Industry	Northern Cape	ZF Mgcawu DM	!Kheis LM
Agriculture, forestry and fishing	7%	15%	33%
Mining and quarrying	24%	18%	0%
Manufacturing	4%	6%	5%
Electricity, gas and water	2%	3%	3%
Construction	2%	2%	1%
Wholesale and retail trade, catering and accommodation	11%	13%	19%
Transport, storage and communication	10%	12%	7%
Finance, insurance, real estate and business services	15%	11%	12%
Community, social and personal services	10%	8%	10%
General government	15%	12%	11%

[75] *Quantec Data (2010) as contained in Smith, T; de Waal, D. 2016. Socio-economic Impact Assessment for the proposed 75 MW Photovoltaic (PV1) Solar Facility (Bokpoort II Solar Development).*

The major established economic growth centres are located in the Kimberley and Upington sub-regions. These are likely to remain the main economic driving forces for the future and will continue to attract rural and urban migrants. The agriculture sector is the main economic sector in the region. The majority of households within the Municipality are involved in poultry production followed by livestock production (Figure 29).

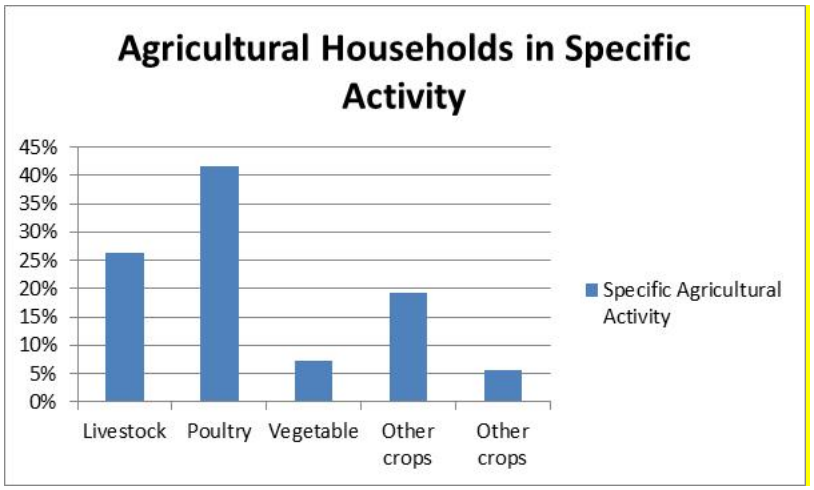

Figure 29: Percentage of agricultural households in each particular activity within the !Kheis LM[76]

The Orange River plays a crucial economic role in the ZF Mgcawu DM, with most of the economic activities linked to or located along the river. The Orange River area delivers a major part of South Africa's table grape production. The Orange River Producers Alliance is a table grape industry that is renowned in as supplier of fresh table grapes to Europe with an output of more than 20 million cartons[77].

More than 90% of Africa's total dried vine fruit production is produced through 1 250 sultana grape growers in the Northern Cape who produced more than 50 000 tons in 2010. The sultanas produced here comprise more than 80% of that which is exported primarily to Europe and other eastern countries[78]. SAD Vine Fruit Pty (Ltd) is located in Upington and owns the largest dried vine fruit processing and packaging plant in South Africa, employing more than 350 persons. It has intakes at Groblershoop, Mylpaal, Louisvaleweg, Keimoes, Kakamas and Vredendal[79].

The Orange River Wine Cellars Co-Op, also based in Upington, is the second largest winemaking cooperative in the world and has wine cellars at Groblershoop, Grootdrink, Upington, Keimoes and Kakamas. This Co-Op has more than 740 members who produce wine grapes and 445 farmers who produce grape juice[80].

In the ZF Mgcawu DM, there are approximately 1 600 farm land units, which belong to 890 owners. Because of the difference in the carrying capacity of the field, there are relatively large differences in the sizes of the farms. The carrying capacity of the field in this area can differ considerably between (for instance) a 10 ha stock unit and 65 ha stock unit further westwards[81].

[76] *Statistics South Africa. 2011. National Census.*
[77] *!Kheis LM Integrated Development Plan (IDP) 2014 - 2015.*
[78] *ZF Mgcawu District Municipality Integrated Development Plan (IDP) 2016 - 2017.*
[79] *Ibid Footnote 78*
[80] *Ibid Footnote 78*
[81] *ZF Mgcawu District Municipality Integrated Development Plan (IDP) 2016 - 2017.*

The central parts of the region consist mainly of semi-desert areas and are, therefore, with a few exceptions, mainly suitable for extensive livestock farming. Livestock farming occurs mainly on large farms where farming is extensive. The larger majority of these farms are privately owned.

The renewable energy sector is also recognised as a key developing sector. There has been an increase in these types of projects in South Africa. There is currently an application to construct a Hydropower project at the Boegoeberg Dam in the Orange River. This project also falls within the local Municipality and would contribute to the local economy.

5.17.5 Employment Levels

The local Municipality unemployment rate is high at 28% in the 2011 Census indicating that there are limited formal job opportunities in the municipality. Youth, or persons 35 years or younger, comprise 34.3% of the municipal unemployment rate.

6 PUBLIC PARTICIPATION PROCESS

Public participation is a process that is designed to enable all interested and affected parties (I&APs) to voice their opinion and/ or concerns which enables the practitioner to evaluate all aspects of the proposed development, with the objective of improving the project by maximising its benefits while minimising its adverse effects.

I&APs include all interested stakeholders, technical specialists, and the various relevant organs of state who work together to produce better decisions.

The primary aims of the public participation (PP) process are:

- to inform I&APs and key stakeholders of the proposed application and environmental studies;
- to initiate meaningful and timeous participation of I&APs;
- to identify issues and concerns of key stakeholders and I&APs with regards to the application for the development (i.e. focus on important issues);
- to promote transparency and an understanding of the project and its potential environmental (social and biophysical) impacts (both positive and negative);
- to provide information used for decision-making;
- to provide a structure for liaison and communication with I&APs and key stakeholders;
- to ensure inclusivity (the needs, interests and values of I&APs must be considered in the decision-making process);
- to focus on issues relevant to the project, and issues considered important by I&APs and key stakeholders; and
- to provide responses to I&AP queries.

The PP process must adhere to the requirements of Regulations 41 and 42 (GNR 326 as amended in 2017). Further, a Public Participation guideline in terms of NEMA was issued by the DEFF in 2017, of which provisions will also be implemented.

The PP process for proposed project will be undertaken according to the steps outlined in Figure 30 below.

Figure 30: Steps in the public participation process

In order to achieve a higher level of engagement, a number of key activities have taken place and will continue to take place. These included the following:

- The identification of stakeholders is a key deliverable at the outset, and it is noted that there are different categories of stakeholders that must be engaged, from the different levels and categories of government, to relevant structures in the non-governmental organisation (NGO) sector, to the communities of wards of residential dwellings which surround the study area;
- The development of a living and dynamic database that captures details of stakeholders from all sectors;
- The fielding of queries from I&APs and others, and providing appropriate information;
- The convening of specific stakeholder groupings/ forums as the need arises;
- The preparation of reports based on information gathered throughout the BA study via the PP process and feeding that into the relevant decision-makers;
- The PP process includes distribution of pamphlets or Background Information Documents (BIDs); and
- Where appropriate site visits may be organised, as well as targeted coverage by the media.

The proposed project PP process has entailed the following activities.

6.1 Authority Consultation

The Competent Authority, the DEFF, is required to provide an Environmental Authorisation (whether positive or negative) for the project. The DEFF was consulted from the outset of this study and has been engaged throughout the project process. The Northern Cape Department of Environment and Nature Conservation (NCDENC) will be the commenting authority.

Authority consultation included the following activities:

- Pre-application meeting held on 25 September 2019; and
- Submission of an application for environmental authorisation in terms of Section 26 of the EIA Regulations 2014 (as amended in 2017) to DEFF.

6.2 Consultation with Other Relevant Stakeholders

Consultation with other relevant key stakeholders will be undertaken through telephone calls and written correspondence in order to actively engage these stakeholders from the outset and to provide background information about the project during the BA process.

All relevant stakeholders will be allowed an opportunity to comment on the draft consultation BA Report (cBAR).

6.3 Site Notification

The EIA Regulations 2014 (as amended in 2017) require that a site notice be fixed at a place conspicuous to the public at the boundary or on the fence of the site where the activity to which the application relates and at points of access or high through traffic. The purpose of this is to draw people's attention to the project and make them aware that they are able to play a role in the project.

I&APs were identified primarily from responses received from the notices that were placed, notifying the public of the project and the invitation for the public to register as stakeholders and inform them of the PP process.

Royal HaskoningDHV erected a number of notices at various noticeable locations (Bokpoort I entrance, Eskom Garona Substation; N8 Gariep Road Interchange, Gariep Road/ N10 link road, !Kheis Local

Municipality and Transnet/ Gariep Road interchange) in the study area on 21 November 2019 (***Appendix E***).

6.4 Identification of Interested and Affected Parties

I&APs were identified through the previous EIA studies and is being updated on an on-going basis. E-mails were sent to key stakeholders and other known I&APs on 26 November 2019, informing them of the application for the project and indicating how they could become involved in the project.

The contact details of all identified I&APs are updated on the project database, which is included in ***Appendix E***.

6.5 Briefing Paper

A Background Information Document (BID) for the proposed project was compiled in English and Afrikaans (***Appendix E***) and distributed to key stakeholders and registered I&APs.

The aim of this document is to provide a brief outline of the application and the nature of the development. It is also aimed at providing preliminary details regarding the BA study and explains how I&APs could become involved in the project.

The BID was distributed to all identified I&APs and stakeholders, together with a registration/ comment sheet inviting I&APs to submit details of any issues, concerns or inputs they might have with regards to the project.

6.6 Public Meeting

A Public Meeting will be held during the review and commenting period of the draft cBAR. Details of the meeting and minutes will be included in the final cBAR.

6.7 Advertising

In compliance with the EIA Regulations 2014 (as amended in 2017), notification of the commencement of the BA study and review of the draft cBAR for the project was advertised in a local newspaper as follows:

- Volksblad on 5-6 March 2020 (***Appendix E***).

The primary aim of this advertisement was to ensure that the widest group of I&APs possible was informed and invited to provide input and questions and comments on the project.

6.8 Issues Trail

Issues and concerns raised thus far in the PP process have been compiled into an Issues Trail. The final Issues Trail will be included in the final cBAR.

6.8.1 Key Issues Raised by the Public

Comments received to date have been included as part of the issues trail (***Appendix E***).

6.9 Public Review of the draft Consultation BAR

The draft cBAR is being made available for authority and public review for a total of 30 days from 06 March to 06 April 2020.

The report will be made available at the following public locations within the study area, which are all readily accessible to I&APs:

- !Kheis Local Municipality- Groblershoop;
- !Kheis Municipal Public Library - Groblershoop;
- Electronically on the Royal HaskoningDHV Website: https://www.royalhaskoningdhv.com/en/south-africa/projects/environmental-reports

6.10 Final Consultation BAR

The final stage in the BA study entails the capturing of responses and comments from I&APs on the cBAR in order to refine the BAR and ensure that all issues of significance are addressed. An electronic copy of the final cBAR will be sent to all registered I&APs.

6.11 PPP Summary

A summary of the PPP is provided in Table 38 below, with the documents provided in ***Appendix E***.

Table 38: Summary of Public participation process

Activity	Description
Identifying stakeholders	Stakeholders were identified and a database of all I&APs were compiled.
Publishing newspaper adverts	Volksblad Newspaper
Distribution of a BID	BIDs were distributed electronically to registered I&APs.
Erection of site notices	A number of A2 site notices were erected.
Preparation of an on-going Issues Trail	Comments, issues of concern and suggestions received from stakeholders thus far have been captured in an Issues Trail.
Release of Draft Report	The draft cBAR was advertised and made available for a period of 30 days for public review and comment. This cBAR is now available for review until 06 April 2020
Public Meeting	A public meeting will however be undertaken during the 30 day review period.
Release of final cBAR	The final cBAR will be the product of all comments and studies, before being submitted to DEFF for review and decision-making.

7 SPECIALIST FINDINGS AND IMPACT ASSESSMENT

7.1 Introduction

Impact assessments must take account of the nature, scale and duration of effects on the environment, whether such effects are positive (beneficial) or negative (detrimental). Each issue/ impact is also assessed according to the project stages from planning, through construction and operation to the decommissioning phase. Where necessary, the proposal for mitigation or optimisation of an impact is noted. A brief discussion of the impact and the rationale behind the assessment of its significance is provided in this Section.

The EIA of the project activities is determined by identifying the environmental aspects and then undertaking an environmental risk assessment to determine the significant environmental aspects. The environmental impact assessment is focussed on the following phases of the project namely:

- Pre-Construction Phase;
- Construction Phase; and
- Operational Phase.

Decommissioning is not foreseen in the next 20-30 years.

As this project is linked to the already DEFF authorised Ndebele and Xhosa PV Plants (Previously PV 1 and PV 2), , the project components emanating from the design optimisation and strategic plans by the Department of Energy for the energy mix of the country as detailed in the IRP 2019 and the proposed activities which are now applied for(i.e. increase of capacity from 75 to 200MW and the inclusion of a BESS) are intrinsically linked to the main project and cannot be viewed in isolation. The BESS is also the best technically feasible option as motivated in Section 4.2.2. The impact assessment is also informed by the previous studies compiled by Golder Associates (refer to Section 1.1.1) as well as input from specialists during 2019/2020 as part of this Basic Assessment process taking into account the changes to the scope of what was previously authorised versus what is now proposed. This is to provide a holistic view of the impacts on the environment and to ensure that these are adequately mitigated to pose as minimal risk as possible.

7.2 Impact Assessment Methodology

The potential environmental impacts associated with the project will be evaluated according to its nature, extent, duration, intensity, probability and significance of the impacts, whereby:

- ***Nature:*** A brief written statement of the environmental aspect being impacted upon by a particular action or activity;
- ***Extent:*** The area over which the impact will be expressed. Typically, the severity and significance of an impact have different scales. This is often useful during the detailed assessment phase of a project in terms of further defining the determined significance or intensity of an impact. For example, high at a local scale, but low at a regional scale;
- ***Duration:*** Indicates what the lifetime of the impact will be;
- ***Intensity:*** Describes whether an impact is destructive or benign;
- ***Probability:*** Describes the likelihood of an impact actually occurring; and
- ***Cumulative:*** In relation to an activity, means the impact of an activity that in itself may not be significant but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area.

The identified impacts are assessed in accordance with the approach outlined below extracted from the Final EIR compiled by Golder Associates[82] (terminology from the Department of Environmental Affairs and Tourism Guideline document on EIA Regulations, April 1998). This approach incorporates two aspects for assessing the potential significance of impacts, namely occurrence and severity, which are further sub-divided as follows:

Occurrence		Severity	
Probability of occurrence	**Duration of occurrence**	**Scale/extent of impact**	**Magnitude (severity) of impact**

To assess each of these factors for each impact, the following four ranking scales are used:

Table 39: Criteria for the ranking of impacts

Probability	Duration
5 - Definite/ don't know	5 - Permanent
4 - Highly probable	4 - Long-term
3 - Medium probability	3 - Medium-term (8 - 15 years)
2 - Low probability	2 - Short-term (0 - 7 years) (impact ceases after the operational life of the activity)
1 - Improbable	1 – Immediate
0 – None	0 - None
Scale	**Magnitude**
5 - International	10 - Very high/ don't know
4 - National	8 - High
3 - Regional	6 - Moderate
2 - Local	4 - Low
1 - Site only	2 - Minor
0 - None	0 - None

Once these factors have been ranked for each impact, the significance of the two aspects, occurrence and severity, must be assessed using the following formula:

SP (significance points) = (magnitude + duration + scale) x probability

The maximum value is 100 significance points (SP). The impact significance is then rated as follows:

Table 40: Impact significance

SP >75	Indicates high environmental significance	An impact which could influence the decision about whether or not to proceed with the project regardless of any possible mitigation.
SP 30 - 75	Indicates moderate Environmental significance	An impact or benefit which is sufficiently important to require management and which could have an influence on the decision unless it is mitigated.
SP <30	Indicates low environmental significance	Impacts with little real effect and which should not have an influence on or require modification of the project design.

[82] *Schlechter, M., & Baxter, B. 2016. Final EIA Report: Proposed 75MW Photovoltaic (PV2) Solar Development on the Remaining Extent of the Farm Bokpoort 390, Northern Cape. Golder Associates. Ref 14/12/16/3/3/2/880.*

+	Positive impact	An impact that constitutes an improvement over pre-project conditions

The suitability and feasibility of all proposed mitigation measures will be included in the assessment of significant impacts. This will be achieved through the comparison of the significance of the impact before and after the proposed mitigation measure is implemented. Mitigation measures identified as necessary will be included in an EMPr.

7.3 Potential Impacts and Significance

The following sections will provide a description of the potential impacts as identified in:

a) the previous EIA studies for the site;[83 & 84]
b) the 2019/2020specialist assessments;
c) the PPP undertaken; and
d) the assessment according to the criteria described in Table 39 and Table 40.

The environmental impacts of the project were assessed for the:

- Construction phase;
- Operational phase; and
- Closure and rehabilitation phase.

Potential cumulative impacts were also identified and assessed for each component, where applicable.

7.3.1 Geology

7.3.1.1 Construction

Excavations for foundations for the PV plants and associated structures will permanently disturb the near-surface geology over parts of the site, resulting in an impact of ***moderate (SP = 40)*** significance, which cannot be mitigated, with regard to the project area only. Within the context of the land falling within the jurisdiction of the !Kheis Local Municipality, the impact will be negligible.

7.3.1.2 Operations

No impacts envisaged (***SP = 0***).

7.3.1.3 Closure and Rehabilitation

No impacts envisaged (***SP = 0***).

7.3.2 Topography

7.3.2.1 Construction

Excavating for building foundations and landscaping to position the PV panels and create runoff management berms will result in minor changes to the existing topography of the site. The changes will be reversible during closure and rehabilitation.

The impact is assessed as being of ***low (SP = 21)*** significance. No mitigation is necessary.

[83] *Schlechter, M., & Baxter, B. 2016. Final EIA Report: Proposed 75MW Photovoltaic (PV2) Solar Development on the Remaining Extent of the Farm Bokpoort 390, Northern Cape. Golder Associates. Ref 14/12/16/3/3/2/880.*
[84] *Schlechter, M., & Baxter, B. 2016. Final EIA Report: Proposed 75MW Photovoltaic (PV1) Solar Development on the Remaining Extent of the Farm Bokpoort 390, Northern Cape. Golder Associates. Ref 14/12/16/3/3/2/881.*

7.3.2.2 Operation

The activities undertaken during the operational phase will not have any effect on the topography of the site ***(SP = 0)***.

7.3.2.3 Closure and rehabilitation

Due to the low rainfall and the sandy soils, the site is naturally not very prone to erosion, but inappropriate closure and rehabilitation could increase the erosion potential, leading to a topographical impact of ***low (SP = 22)*** significance. The site will be largely restored to its original topography. If it is shaped to be free draining, but resistant to erosion, it will result in a positive impact of ***low (SP = +21)*** significance.

7.3.3 Air Quality

7.3.3.1 Construction

The PM emissions associated with the construction will be of a temporary nature. Emission will vary from day to day depending on the phase of construction, the level of activity, and the prevailing meteorological conditions (USEPA, 1996).

The following possible sources of PM emissions have been identified for the construction phase:

- Vehicle activities associated with the transport of equipment to the site;
- Preparation of the surface area prior to development; and
- The removal of construction equipment from site after the set-up of new infrastructure.

Vehicles travelling to and from the site will emit PM and gases, such as NOx. Expected vehicle volumes, however, will not result in any significant impact on local air quality beyond the direct vicinity of key transport routes.

The impact is assessed as being ***moderate (SP = 30)*** significance for both without mitigation and with mitigation, control measures have been suggested below:

- Control techniques for fugitive PM sources during the construction phase include watering, chemical stabilisation or reduction of surface wind speed with windbreaks or source enclosures. Watering is the most common and least expensive method, although it only provides temporary dust control. Wet suppression of unpaved areas can achieve dust emission reductions of approximately 70% or more, which can be increased by up to 95% through the use of chemical stabilisation. The use of chemicals provides for longer dust suppression but is more costly and may have adverse environmental effects. It is unlikely that such methods will be required at the proposed site. Windbreaks and source enclosures are often impractical because of the size of the construction area, but key areas of current activity can be closed off to limit impacts.

7.3.3.2 Operation

Potential Emissions

If areas exposed during the construction phases are promptly revegetated, emissions during the operational phase of the facility are expected to be insignificant. Two sources of potential emissions are presented below:

- Areas left exposed after construction can results in emissions of PM particularly during periods of high wind speeds, or due to wheel entrainment of PM if vehicles travel over these areas.
- Vehicles travelling to and from the site will emit PM and gases. Expected vehicle volumes, however, will not result in any significant impact on local air quality beyond the direct vicinity of the main access road and access gate.

The impact assessed as being ***low (SP = 16)*** significance with and without mitigation for fugitive PM emissions, mitigation measures include:

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

The impact assessed for wheel entrained and Vehicular emissions has been assessed as being ***moderate (SP = 40)*** significance for both mitigation and without mitigation.
While motor vehicles emit gaseous pollutants such as NO_x, the expected traffic levels to and from the site indicate that there will not be significant ambient air quality impacts beyond the access routes. Wheel entrained dust can supplement the PM load. Various measures are available to limit emissions by vehicles accessing and travelling onsite:

- Clear, signposted roads with no off-road driving permitted;
- Limit unnecessary travel onsite:
- Planned, efficient check and maintenance routines;
- Controlled access; and
- Clear signage.
- Signposted speed limits onsite and the use of speed humps if necessary, to enforce onsite speed limit; and
- Prevent idling of vehicles at the access gate.

Battery Energy Storage System
Loss of containment due to corrosion or fires, or during maintenance procedures poses risks to ambient air quality.

- In the case of lithium ion batteries, the following emissions are of concern:
  - When exposed to water (including humidity) due to a containment breach, lithium emits flammable gases;
  - Most lithium-ion batteries contain organic electrolytes (e.g. lithium perchlorate, acetonitrile), that are
  - combustible, with associated emissions;
  - Additional heavy metals (such a cobalt and manganese) within the battery can be emitted to atmosphere under upset conditions (e.g. thermal runaway fire conditions)

- In the case of lead-acid batteries, the following considerations are relevant:
  - When overcharged the battery can produce H_2, which poses an explosion risk, and H_2S, which has an odour nuisance (rather than health risk) at expected ambient concentrations.

The impact assessed as being ***low (SP = 16)*** significance for both with and without mitigation measures as the batteries are installed on site with mitigations, control measures include:

- Strict BESS management and monitoring systems:
  - Temperature monitoring to ensure the system does not overheat; and
  - Prevent overcharging as this poses an explosion risk.
- Containment loss is the greatest concern in relation to the storage of hazardous chemicals onsite, and is a particular concern with the lead-acid BESS since sulphuric acid is highly corrosive:
  - Acute exposure to sulphuric acid fumes (an occupational rather than ambient air quality risk) can cause irritation to eyes and the mucus membranes of the respiratory system;
- Toxic fumes of molten lead:
  - Ambient lead is regulated under the NAAQS (Table 1) due to well established health implications of chronic exposure;
  - Fugitive emissions of other gases (e.g. H2S and SOx) pose further risks; and
  - Depending on the metal alloy composition in lead-acid batteries, AsH3 and SbH3 can also be emitted.

Impacts has been assessed as being ***low (SP = 17)*** significance for both with and without mitigation as batteries are installed on site already in containment and therefore is assessed with mitigation, mitigation measures include:

- Checks and maintenance in line with manufacturer specifications to prevent containment breaches; and
- Secondary containment areas to prevent ambient air quality impacts in the case of a breach.

7.3.3.3 Closure and rehabilitation

The following activities are associated with the decommissioning phase:

- Existing structures demolished, rubble removed, and the area levelled;
- Remaining exposed excavated areas filled and levelled;
- Topsoil replaced; and
- Land and permanent waste piles prepared for revegetation.

Possible sources of particulate emissions during the closure and post-closure phase include:

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

The impact associated with the Fugitive PM has been as being ***moderate (SP = 30)*** significance for both with and without mitigation measures, measures include:

- Windbreaks and source enclosures can be used during demolition, rubble removal, infilling, levelling and topsoil covering. Rubble piles can be covered and transported away from the site in covered trucks. It is key that all exposed areas are vegetated as soon as possible during the decommissioning process. Plants used for revegetation should be indigenous to the area, hardy, fast-growing, nitrogen-fixing, provide high plant cover, be adapted to growing on exposed and disturbed soil (pioneer plants) and should easily be propagated by seed or cuttings.

Decommissioning of BESS can also result in emissions to atmosphere due to containment issues (refer to 7.3.3.2. Operational Phase). As such, the decommissioned components should be removed from site as soon as possible and transferred to an appropriate recycling facility. While there are recycling options for lead-acid batteries in South Africa, opportunities for the recycling of lithium ion batteries needs further investigation.

The impact has been assessed as ***low (SP = 17)*** significance for both with and without mitigation, the following mitigation measures has been recommended:

- BESS must be decommissioned by trained personnel in line with manufacturer specifications. Decommissioned BESS must be removed offsite promptly and taken to the nearest appropriate recycling facility. While there are recycling options for lead-acid batteries in South Africa, opportunities for the recycling of lithium ion batteries needs further investigation.

7.3.4 Agricultural Potential, Soil, Land Capability and Land Use

7.3.4.1 Construction

The significance of all potential agricultural impacts is kept low by the fact that the proposed site is on land of extremely limited agricultural potential that is only viable for low intensity grazing.

The following two potential impacts of the developments on agricultural resources and productivity are described below:

Loss of Agricultural Land Use
Agricultural grazing land directly occupied by the development infrastructure, which includes all associated infrastructure, will become unavailable for agricultural use. The impact is rated as being potentially of ***moderate (SP = 35)*** significance for both without mitigation and with mitigation as there are mitigations possible and because of the low value of the agricultural resource, which is not scarce.

Soil degradation
Soil degradation can result from erosion, topsoil loss and contamination. Erosion can occur as a result of the alteration of the land surface run-off characteristics, which can be caused by construction related land surface disturbance, vegetation removal, and the establishment of hard surface areas including roads. Loss of topsoil can result from poor topsoil management during construction related excavations. Hydrocarbon spillages from construction activities can contaminate soil. Soil degradation will reduce the ability of the soil to support vegetation growth. The water erosion risk is low due to the low slope gradients and low to moderate erodibility of the soils, but wind erosion risk is high. The impact is rated as being potentially of ***Low (SP = 18)*** significance and can be mitigated to ***low (SP = 12)*** significance by:

- Implementation of an effective system of storm water run-off control, where it is required - that is at all points of disturbance where water accumulation might occur.
- If an activity will mechanically disturb the soil profile below surface, then any available topsoil should first be stripped from the entire surface to be disturbed and stockpiled for re-spreading during rehabilitation, which may be after construction or only at decommissioning.
- If levelling requires significant cutting, topsoil should be temporarily stockpiled and then re-spread after cutting, so that there is a covering of topsoil over the entire surface before the panels are mounted.
- Topsoil stockpiles must be conserved against losses through erosion by establishing vegetation cover on them.
- Dispose of all subsurface spoils from excavations where they will not impact on undisturbed land.
- Establish an effective record keeping system for each area where soil is disturbed for constructional purposes. These records should be included in environmental performance reports, and should include all the records below:
    - Record the GPS coordinates of each area.
    - Record the date of topsoil stripping.
    - Record the GPS coordinates of where the topsoil is stockpiled.
    - Record the date of cessation of constructional (or operational) activities at the particular site.
    - Photograph the area on cessation of constructional activities.
    - Record date and depth of re-spreading of topsoil.
    - Photograph the area on completion of rehabilitation and on an annual basis thereafter to show vegetation establishment and evaluate progress of restoration over time.

7.3.4.2 Operation

Loss of agricultural land use and soil degradation occur at the start of the construction phase and are therefore not listed under operational phase impacts. There is no further loss of land that occurs in subsequent phases.

7.3.4.3 Closure and Rehabilitation

Only one impact is foreseen for the closure or rehabilitation phase:

Soil Degradation
Soil degradation can result from erosion, topsoil loss and contamination. Erosion can occur as a result of the alteration of the land surface run-off characteristics, which can be caused by decommissioning related

land surface disturbance. Loss of topsoil can result from poor topsoil management during decommissioning related excavations. Hydrocarbon spillages from decommissioning activities can contaminate soil. Soil degradation will reduce the ability of the soil to support vegetation growth. The impact is rated as being potentially of ***Low (SP = 18)*** significance and can be mitigated to ***low (SP = 12)*** significance by:

- If an activity will mechanically disturb the soil profile below surface, then any available topsoil should first be stripped from the entire surface to be disturbed and stockpiled for re-spreading during rehabilitation, which may be after construction or only at decommissioning.
- The depth of topsoil stripping is dependent on the specific field conditions. The maximum depth should be 30cm.
- Topsoil should be retained in the area below the panels (or mirrors). It is not desirable to strip and stockpile this topsoil for the whole of the operational phase. It will be much more effective for rehabilitation, to retain the topsoil in place.
- It is only in areas where topsoil cannot be retained on the surface during the operational phase, and where the area will be rehabilitated back to veld after decommissioning, that it should be stripped and stockpiled for the duration of the operational phase for re-spreading during de-commissioning.
- Topsoil stockpiles must be conserved against losses through erosion by establishing vegetation cover on them.
- Dispose of all subsurface spoils from excavations where they will not impact on undisturbed land.
- The monitoring protocol recommended in the construction phase should be continued to the operational phase if removal of topsoil is required.

7.3.4.4 Cumulative Impacts

The potential cumulative agricultural impact of importance is a regional loss or degradation of agricultural land, with a consequent decrease in agricultural production. The defining question for assessing the cumulative agricultural impact is this:

> ***What level of loss of agricultural land is acceptable in the area, and will the loss associated with the proposed Bokpoort PV development, cause that level in the area to be exceeded?***

The loss of agricultural land in the area is highly likely to be within an acceptable limit in terms of loss of low potential agricultural land, of which there is no scarcity in the country. This is particularly so when considered within the context of the following two points:

- In order for South Africa to achieve its renewable energy generation goals, agriculturally zoned land will need to be used for renewable energy generation. It is far more preferable to incur a cumulative loss of agricultural land in a region such as the one being assessed, which has no cultivation potential, and low grazing capacity, than to lose agricultural land that has a higher potential, and that is much scarcer, to renewable energy development elsewhere in the country. The limits of acceptable agricultural land loss are therefore far higher in this region than in regions with higher agricultural potential.
- It is also preferable, from an impact point of view as well as from practical considerations, to rather have a concentrated node of renewable energy development within one area, as is the case around this project, than to spread out the same number of developments over a larger area.

Acceptable levels of change in terms of other areas of impact such as visual impact would be exceeded long before agricultural levels of change came anywhere near to being exceeded.

It should also be noted that there are few land uses, other than renewable energy, that are competing for agricultural land use in this area. The cumulative impact from developments, other than renewable energy, is therefore low.

7.3.5 Ecology

7.3.5.1 Construction

The main impact on biodiversity during the construction phase arises from changes in land cover due to the proposed construction of the Project and all associated infrastructure, resulting in direct impacts on the extent and composition of vegetation communities and associated faunal groups. Specific project impacts that could occur include:

- Reduction in extent of habitats within the Project footprint;
- Introduction and exacerbation of declared and invasive plant species;
- Loss/disturbance of flora and fauna species of conservation concern;
- Loss/disturbance of other fauna species;
- Reduction in extent of Natural Habitat; and
- Reduction in extent of Critical Habitat; and
- Soil erosion and sediment loading of surface water runoff.

Predicted impacts on biodiversity during the construction phase of the Project relate to vegetation clearance within the photovoltaic plant development footprint, resulting in direct effects on species and ecosystems of conservation concern, indirect effects on ecosystem integrity due to dust and sediment generation causing contamination of surface water systems.

Loss of extent of modified habitats within the Project footprint

Site clearance within the footprint of the photovoltaic plant and associated panels will result in a combined loss of approximately 1 500 ha (150ha per PV Plant) of existing vegetation within the study area, including calcareous low shrub plains, open shrub plains and open shrub duneveld. These vegetation communities (although largely natural) were considered to be comparatively deteriorated as a result of persistent livestock grazing pressure and were ascribed a moderate ecological integrity status.

The magnitude of loss of these habitats is considered low in the context of the expansive area covered by the regional Kalahari Karroid shrubland vegetation type which supports similar habitat types and vegetation communities. The loss will be for the duration of the Project until such a time as the photovoltaic plant is decommissioned and the site rehabilitated, so will be long-term in duration. This impact is largely restricted to the development footprint (areas subjected to surface clearance); the overall impact significance is therefore considered moderate, notably as a result of the spatial restriction t moderate ecological sensitivity areas.

The anticipated magnitude of impacts, despite being largely irremediable, could be reduced to minor, and the overall impact significance to low, through the application of the recommended mitigation measures that restrict the exacerbation of this impact to surrounding areas. The impact is rated as being potentially of ***Moderate (SP = 50)*** significance and can be mitigated to ***Moderate (SP = 35)*** significance by:

- An Environmental Officer (EO) shall be appointed prior to construction. The appointed Environmental Officer for the project should have an appropriate, not necessarily detailed, knowledge of ecological and biodiversity aspects of the site, surrounds and the general region.
- The Project shall ensure that valid permits are obtained for the removal, destruction and/or transplant of protected and conservation important plant species from the development site:
    - Prior to site clearance, conduct a detailed ‘walkthrough’ of the proposed site to ascertain the number, abundance and physical conditions of all protected (NFA, 1998) tree species to assist with permit application (DAFF); and
    - Prior to site clearance, conduct a detailed ‘walkthrough’ of the proposed site to ascertain the number, abundance and physical conditions of all protected plant species (NCNCA, 2009) to assist with permit application (NCDENC).
    - Prior to site clearance, conduct targeted searches for less mobile animal species of conservation concern with high probability of occurring within the Project footprint (i.e. small mammals,

medium mammals that may have dens/resting places/ roosts, burrows, etc. within the footprint) to allow relocation to take place where necessary, and avoid mortalities of these species;

- Under no circumstances shall any natural area on neighbouring properties (outside the approved development footprint) be impacted, degraded, cleared, or affected in any manner. The construction of a semi-permanent fence, which will prevent vehicle and personnel access to adjacent areas) shall be constructed.
- Cleared vegetation and debris that has not been utilised must be collected and disposed of at a suitable waste disposal site. Under no circumstances may it be burned on site.
- No painting or marking of rocks or vegetation to identify locality or other information shall be allowed, as it will disfigure the natural setting. Marking shall be done by steel stakes with tags, if required. All temporary markings will be removed upon completion of the construction.

Introduction/Spread of exotic invasive species

Exotic invasive species have been recorded within the Study Area; vegetation clearance works in advance of construction may create conditions that are favourable for the establishment and spread of these species to neighbouring areas, and even further afield if earth movements take place. The impact magnitude could be high as exotic species are capable of rapidly spreading throughout a locality; and the duration is considered permanent as many exotic species are costly and difficult to eradicate, particularly when these species have become established in an area.

The probability of this occurring is considered medium, given that some (few) declared invasive species have already been recorded within the Study Area. The overall impact significance is considered moderate prior to mitigation. The application of the recommended mitigation measures reduces the potential magnitude and extent of effects, leaving an impact of low significance post- mitigation. The impact is rated as being potentially of ***Moderate (SP = 52)*** significance and can be mitigated to ***Low (SP = 15)*** significance by:

- Development and implementation of an Alien and Invasive Management Programme (flora and fauna). The aim of this programme should include (*inter alia*) the identification, control and eradication of invasive and exotic animals and plants from the site and immediate surrounds. The Environmental Officer shall compile relevant action plans to deal with the presence of alien and invasive species.

Loss/disturbance of flora and fauna species of conservation concern

Vegetation clearance for construction of the proposed PV solar facilities will result in the loss/disturbance of habitat for species of conservation concern, notably so for flora species, but also for fauna species such as Bat-Eared Fox and Cape Fox, whose prey species inhabit the vegetation within the Study Area for foraging and shelter. Construction activities could cause fatalities to individuals of slow-moving or burrowing species of conservation concern which may not be able to escape oncoming machinery e.g. Suricate, Karoo Round-eared Sengi, Cape Short-tailed Gerbil, and Highveld Gerbil. In addition, indirect effects due to the presence of people and heavy machinery may impact faunal species of conservation concern in the wider landscape. High fatality figures are typical for Bat-eared fox and Cape fox that are particularly susceptible as they are nocturnal species that frequent and utilise roads during the night.

The potential impact of loss/disturbance of species of conservation concern is assessed as high, due to the confirmed presence of several species of conservation concern, and the predicted presence of several others. Anticipated impacts can be reduced to low significance, provided that the recommended mitigation measures are applied; specifically the appointment of an Environmental Control Officer for the duration of construction, and additional targeted surveys in for resting areas/dens of mammal species of conservation concern that are known to be present within the Study Area, such as Honey Badger, Aardvark, Striped Polecat, and Bat-eared Fox, directly in advance of clearance works. Strict control of vehicle movement, notably during nocturnal periods, in addition to reduced speeds, will assist in limiting accidental fatalities. The impact is rated as being potentially of ***Moderate (SP = 56)*** significance and can be mitigated to ***Moderate (SP = 36)*** significance by:

- Where possible, collection of propagules, including seeds, cuttings and seedlings of floral species of conservation concern, should be conducted to preserve genetic diversity and retain these species for specific conservation efforts. Where possible, these species should be replanted in areas of the study area that are proposed for rehabilitation. Specific plans for this should be outlined in a Biodiversity Management/Action Plan for the Project.
- Due to the type of development, the type and nature of fencing/ demarcation should not attempt to facilitate free movement of smaller/ medium-sized animals as this could lead to unwanted presence (and accidental killing) of animals within the development site.
- The use of electric fences (particularly on ground level) is discouraged. Top wire strands should be grounded to avoid electrocution of perching birds.
- Prevent contamination of surrounding, natural habitat from any source of pollution, notably from hydrocarbon spillages, runoff end contamination from transformed areas. Ducts that facilitate water flow underneath roads shall be kept clear of litter, debris and shall not be used to dispose of chemicals, unwanted effluent, etc

Loss/disturbance of other fauna species

Vegetation clearance could result in direct impacts including mortality and injury of other fauna. This is considered to be an impact of moderate significance – although species may not be of specific conservation concern, they contribute to the overall regional biodiversity and ecological integrity of the Study Area. Provided that the recommended mitigation measures are put in place, the predicted impact can be reduced to one of low significance. The impact is rated as being potentially of ***Moderate (SP = 55)*** significance and can be mitigated to ***Low (SP = 27)***.

Reduction in extent of natural habitats

Natural habitat within the Study Area consists of the rocky outcrop to the north of the Study Area. The magnitude of predicted effects on this habitat are considered to potentially be of moderate significance, as although only a small area of habitat would be affected in the context of the total area of those habitat types, the good-pristine ecological integrity assigned to these areas and its classification as Natural Habitat (IFC, 2012) increases the biodiversity value of these habitats. The IFC requires no net loss of Natural Habitats, therefore provided that the application of the recommended mitigation measures is adhered to, i.e. avoidance of any construction works or vegetation clearance in this habitat, the predicted effects can be reduced to low significance. The impact is rated as being potentially of ***Moderate (SP = 42)*** significance and can be mitigated to ***Low (SP = 18)*** significance by:

- No surface disturbance or vegetation clearance should occur in the rocky outcrop that consists of Natural Habitat as defined by IFC. This habitat, plus a 250 m buffer, should be demarcated and no construction activity should occur within the demarcated zone;

Soil erosion and sediment loading of surface water runoff

Dust is expected to be generated during construction activities and earthworks; dust can suppress photosynthesis and affect the growth rates of some plant species. This can have knock-on effects on the ability of vegetation communities to support wildlife. In addition, the clearance of the vegetation on site is expected to create conditions more conducive to soil erosion as a result of wind and storm water runoff, which can also contribute to sedimentation of surface water systems. The impact significance is predicted to be medium prior to mitigation, due to the limited extent and duration of predicted effects which would be greatest during seasonal rains.

With the application of recommended mitigation measures, the duration, extent and probability of impact can all be reduced; reducing the resulting impact to one of low environmental significance post-mitigation. The impact is rated as being potentially of ***Moderate (SP = 40)*** significance and can be mitigated to ***Low (SP = 12)*** significance by:

- Prevent contamination of surrounding, natural habitat from any source of pollution, notably from hydrocarbon spillages, runoff end contamination from transformed areas. Ducts that facilitate water

flow underneath roads shall be kept clear of litter, debris and shall not be used to dispose of chemicals, unwanted effluent, etc

7.3.5.2 Operation

Predicted operational phase impacts relate to disturbance to resident fauna species as a result of the presence of the photovoltaic plant, and contamination risks for the Orange River.

Spread of invasive plant species

The spread of invasive species, particularly invasive plant propagules by heavy machinery and earth works could cause an impact of high environmental significance, depending on the invasive plant species that occur in the area. The application of effective mitigation measures is critical in ensuring an impact of low environmental significance post-mitigation. The impact is rated as being potentially of ***Moderate (SP = 52)*** significance and can be mitigated to ***Low (SP = 15)*** significance by:

- Continue the Alien and Invasive Management Programme of declared and invasive plant species. The Environmental Manager shall compile relevant action plans to deal with the presence of alien and invasive species.

Direct loss (injury/mortality) of fauna species via roadkill

Increased vehicular traffic in the study area during the operation of the photovoltaic plant is likely to result in increased incidences of road kill, particularly at night. Magnitude in this case refers to the number of wildlife road deaths, which is considered to be potentially high. The impact would be long-term and would affect wildlife on a local scale with an estimated high probability of occurrence, resulting in an impact of moderate significance.

Although the application of mitigation measures would reduce the number of road kill deaths (magnitude) and the probability of vehicle-animal collisions happening, the impact remains one of moderate significance post-mitigation. The impact is rated as being potentially of ***Moderate (SP = 70)*** significance and can be mitigated to ***Moderate (SP = 40)*** significance by:

- Traffic speed limits of a maximum of 40 km/h should be imposed for all construction vehicles on all site rods and site access roads to reduce accidental animal road fatalities.
- Information signs regarding animals that may crossroads, notably during nocturnal periods, should be erected at selected localities. Monitoring of road conditions will inform of sites where burrows are observed.

Disturbance of faunal species of conservation concern – site lighting

Based on observations of the Bokpoort I facility made during the field work conducted in September 2015, the Bokpoort II facility will be well-lit at night. In addition, frequent security patrols of the boundary throughout the day were observed. These, together with on-going operation and maintenance activities at the facility, are expected to cause disturbance to faunal species of conservation concern in surrounding areas, particularly at night time. The magnitude of the effects is expected to be moderate given the extent of lighting observed at the existing facility. The predicted impact is thus considered to be of moderate significance prior to mitigation.

Once the recommended mitigation measures are applied, the magnitude of effects on bats and the probability of effects on other faunal species (some of the more adaptable fauna species e.g. foxes may become accustomed to a certain level of disturbance over time) can be reduced, reducing the significance of the overall impact to low. The impact is rated as being potentially of ***Moderate (SP = 60)*** significance and can be mitigated to ***Low (SP = 20)*** significance by:

- Minimize the use of floodlight and high intensity lighting during the night. Where unavoidable, lights should be mounted as low as possible and fully shielded where possible. Beams should be directed only to areas where it is needed (avoid peripheral light).
- Use light bulbs that produces long wavelengths (ambers and reds).

Disturbance of faunal species of conservation concern – barrier to movement

Security fencing on the perimeter of the development compound will present a barrier to movement for mammal species of conservation concern such as Aardvark, Bat-eared Fox and Honey Badger, as well as larger reptiles. This may reduce mammal movement capability through the landscape, forcing affected species to make longer, more energetically-expensive journeys to get around the fenced areas. The magnitude of potential effects is considered moderate, as no direct mortality or injury to species of conservation concern is anticipated. The effects would be long-term, occur at a local scale and have a moderate likelihood of occurrence, given the relatively sparse mammal population within the study area. The overall significance of impact is considered to be moderate. It is difficult to mitigate the presence of the security fence during the lifetime of the Project; effects would only be reduced following closure and decommissioning. The impact is rated as being potentially of ***Moderate (SP = 48)*** significance and can be mitigated to ***Moderate (SP = 36)*** significance by:

- The persistence of opportunistic animal species within the development footprint and appurtenant infrastructure should be monitored and discouraged.

7.3.5.3 Closure and Rehabilitation

Predicted impacts on biodiversity during the decommissioning and closure phase of the project relate to the spread of invasive species as a result of large-scale ground works, and contamination of surface water systems.

Spread of invasive plant species

The spread of invasive species, particularly invasive plant propagules by heavy machinery and earth works could cause an impact of high environmental significance, depending on the invasive plant species that occur in the area. The application of effective mitigation measures is critical in ensuring an impact of low environmental significance post-mitigation. The impact is rated as being potentially of ***Moderate (SP = 65)*** significance and can be mitigated to ***Low (SP = 21)*** significance by:

- The use of locally indigenous plant species for landscaping and rehabilitation purposes is strongly recommended. In particular, the retention of trees (notably protected trees) should be assessed as part of the rehabilitation aspect
- Under no circumstances shall exotic and invasive plants be used for landscaping purposes.
- An invasive species management plan for rehabilitation works should be developed. This will include the identification of target areas for invasive species control, and species-specific eradication methods and measures that will need to be enacted
- Restoration/rehabilitation of the Project footprint must include consideration of compatible measures for biodiversity enhancement. Such measures should include planting of native species vegetation using the plants/propagules maintained since construction phase and demarcation of rehabilitated areas as conservation areas only i.e. no livestock grazing should take place in these areas

Soil erosion and sediment loading of surface water runoff

Relics of the operational and decommissioning phases of the project could potentially cause unintended changes in surface water run-off that might cause and contribute to conditions that are conducive for soil erosion. Similarly, poorly vegetated areas might be subjected to wind, which will contribute to surface erosion. The impact significance is predicted to be medium prior to mitigation, due to the limited extent and duration of predicted effects which would be greatest during seasonal rains.

With the application of recommended mitigation measures, the duration, extent and probability of impact can all be reduced; reducing the resulting impact to one of low environmental significance post-mitigation. The impact is rated as being potentially of ***Moderate (SP = 39)*** significance and can be mitigated to ***Low (SP = 14)*** significance by:

- Prevent contamination of surrounding, natural habitat from any source of pollution, notably from hydrocarbon spillages, runoff end contamination from transformed areas. Ducts that facilitate water

flow underneath roads shall be kept clear of litter, debris and shall not be used to dispose of chemicals, unwanted effluent, etc

7.3.5.4 Cumulative Impacts

The Project is located adjacent to the existing Bokpoort I development. In addition, the proposed SolAfrica Sanddraai 75 MW PV Project in !Kheis LM is situated on the farm directly adjacent to the Project, and the proposed Kheis Solar Park 1 PV project is located in similar habitat approximately 20 km north of the Project (refer to Figure 31).

Potential residual (post-mitigation) impacts of the Bokpoort II PV Project that may contribute to the cumulative effects of other proposed and permitted solar developments in the region relate to potential indirect impacts on fauna and exacerbation of the loss of remaining areas of natural habitat. The Project may contribute to cumulative impacts on fauna through increased incidences of road kill as a result of increased vehicular traffic and the creation of a barrier to normal movement of medium-large mammals and reptiles due to the physical barrier that will be created by the site security fencing. Incremental losses of remaining areas of natural (untransformed) habitat is anticipated due to the continual increase of human/ industrial related activities on a regional scale.

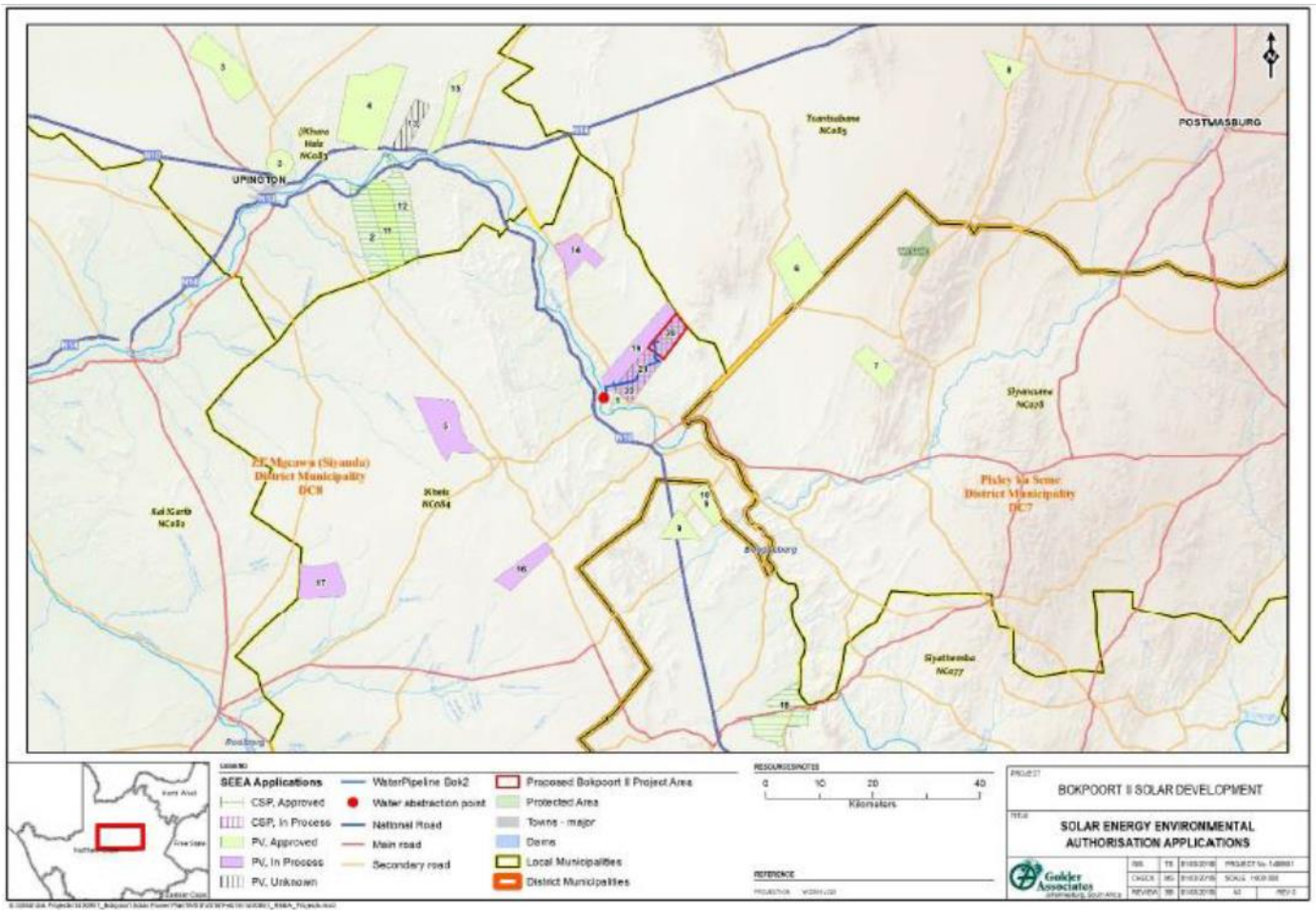

Figure 31: Proposed and authorised solar developments that may contribute to cumulative impacts

7.3.6 Avifauna

Considering all the bird baseline data, resulted in the identification of a set of focal species. The focal species for the impact assessment were determined to be: Verreaux's Eagle, Lappet-faced Vulture, Cape Eagle-Owl, Lanner Falcon, Martial Eagle, Pygmy Falcon, Palechanting Goshawk, Greater Kestrel, Kori Bustard,

Ludwig's Bustard, Northern Black Korhaan, Burchell's Courser, Eastern Clapper Lark, Fawn-coloured Lark, Black-eared Sparrow-Lark, Black-headed Canary, Sociable Weaver, Namaqua Sandgrouse, Rock Martin, Barn Swallow, and Namaqua Dove. By considering focal species we are not ignoring other birds, as in most cases these focal species serve as surrogates for other species, examples being Martial Eagle for Booted Eagle and Northern Black Korhaan for Karoo Korhaan.

7.3.6.1 Construction

Habitat Destruction

The removal and/or destruction and/or alteration of habitat used by birds, may impact on the foraging and/or breeding success of certain species, and will lead to numerous birds being displaced from the projects site, and needing to find suitable available habitat elsewhere. Habitat loss may affect and be more significant for important terrestrial species such as coursers, korhaans and bustards. Raptors (e.g. Martial Eagle, Black-chested Snake-Eagle and Pale Chanting Goshawk) may also be affected to a lesser degree, through the loss of potential hunting habitat. The proposed amendment may reduce the duration of total habitat loss compared to the original authorisation if rehabilitation of natural vegetation underneath the solar panels is implemented. This would provide habitat, albeit modified, for at least some important bird species such as coursers and francolins.

This impact has been assessed as being ***moderate (SP = 70)*** without mitigation and ***moderate (SP = 60)*** significance with mitigation by:

- A site-specific environmental management programme (EMPr) must be implemented, which gives appropriate and detailed description of how construction activities must be conducted to reduce unnecessary destruction of habitat;
- All contractors are to adhere to the EMPr and should apply good environmental practice during
- construction;
- High traffic areas and buildings such as offices, batching plants, storage areas etc. should, where
- possible be situated in areas that are already disturbed;
- Existing roads and farm tracks must be used where possible;
- The minimum footprint areas of infrastructure should be used wherever possible, including road widths and lengths;
- No off-road driving;
- Environmental Control Officer (ECO) to oversee activities and ensure that the EMPr is implemented and enforced; and
- Following construction, rehabilitation of areas underneath the solar panels and those disturbed by the temporary contractor's facility must be undertaken and to this end a habitat restoration plan is to be developed by a specialist and included within the EMPr.

7.3.6.2 Disturbance and Displacement

Birds are disturbed and displaced from the project site and surrounding areas due to construction activities and associated noise etc. Particularly at risk are sensitive species breeding on and around the site or regularly utilizing the project site for foraging/hunting e.g. eagles, korhaans, coursers and bustards.

The impact has been assessed as being ***moderate (SP = 48)*** with mitigation this impact can be ***moderate (SP = 30)*** significance by:

- All contractors are to adhere to the EMPr and should apply good environmental practice during construction;
- ECO to oversee activities and ensure that the site specific EMPr is implemented and enforced;
- The appointed ECO must be trained by an avifaunal specialist to identify the potential Red Data species as well as the signs that indicate possible breeding by these species;
- The ECO must then, during audits/site visits, make a concerted effort to look out for such breeding activities of Red Data species, and such efforts may include the training of construction staff (e.g. in Toolbox talks) to identify Red Data species, followed by regular questioning of staff as to the regular whereabouts on site of these species; If any of the Red Data species are confirmed to be breeding

(e.g. if a nest site is found), construction activities within 500 m of the breeding site must cease, and an avifaunal specialist is to be contacted immediately for further assessment of the situation and instruction on how to proceed;

- Prior to construction, an avifaunal specialist should conduct a site walkthrough, covering the final road, pipeline and power line routes as well as the temporary contractors facility, to identify any nests/breeding/roosting activity of sensitive species, as well as any additional sensitive habitats;
- The results of which may inform the final construction schedule in close proximity to that specific area, including abbreviating construction time, scheduling activities around avian breeding and/or movement schedules, and lowering levels of associated noise;
- No construction activities or staff are permitted within 1.5 km of the identified Martial Eagle nest buffer; and
- A construction phase bird monitoring programme must be implemented by a bird specialist, to document potential impacts on key species such as korhaans, bustards and eagles, and must include the ongoing monitoring of the active Verreaux's Eagle and Martial eagle nest sites.

7.3.6.3 Operation

Disturbance and Displacement

Birds are disturbed and displaced from the project site and surrounding areas, or from the grid connection servitude and surrounding areas, due ongoing operational and maintenance activities. Particularly at risk are sensitive species breeding or foraging/hunting in close proximity to the activities, for example raptors that may nest on the new powerline tower being disturbed by power line and servitude maintenance.

This impact has been assessed as being ***moderate (SP = 56)*** without mitigation which can be ***low (SP = 24)*** significance when the mitigation measures below are applied:

- A site specific operational EMPr must be implemented, which gives appropriate and detailed description of how operational and maintenance activities must be conducted to reduce unnecessary disturbance.
- All contractors are to adhere to the environmental management programme and should apply good environmental practice during all operations.
- The on-site operational facilities manager (or a suitably appointed Environmental Manager) must be trained by an avifaunal specialist to identify the potential Red Data species as well as the signs that indicate possibly breeding by these species.
- If a priority species or Red Data species is found to be breeding (e.g. a nest site is located) on or within 2 km of the operational facility (or the grid connection servitude), the nest/breeding site must not be disturbed, and the avifaunal specialist must be contacted for further instruction.
- The on-site operational facilities manager (or a suitably appointed Environmental Manager) must conduct inspections every two months of the grid connection line, and all existing transmission line pylons within 2 km of the project site boundary to locate possible nesting raptors.
- Any such nests must not be disturbed and should be reported to the avifaunal specialist for further instruction.
- Operational phase bird monitoring, in line with the solar guidelines, must be implemented.
- No operational activities or staff are permitted within 1.5 km of the identified Martial Eagle nest.

Collisions with Infrastructure (excluding Powerlines)

The proposed amendment may impose an increased risk of collision for small birds due to an increased area of panels associated with PV and a potentially increased 'lake effect'. The risk of collision for small and medium sized birds may also increase from the proposed amendment if the recommended rehabilitation and regrowth of natural vegetation is implemented underneath the solar panels due to increased use of the area by birds. Birds collide with heliostats and/or the PV panels and/or the central receiver tower. Birds may be attracted to the reflective surfaces which may be mistaken for large water bodies and can cause disorientation of flying birds, resulting in injury and/or death.

The impact has been assessed as being ***moderate (SP = 55)*** before mitigation and ***low (SP = 27)*** significance with mitigation measures recommended:

- All artificial water points (e.g. livestock water points and wind pumps) on the project site and within 500 m from the boundary of the project site, must be moved or shut down (if not already removed from the project site during construction) so that birds are not attracted to the project site and immediate surrounding areas.
- All water related infrastructure (e.g. pipes, pumps, reservoirs, toilets, taps etc.) must be regularly (twice weekly) checked for leaks, and repaired immediately.
- Lighting should be kept to a minimum to avoid attracting insects and birds and light sensors/switches should be utilised to keep lights off when not required.
- Lighting fixtures should be hooded and directed downward where possible, to minimize the skyward and horizontal illumination, lighting should be motion activated where possible.
- Careful selection of and modifications to solar facility equipment should be made where possible e.g. white borders could be applied to PV panels to reduce the resemblance of solar arrays to waterbodies.
- Develop and implement an operational monitoring programme for birds in line with applicable solar guidelines, which must include searching for mortalities.
- Frequent and regular review of operational phase monitoring data and results by an avifaunal specialist.
- If unacceptable impacts are observed (in the opinion of the bird specialist and independent review), the specialist should conduct a literature review specific to the impact and provide updated and relevant mitigation options to be implemented.
- As a starting point for the review of possible mitigations, the following may need to be considered:
    - Assess the suitability of using deterrent devices to reduce collision risk, which may include the use of rotating/flashing mirrors, or sound deterrents.

Water Pollution

The utilisation of dust suppression or cleaning chemicals used on solar panels imposes a risk of contamination of pollution of water resources.

The impact has been assessed as being ***moderate (SP = 30)*** before mitigation and ***low (SP = 16)*** significance with mitigation measures recommended:

- Ensure that birds do not get in contact with any evaporation ponds that may be required i.e. ponds should be covered with wire mesh or netting to reduce the possibilities of, attracting, drowning, or poisoning birds.
- All cleaning products used on the site should be environmentally friendly and bio-degradable.
- The operational environmental management programme must include site specific measures for the effective management and treatment of any wastewater to be produced.

Excessive Use of Water

Using large amounts of water, may drain/deplete local reserves used by birds in naturally dry habitats.

The impact has been assessed as being ***moderate (SP = 33)*** before mitigation and ***low (SP = 18)*** significance with mitigation measures recommended:

- Utilise water from sources other than ground-water to clean solar panels as to not deplete local groundwater levels.

Disruption of Bird Movement Patterns

Utility scale solar energy facilities may form a physical barrier to movement of birds across the landscape, and this may alter migration routes and increase distances travelled and energy expenditure or block movement to important areas such as hunting and foraging areas. This potential impact is not yet well understood, is likely to be more significant as a cumulative impact with surrounding developments, is difficult to measure and assess, and therefore mitigation measures are difficult to identify. The ‘lake effect’ could potentially increase with the proposed amendment, evidence supporting this impact is not strong, however.

The impact has been assessed as being ***moderate (SP = 39)*** before mitigation and ***low (SP = 20)*** significance with mitigation measures recommended:

- Where not prescribed by technical or local and international requirements, external lighting to be of an intermittent and coloured nature rather than constant white light to reduce the potential impact on the movement patterns of nocturnal species. Habitat rehabilitation and promoting the regrowth of natural vegetation below the solar panels would reduce the barrier effect to some bird species reluctant to cross unsuitable habitat or cleared vegetation, such as francolins.
- Perimeter fencing must be designed to prevent entrapment of large bodied species such as korhaans between fence rows, giving them sufficient space for take-off, i.e. if a double-layer of parallel fencing is used, the gap between the fences should be large enough to allow for large birds to take-off and leave the area. Where this would result in unacceptable compromises to the security of the site, large-bodied birds should be prevented from entering the gaps between parallel fence rows. Perimeter fence design to be done in consultation with an avifaunal specialist.
- Markers or panel gaps on solar panels to break-up reflections and reduce the 'lake effect'.

7.3.6.4 Closure and Rehabilitation

No impacts assessed.

7.3.6.5 Cumulative Impacts

Approximately 16 solar energy projects in various stages of the EIA application process fall within this 50 km radius of the project site (Table 1 in **appendix B4**). Should 50% or more of these projects be constructed the cumulative impact of the residual impacts may have a significance rating of ***85 (High)***. Depending on the type of solar technology employed and the level of mitigation implemented at each of the developments the cumulative impacts may have had a significance rating of ***65 (Moderate)*** after mitigation.

It is difficult to say with high confidence at this stage what the cumulative impact of all the proposed developments will be on birds as the specifics of the final technologies to be utilised at each site, and levels of habitat rehabilitation within the project sites, is unknown.

7.3.7 Bat

7.3.7.1 Construction

Reduction in foraging habitat due to vegetation clearance

Negative impacts during the construction phase pertain to the clearance of indigenous vegetation from the development area. The vegetation clearing will cause habitat loss and fragmentation, reducing the foraging habitat available to bats in this area. The natural functioning of the ecosystem of the development footprint will be permanently altered.

The impact has been assessed as being ***moderate (SP = 55)*** before mitigation and ***low (SP = 28)*** significance with mitigation measures recommended:

- Vegetation clearance and disturbance of topsoil should be limited to developable areas and minimized as much as possible. Areas to be cleared should be clearly delineated and movement of vehicles should be limited to these areas;
- Upon completion of construction, vegetation rehabilitation should be carried out in areas that were disturbed during construction if the ground surface is no longer in use for the operation of the plants;

Disturbance and displacement due to construction noise and lighting

Construction activities and lighting of the site may cause disturbance and displacement whereby bats will no longer utilize the area and the bat community in the greater area may be altered. If bats have taken to roosting within the more recently built houses/buildings on site, traffic and construction noise may be a disturbance to them.

The impact has been assessed as being ***moderate (SP = 36)*** before mitigation and ***low (SP = 24)*** significance with mitigation measures recommended:

- Construction activities should be reduced as much as possible during the night to limit noise and light disturbance to bats;
- If nocturnal lighting is required during construction, it should be directed and limited to work areas to prevent light spillage; and
- If feasible, warm LED bulbs should be used for site lighting to limit the attraction of insects to the light and in turn prevent a shift in the bat community present in the area.

7.3.7.2 Operation

Barrier effect of PV plants to normal foraging and commuting behaviours

Operation of ten plants will impact the foraging and commuting of bats within and around the development area as the plants have a barrier effect to their normal behaviour and use of the area.

The impact has been assessed as being ***moderate (SP = 52)*** before mitigation and ***low (SP = 27)*** significance with mitigation.

Change of bat community utilizing development area due to security lighting

Security lighting of the plants at night will alter the natural bat community in the area as some species actively forage on insects attracted to light, while other species are deterred from the area by the light.

The impact has been assessed as being ***moderate (SP = 44)*** before mitigation and ***low (SP = 28)*** significance with mitigation.

Collision of bats with PV panels

Collision of bats with PV panels has been assessed as having a **low** pre-mitigation significance rating as bats are not likely to mistake panels as water sources and will typically utilize their established drinking sources. Additionally, bats should quickly learn that the panels are not water sources and leave the area to search for water elsewhere.

The impact has been assessed as being ***low (SP = 12)*** before mitigation and ***low (SP = 6)*** significance with mitigation.

Recommended mitigation measured for the operational phase:

- Lighting of the site during operation should also be directional and limited to only the necessary areas to prevent light spillage, and warm LED bulbs should be used; and
- Searches for bat carcasses on the ground around and beneath the PV panels should be conducted in tandem with searches for bird carcasses. The Environmental Control Officer must freeze bat carcasses and keep a record of the location, date and time of when it was found.

7.3.7.3 Closure and Rehabilitation

Disturbance and displacement due to decommission noise and lighting

The negative impact of disturbance and displacement may result from decommissioning activities due to noise, vehicles moving through the site and additional lighting of the area.

The impact has been assessed as being ***moderate (SP = 36)*** before mitigation and ***low (SP = 24)*** significance with mitigation measures recommended:

- Decommission activities should be reduced as much as possible during the night to limit noise and light disturbance to bats;
- If nocturnal lighting is required during decommission, it should be directed and limited to work areas to prevent light spillage and warm LED bulbs should be used; and

- Upon completion of decommission, vegetation rehabilitation should be carried out over the site to re-establish the natural ecosystem functioning of the development footprint and restore the use of the area by bats.

7.3.7.4 Cumulative Impacts

The renewable energy EIA application database map for the second quarter of 2019 (distributed by Department of Environmental Affairs) was used to identify all renewable energy developments within a 50 km radius of the proposed site. The applications listed as 'approved' or 'in process' are:

- Inyanga solar energy project (75 MW) on Farm O'poort 384
- Three 75 MW Arriesfontein photovoltaic solar power plants on the farm Arriesfontein
- Hydropower station at Boegoeberg dam on the Orange River
- Prieska solar power plant within the Siyathemba Municipality (19 MW)
- Marang solar project on the Blauwbospan No. 113
- PV solar energy facility on the farm Kleinbegin (50 MW)
- 150 MW Ilanga CSP facility
- Karoshoek CSP facility in the Khara Hais municipality (100 MW)
- Kheis solar park 1 and 2 PV project on a site south east of Upington
- Tew Isitha solar 1 and solar 2 facilities (75 MW) in the David Kruiper local municipality
- 86 MW PV solar facility on the farm Rooilyf No. 389
- The operational Bokpoort I PV solar plant

The proposed Bokpoort solar facility amendment and above-mentioned developments will primarily negatively impact bats by reducing foraging areas and roosting resources within the greater area. However, the Orange River and its riparian vegetation is a more important source of drinking water and prime foraging grounds for bats than the surrounding areas that the Bokpoort development is located within. It is essential for each facility to apply site specific mitigation measures recommended by relevant specialists to mitigate the cumulative impacts of renewable energy developments in the region. Thus, the proposed Bokpoort solar facility must adhere to the outlined mitigation measures listed above to reduce cumulative impacts of development in the greater area.

7.3.8 Surface Water

7.3.8.1 Construction

The construction activities could lead to erosion from de-vegetated areas and runoff carrying a high silt load and contaminants such as fuel, hydraulic fluids, degreasing and other chemicals and cement. Due to the very gentle slope, the sandy nature of the soil and the low rainfall in the area, only limited runoff is likely to occur under all but exceptionally high rainfall conditions. The potential surface water impacts during the construction phase have been assessed as being of ***moderate (SP = 40)*** significance. The following measures are recommended to reduce the potential impacts further to a ***low (SP = 21)*** significance:

- Construct pollution control systems such as bunded areas, and runoff control systems such as diversion berms and water collection areas such as the process water/evaporation dam first, before undertaking any other activities;
- Construct berms down-gradient of construction areas to collect dirty runoff. Allow silt to settle, examine for contamination with oil and/or hydraulic fluids. Remove contaminated material monthly for remediation or appropriate disposal in accordance with prevailing legislation. Clean silt can be used during re-vegetation of bare areas;
- Place drip trays under vehicles when parked;
- Service vehicles in a workshop, not in the field;
- If in-field refuelling is done from a tanker, it should be done in a designated dirty area and a spill kit and clean-up team must be available on site;
- Spillages should be cleaned up immediately and contaminated soil must either be remediated in situ or disposed of at an appropriately licensed landfill site;

- Potentially contaminating wastes (empty containers for paint, solvents, chemicals, etc.) and cement should be stored in bunded areas until removed by a reputable contractor for disposal at an appropriately licensed site;
- Provision of adequate sanitation facilities in the form of chemical toilets that are serviced regularly; and
- Providing environmental awareness training for workers on site.

7.3.8.2 Operation

Once operational, the 200MW Ndebele and Xhosa PV Plant installation will require a slight change in water demand which will be affected positively with the total demand changing to 0.22 million cubic metres per annum (Mm3/a) (10 x 0.022 Mm3/a) for the 10 PV solar facilities instead of the 0.3 Mm3/a (0.25 + 2 x 0.025 Mm3/a) for the CSP and two (2) PV solar facilities. During the operational phase there is a possibility of increased Spillage of fuels, lubricants and other chemicals from the BESS. The installation and operation of the PV plants will result in the creation of some relatively small impervious areas (e.g. buildings, roads and the surfaces of the PV panels). Such areas will not have a large enough footprint to affect the overall infiltration rate on site significantly. Vehicular movement between the solar panels will disturb the sandy soil surface, but it will not reduce the infiltration rate significantly, because sand is resistant to compaction,

Cyanobacteria are known to cause biological crusting in the arid Kalahari Basin. Such crusts provide nutrients to desert plants. They are constantly disturbed by the movement of game and livestock, but they re-establish rapidly and there is no evidence that they interfere with infiltration. It is thus unlikely that localised runoff from such small footprints, with spaces in between large enough for vehicular access for cleaning and maintenance purposes, will result in an accumulation of runoff that would cause erosion and migrate off site.

The potential surface water impact during the construction phase has been assessed as being of ***moderate (SP = 45)*** significance. The following measures are recommended to reduce the potential impact to one of ***low (SP = 27)*** significance:

- Remove settled silt from runoff control berms regularly, examine for contamination with oil and/or hydraulic fluids. Subject contaminated material to remediation or appropriate disposal in accordance with prevailing legislation. Clean silt can be used during re-vegetation of bare areas.
- Place drip trays under vehicles when parked.
- Service vehicles in a workshop, not in the field.
- Spillages should be cleaned up immediately and contaminated soil must either be remediated in situ or disposed of at an appropriately licensed landfill site.
- Potentially contaminating wastes (empty containers for paint, solvents, chemicals, etc.) and cement should be stored in bunded areas until removed by a reputable contractor for disposal at an appropriately licensed site.
- Provide environmental awareness training for workers on site.
- Clean-up of spills as soon as they occur.
- Maintenance of the abstraction pumps to prevent spills.
- Maintenance of the BESS to ensure optimal functionality and prevent fire risks.
- Maintenance and quality control of firefighting equipment and systems.
- Mitigations for spillage or leakages will include bunded areas to store chemicals and/or fuel, containerisation of the BESS and cleaning up spills as soon as they occur.

7.3.8.3 Closure and Rehabilitation

The closure and rehabilitation phase will be of shorter duration than the construction phase. The potential impacts will be similar and similar remediation measures are recommended to reduce the assessed impacts from a ***moderate (SP = 40)*** to a ***low (SP = 21)*** significance. Demolition of containment systems such as the bunded areas should take place after all other structures have been removed.

7.3.9 Groundwater

7.3.9.1 Construction

The groundwater quality can be impacted by spillage of fuels, lubricants, chemicals from construction equipment, vehicles and temporary workshop during the construction phase or from leakage from the BESS. Mitigations for spillage or leakages will include bunded areas to store chemicals and/or fuel, containerisation of the BESS and cleaning up spills as soon as they occur. With proper mitigations in place the significance of the impact is likely to be low. Increased runoff due to vegetation removal will cause a decrease in infiltration into soil and consequently decrease recharge to the underling aquifer. Based on the Groundwater Resource Directed Measures (GRDM) the recharge within the D73D quaternary catchment is low (3.6 mm/a). The extended project area is relatively small (~1500 hectares for the total site and 150 hectares per PV Plant) and increased runoff is expected to be low and sustainable drainage systems (SuDS) can also be implemented to manage the storm water thus lower the impact of increased runoff.The potential impact is assessed as being of ***moderate (SP = 40)*** significance. It can be reduced to one of ***low (SP = 24)*** significance by:

- Clean-up of spills as soon as they occur.
- Mitigations for spillage or leakages will include bunded areas to store chemicals and/or fuel, containerisation of the BESS and cleaning up spills as soon as they occur.

7.3.9.2 Operation

If leakage from the BESS reach the groundwater, contamination can be expected. unsatisfactory water quality (containing elevated counts of microbiological determinants or metal concentrations for example) is used to clean the solar cells this could infiltrate into the subsurface and possibly pollute the groundwater. It is expected that without mitigation a ***moderate (SP = 65)*** and which can be reduced to ***low (SP = 16)*** significance by:

- Clean-up of spills as soon as they occur.
- Maintenance of the Battery Energy Storage System to ensure optimal functionality and prevent fire risks
- Maintenance and quality control of firefighting equipment and systems.
- Mitigations for spillage or leakages will include bunded areas to store chemicals and/or fuel, containerisation of the BESS and cleaning up spills as soon as they occur.

7.3.9.3 Closure and Rehabilitation

Following the hydrocensus and data obtained from the GRDM the groundwater level ranges from ~25 m bgl to ~ 45 m bgl. Infiltration potential/ aquifer vulnerability is classified as having low environmental significance due to deeper groundwater level conditions which allow for a large unsaturated zone above the groundwater level which can naturally attenuate any infiltering leakage or spills. Unsaturated flow conditions within the upper weather zone/ unsaturated zone also involves slower movement of moisture allowing for longer periods of time for natural attenuation to occur. Remediation measures are recommended to reduce the assessed impacts from a ***moderate (SP = 40)*** to a ***low (SP = 15)*** significance. Demolition of containment systems such as the PCD and bunded areas should take place last, after all other structures have been removed.

7.3.10 Visual

The vast majority of receptor locations are located greater than 10km distant from the facility and are predominantly located along the Orange River (within the Orange River corridor). Accordingly, a potentially significant distance between the solar facility components and the majority of the receptor locations is present. In this addendum report distance banding from the proposed facility footprint has been used to determine the zone of likely visual exposure to the facilities into which the respective receptor locations would fall. Increasing distance from the proposed facility footprint has been used to give an indication of the likely visibility or potential degree of visual exposure to the solar plant developments from different parts of the study area. The following zones (distance bandings) have been utilised:

- <2km – zone of high potential visual exposure
- 2km-5km – zone of moderate potential visual exposure
- 5km-10km – zone of low potential visual exposure
- >10km – zone of marginal / negligible visual exposure

It is very important to note that all but one of the (sensitive) receptor locations located within a distance of 10km of the proposed development fall into the zone of low potential visual exposure. The Bokpoort Farmstead is the only receptor location that is situated within the zone of moderate to high visual exposure. This receptor location is located within the viewshed of the development (Figure 32 & Figure 33); it is located on an isolated hillside (Photograph 5) with an aspect that faces in a northwards arc towards the development site. The raised position of the farmstead in relation to the surrounding plains entails that it is exposed to a clear view of much of the terrain (refer to Photograph 6).

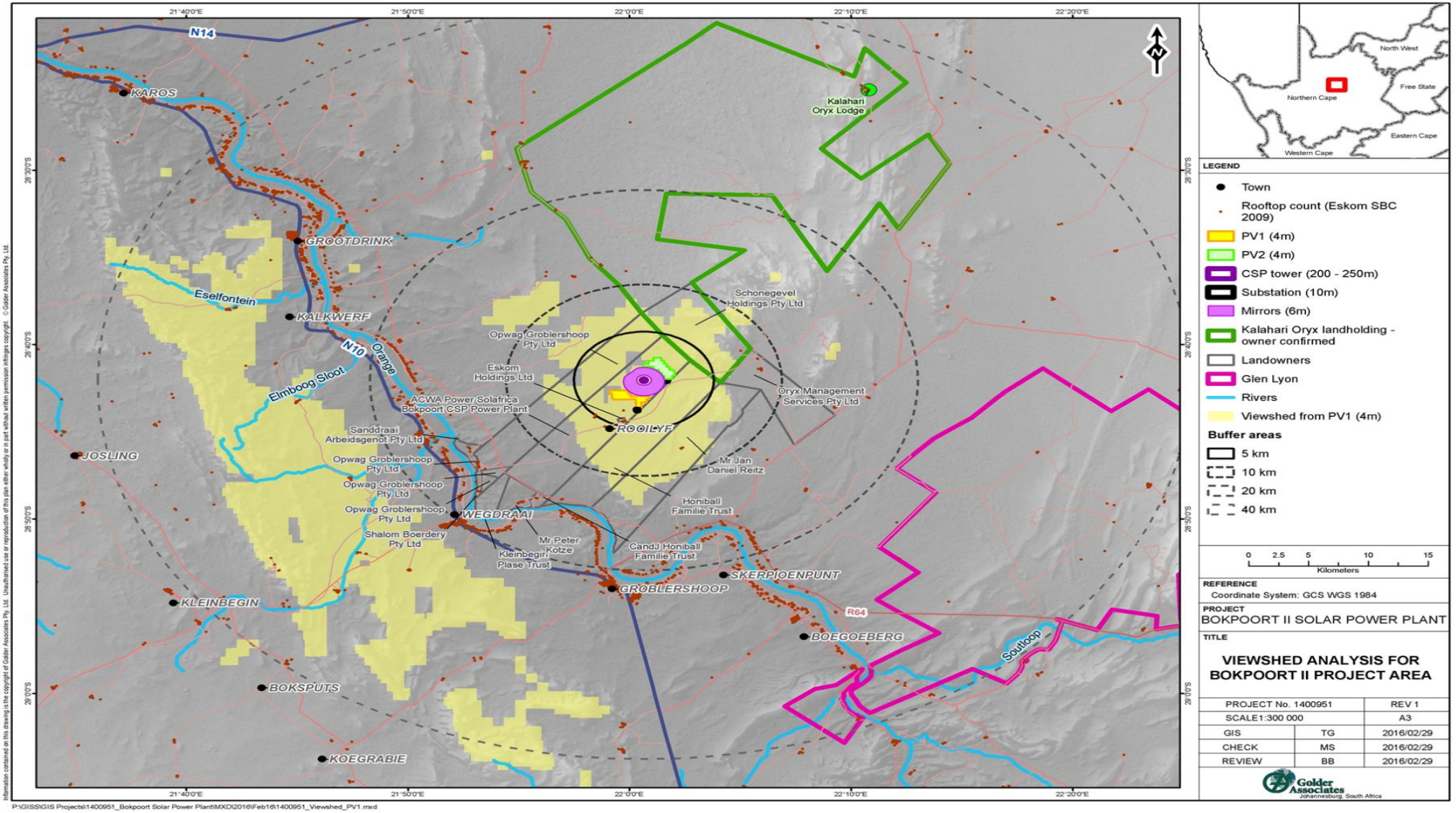

Figure 32: Viewshed Analysis undertaken as part of the original Visual Impact Assessment for the original PV1 component – representative of the southern part of the development site

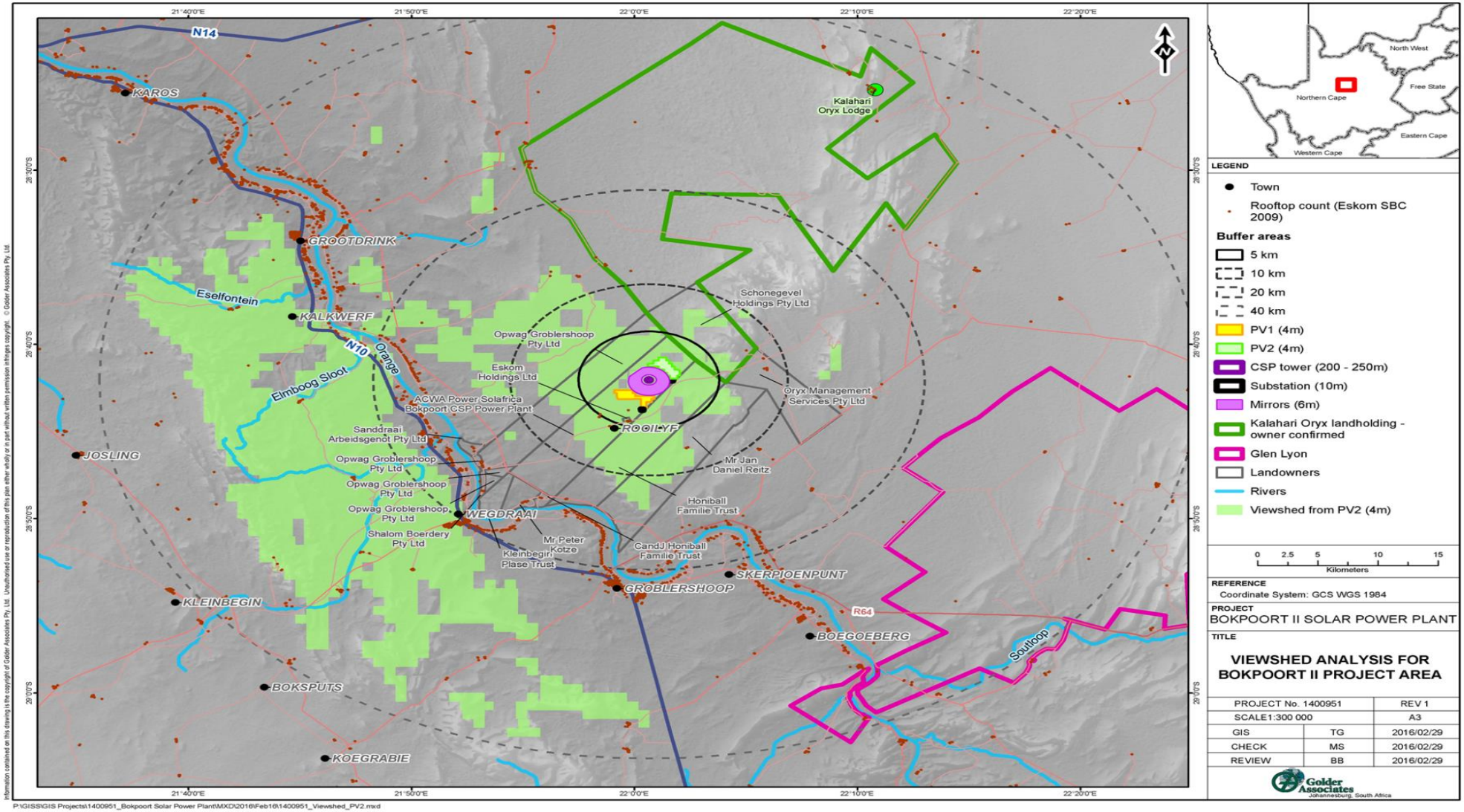

Figure 33: Viewshed Analysis undertaken as part of the original Visual Impact Assessment for the original PV2 component – representative of the northern part of the development site

Photograph 5: The Bokpoort Farmstead viewed from the Sanddraai Property to the west. Note the elevated position of the farmstead in relation to the surrounding terrain.

Of the six other sensitive receptor locations located within a distance of 10km of the development site, ***none*** are located within the viewshed of either the northern or southern part of the development (Figure 32 and Figure 33), thus meaning that **none of these 6 receptor locations will be exposed to any views of the proposed development**. Parts of the 5-10km radial area around the proposed development are located within the viewsheds of the development, in particular the viewshed of the northern part of the development which covers a greater area as the northern part of the development is located on higher-lying ground than the southern part of the development footprint. However significant parts of the radial area fall outside of the viewshed of the proposed development (Figure 32 and Figure 33). This is largely due to the presence of hilly / mountainous terrain located within the north-eastern and eastern parts of the 10km radial area. This higher-lying terrain screens much of the 10km radial area in which the receptors are located, blocking views towards the site footprint.

Beyond the 10km radial area the visual exposure factor associated with the proposed plant would be minimal and twinned with the absence of visibility of the plant in large areas where receptor locations are clustered, in particular along the Orange River corridor would result in a negligible visual impact. Most of the Orange River corridor lies outside of the viewshed of the development, and accordingly will not be visually affected by the proposed development.

When non-static receptor locations are considered, the visual intrusion factor of the development will be very low to negligible. The only public access located in the 10km radial area is a short section of the Gariep District Road. This, and the other stretches of the road are located outside of the viewsheds of the development (Figure 32 and Figure 33), and thus will be exposed to no visual exposure to the proposed development.

Photograph 6: View in the direction of the development site from the raised portion of the Gariep District Road that crosses the Transnet Railway; neither the Bokpoort 1 Solar Plant or the proposed development area would be visible.

Overall, the degree of visual intrusion associated with the proposed development components is likely to be low at worst, with the distance between most of the receptor locations and the development site being the greatest contributing factor, twinned with the non-visibility of the development in large parts of the study area. The proposed development is thus very unlikely to result in the creation of a visual impact, or perceptions of visual impact by people inhabiting the sensitive receptor locations in the 10km radial area or moving transiently within the area. Twinned with the presence of the Bokpoort 1 CSP Plant and the Eskom Garona Substation the proposed solar development will add to the presence of large-scale power generation infrastructure in the study area, but which due to its remote location and the low density of human settlement will not generate any degree of visual exposure beyond that which is very low, thus being unlikely to generate any visual impacts. PV arrays are not typically associated with glint or glare as the PV surfaces are non-reflective, and only the metal supports could potentially cause glare, thus greatly reducing the potential for glint or glare-related impacts. Thus, glint and glare associated with the proposed development is unlikely to be a visual impact-related issue.

In order to assess the impact of lighting at the proposed solar power station facility, it is necessary to explore the nature of the night-time environment in the study area. Most parts of the study area are highly rural in nature with a very low density of human settlement. Accordingly, the night-time environment within the wider area is thus characterised by few sources of artificial lighting. Where these occur, these are highly localised. The location of the viewer is important as viewers located in low-lying terrain settings (such as in the Orange River valley) would not be able to view the lights in the surrounding area. However, viewers in higher lying settings, such as certain of the receptor locations on higher-lying ground closer to the N10 national road

west of the Orange River valley would be able to view a greater area, and thus see the light sources in this wider area (including the ground to the east of the river).

The primary sources of lighting are floodlights that illuminate on a permanent (nightly) basis in a number of the small settlements located along the N10 including Wegdraai, Saalskop and Grootdrink to the north as well as in certain parts of Groblershoop and the settlement of Boegoeberg to the south. A number of these very tall floodlights provide general illumination for these respective settlements in the absence of (lower) street lighting. The height of these lights makes them highly visible in an otherwise dark night-time context. When viewed from a high point the effect is of 'islands of light' in an otherwise very dark, unlit night-time context.

The Bokpoort 1 CSP Plant has introduced a further set of lights into this dark environment and is the only really visible source of light on the eastern side of the Orange River (when viewed from afar). The Bokpoort 1 CSP Plant is located relatively far from the Orange River and cannot be discerned from the higher points on the western side of the Orange River during the day. However, a set of lights at the power plant is visible from higher-lying terrain to the west of the river. A collection of lights is visible at the plant's location. These lights are likely to be tall, floodlight-type lights in order to be viewed from the higher lying areas to the west of the river. This set of lights adds to the few sources of lighting visible in the wider area.

It should be noted that it is not known what type of lighting is planned at the proposed facility. However, if similar type of lighting was developed at the proposed facility, the relative proximity of the proposed facility to the Bokpoort 1 CSP Plant when viewed from the area to the west would effectively add to the cluster of lighting that is already visible in this part of the study area. The number of lights as visible could more than double. The degree of visibility of lighting would depend on the height of the lights, the degree of illumination (strength) and their orientation. It is important to note that lighting at the proposed plant may not become a permanent feature of the light time environment if it is not operated on a permanent (nightly) basis, and only used in case of emergency maintenance requirements.

The generation of dust plumes could constitute a visual impact, although it would only be a transient impact that is dependent on atmospheric factors such as wind. Dust plumes associated with the proposed development that could become problematic in a visual context could be generated in two ways:

- By the clearing of vegetation on the development site during construction, leaving the underlying soils exposed, and through the subsequent movement of construction vehicles or through bulk earth moving activities.
- By construction traffic along the access roads to the development site, which would likely be the Gariep District Road and the Transnet Access road, both of which are not tarred and from which dust would be generated.

The study area is located in an arid environment, and thus the generation of dust is not necessarily incongruent in this setting. The risk of excessive dust creation relates to the potential vegetation clearing across the entire development footprint, rather than the phased clearing of vegetation. It is accepted that vegetation across most of the development footprint will need to be cleared but should the entire development footprint be cleared of vegetation at the start of the construction period, this will leave the underlying soils exposed over a very large area for a relatively long period of time. In particular in the northern parts of the site where sandier soils as opposed to gravelly substrate is encountered, the risk of mobilisation of this substrate by wind would be high.

The visual impacts associated with such increased dust plume creation would be ameliorated by the same factors that will ameliorate the degree of visual impact associated with the proposed PV plant infrastructure – i.e. the remote location of the site twinned with the topographical characteristics of the area that entail that the development site would not be visible from large parts of its surrounds and the distance of sensitive receptors from the site. In this regard dust plumes generated on the development site are unlikely to be

perceived as a source of visual impact, nonetheless mitigation needs to be applied to prevent this impact from occurring.

The Gariep District Road is an unsurfaced (untarred) road and accordingly dust is typically generated by vehicles travelling along it. Dust generation on the road, however has in the past proved to be a contentious issue in the context of the construction of the Bokpoort Solar Power Plant and the large number of construction vehicles that travelled along the road and which generated large volumes of dust. The objections from local farmers and land owners were centred on the adverse impacts of the depositing of large volumes of fine dust on the vegetation surrounding the road that allegedly greatly reduced the palatability of the vegetation and the overall grazing capacity of the veld. The transport of components of the proposed PV plant developments by road would result in a highly significant daily increase in the volume of heavy vehicle traffic along the road, which would last for much of the duration of the construction period. In this context the generation of dust plumes by a large increased volume of heavy vehicle traffic may be perceived as a negative visual intrusion in conjunction with negative perceptions regarding dust-related grazing impacts, as well as road safety concerns.

A different set of receptors to those potentially affected by the development footprint would potentially be exposed to the dust plumes generated by construction traffic along the Gariep District Road. If construction traffic approached the development site from the south-east – i.e. from the N8 National Road – a number of farmsteads, including three farmsteads located close to the road, and a greater number along the opposite side of the Orange River – would be exposed to the regular dust plumes generated by construction vehicles. Though not necessarily significant as an impact on its own, the visual intrusion of the dust plumes could be perceived to have significant nuisance value in combination with negative perceptions of adverse effects on vegetation and concerns relating to road safety. It is important that mitigation be implemented to reduce the impact and extent of dust generated by the large numbers of construction vehicles that will need to use this road to access the site.

Dust plumes generated along the Transnet Rail access road could have a similar visual effect, but apart from a short stretch of the road located close to the Gariep District Road. This road is remote from any areas of public access and dust plume-related impacts will be mitigated by the distance factor in a similar manner to dust plumes generated on the development site.

7.3.10.1 Construction

Local residents and travellers along local roads will initially see vehicles transporting personnel, equipment and materials to the Bokpoort II site. Dust plumes resulting from travel along unpaved roads and earthmoving activities on the site would be visible from distances of several kilometres.

The solar panels are expected to be 4.5 metres. Although it will be theoretically visible from as far as 40 km, it will not be prominent to the naked eye from distances in excess of 10km. The construction site would not be visible to the vast majority of the receptor locations in the study area, and thus would not cause any visual impact for the majority of the study area. No lighting impacts are anticipated in the construction phase as all construction is expected to occur during daylight hours. The construction site would not be visible to the vast majority of the receptor locations in the study area, and thus dust plumes generated at the construction site would be unlikely to cause any visual impact for the majority of the study area. Large numbers of heavy construction vehicles will need to access the site along public access routes to transport infrastructure components to the site. Such a large number of vehicles will greatly increase the volumes of traffic compared to the ambient traffic volumes on the Gariep District Road. Each vehicle could create a dust plume that could constitute visual intrusion or nuisance factor that could be negatively perceived by adjacent landowners in addition to concerns regarding vegetation impacts and road safety.

The visual impact is assessed as being of ***moderate (SP = 30)*** significance. The following mitigation measures are recommended to reduce the impact to one of ***low (SP = 15)*** significance:

- clearing of vegetation only be undertaken in a phased manner, so as to prevent the large-scale exposure of soils and substrate that could result in a large visual contrast compared to the surrounding vegetation. so as to also prevent the large-scale exposure of soils and substrate that could result in large-scale mobilisation of unconsolidated substrate by wind.
- Dust suppression measures must be implemented on the construction site and especially on road stretches located within 500m of households / farmsteads located close to the access route.
- Bulk earthworks must not occur on (forecast) very windy days.

7.3.10.2 Operation

The PV arrays would not be visible to the vast majority of the receptor locations in the study area, and thus would not cause any visual impact for the majority of the study area. Lighting at the Solar Power Plant could create a visual impact on the night-time environment by introducing new sources of lighting to a relatively unlit night-time environment. This impact would be more pronounced if lighting sources were permanently lit at night and if floodlight-type lighting was used. The visual impact of the installation during the operational phase is assessed as being of ***moderate (SP = 56)*** significance. The following mitigation measures are recommended to reduce the impact to one of ***moderate (SP = 36)*** significance:

- Within linear servitudes and on the development site, all cleared areas during the construction phase that will not form part of the plant footprint, including power line and pipeline servitudes should be rehabilitated and replanted with grass or low shrubs with non-invasive root systems, in order to avoid the creation of areas devoid of vegetation that may be visible from receptor locations.
- Lighting of the plant at night should be limited to security lighting (where this is necessary), and emergency operational lighting must only be lit when required.
- The height of any lights should be limited; more lights of lower height should be installed rather than fewer floodlights that would be visible from a wider area.
- All lighting should be downward, and inward facing (towards the plant), to avoid light spill into surrounding areas.

7.3.10.3 Closure and Rehabilitation

The site would not be visible to the vast majority of the receptor locations in the study area, and thus dust plumes generated at the closure site would be unlikely to cause any visual impact for the majority of the study area. The visual impact is assessed as being of ***moderate (SP = 18)*** significance. The following mitigation measures are recommended to reduce the impact to one of ***low (SP = 16)*** significance:

- Wet suppression of dust generation, especially on dry, windy days;
- Continued monitoring of dust fall;
- Re-vegetating bare areas with locally indigenous grasses and forbs as soon as possible;
- Using motion activated security lighting, where practical, to avoid unnecessary constant illumination; and
- Avoid unnecessary vehicle trips at night.

7.3.10.4 Cumulative Impacts

- The proposed development will be located immediately adjacent to the Bokpoort Solar Power Facility, so when viewed from the surrounds it will form part of a visual environment that is already transformed from a natural context. The proposed development will add to the transformation of the landscape in the local area, thus increasing the cumulative visual effect on the landscape. However, the remoteness of the location lowers the overall cumulative visual impact in a wider study area context.
- The proposed development will be located immediately adjacent to the Bokpoort Solar Power Facility and lighting at the new plant would increase the number of lighting sources able to be viewed from this area. Permanent lighting at the new plant would thus increase the number of light sources, albeit in a cluster rather than adding diffuse lighting sources to the landscape, further altering the overall dark night time environment to a more lit one.

- Generation of dust plumes is not incongruous to this hot arid environment, but the area surrounding the development site is not characterised by the large-scale generation of large dust plumes on a regular basis. Such an impact would not further an existing impact.

7.3.11 Heritage

7.3.11.1 Construction

As no sites, features or objects of cultural significance are known to exist in the development area, there would be no impact as a result of the proposed development. Should any heritage artefacts be exposed during excavation, work on the area where the artefacts were discovered, shall cease immediately and the Environmental Control Officer shall be notified as soon as possible. All discoveries shall be reported immediately to a heritage practitioner so that an investigation and evaluation of the finds can be made. Acting upon advice from these specialists, the Environmental Control Officer will advise the necessary actions to be taken. Under no circumstances shall any artefacts be removed, destroyed or interfered with by anyone on the site; and contractors and workers shall be advised of the penalties associated with the unlawful removal of cultural, historical, archaeological or palaeontological artefacts, as set out in the National Heritage Resources Act (Act No. 25 of 1999), Section 51.(1).

7.3.11.2 Operation

the assessment has determined that no sites, features or objects of heritage significance occur in the study area. Therefore, no impacts are foreseen during this phase.

7.3.11.3 Closure and Rehabilitation

There is almost no possibility of finding any previously undiscovered resources on the previously disturbed areas during the closure and rehabilitation phase.

7.3.11.4 Cumulative Impacts

The cumulative impact of the proposed Bokpoort project is assessed by adding impacts from this proposed development to existing and other proposed developments with similar impacts within a 60 km radius. The existing and proposed developments that were taken into consideration for cumulative impacts include a total of six other plants and are listed in Table 41. From the map ‘South African Generation Projects’ (Figure 34) below, it can be seen that the Bokpoort project is located in an area where little such development has taken place, with the implication that the cumulative impact would be very low.

Table 41: Existing and planned alternative energy generation facilities in the larger region

Name	Nearest Town	Technology	Capacity	Status
Bokpoort	Groblershoop	Concentrated Solar Thermal	50MW	Fully operational
Eskom	Upington	Concentrated Solar Thermal	100MW	Awaiting construction
Grootdrink	Upington	Solar PV	?	Proposed
Karoshoek	Upington	Concentrated Solar Thermal	100MW	Awaiting construction
Tewa Isitha	Upington	Solar PV	?	Proposed
Upington	Upington	Solar PV	8.9MW	Fully operational

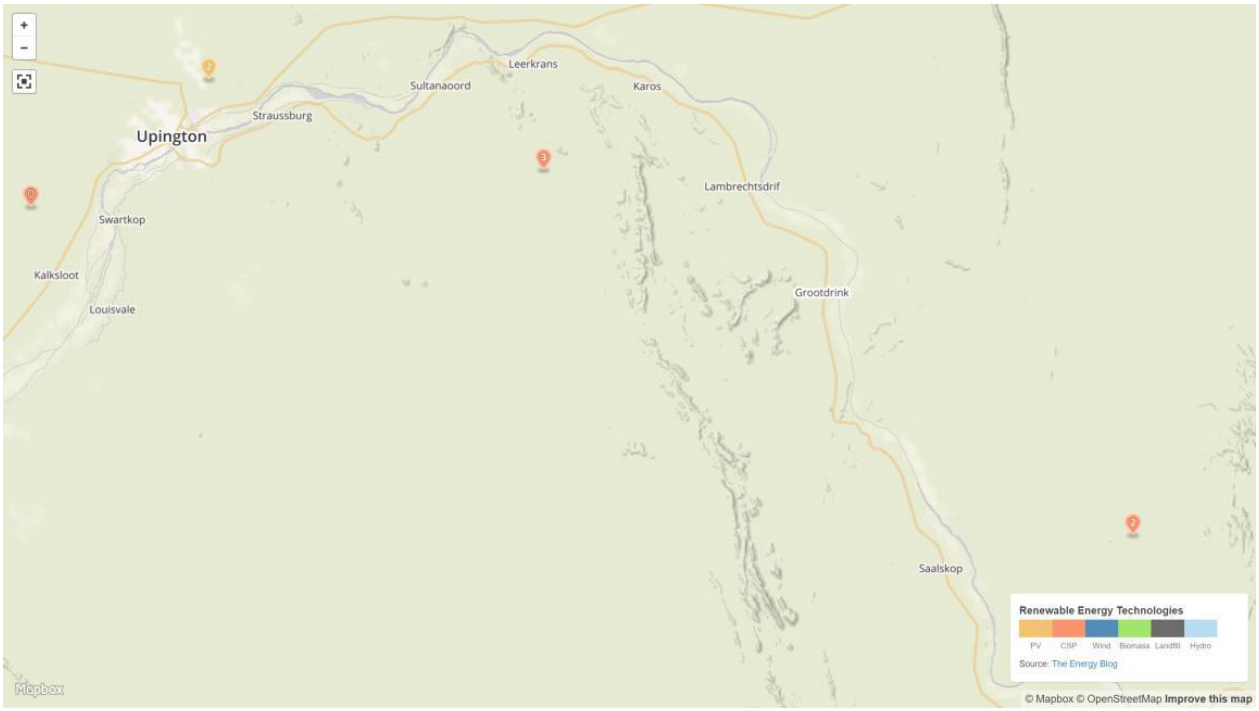

Figure 34: Map indicating the location of alternative energy generation facilities in the larger region[85]

The cultural heritage profile of the larger region is very limited. Most frequently found are stone artefacts, mostly dating to the Middle Stone Age. Sites containing such material are usually located along the margins of water features (pans, drainage lines), small hills and rocky outcrops. Such surface scatters or 'background scatter' is usually viewed to be of limited significance (Orton 2016)[86]. In addition to the Stone Age profile, there is also the colonial element. This manifests largely as individual farmsteads, in all its complexity, burial sites and infrastructure features such as roads, railways and power lines, which occurs only in limited numbers. This again has the implication that the cumulative impact would be very low.

7.3.12 Palaeontology

7.3.12.1 Construction

The Precambrian metamorphic bedrocks underling the study area at depth are unfossiliferous while the overlying Late Caenozoic superficial sediments are generally fossil-poor. As a consequence of the paucity of irreplaceable, unique or rare fossil remains within the development footprint the overall impact significance of the construction phase of the proposed solar energy project is assessed as ***low (SP = 16)*** without mitigation, and ***very low (SP = 8)*** after mitigation:

- Monitoring of all substantial bedrock excavations for fossil remains by Environmental Control Officer on an ongoing basis during construction phase, with reporting of any substantial new palaeontological finds (notably fossil vertebrate bones & teeth) to SAHRA for possible specialist mitigation.

7.3.12.2 Operation

No significant further impacts on fossil heritage are anticipated operational phase of the solar power facility.

7.3.12.3 Closure and Rehabilitation

No significant further impacts on fossil heritage are anticipated closure phase of the solar power facility.

[85] *https://www.energy.org.za/map-south-african-generation-projects-accessed 27/01/2020*
[86] *Orton, J. 2016. Prehistoric cultural landscapes in South Africa: a typology and discussion. South African Archaeological Bulletin 71:119-129*

7.3.12.4 Cumulative Impacts

Given the low impact significance assessed for all solar energy developments concerned which are all underlain by very similar geology, it is likely that cumulative impacts associated with the development are **low**. Very few palaeontological impact assessments for other developments in the wider project area near Groblershoop have been undertaken (SAHRIS website); one exception - for solar projects on the farm Sand Draai by Bamford (2016)[87] - also concluded that the palaeontological sensitivity of the region is low.

7.3.13 Traffic

7.3.13.1 Construction

The envisioned impact of the PV facilities during the construction phase on the surrounding road network includes:

a) Deterioration of road network condition

The increase in traffic, and especially of vehicles carrying heavy loads will cause an increase in deterioration of the road network. The heavy vehicles are unlikely to have a significant impact on the National roads (N10, N14 and N8) as these roads have been built to high standard to carry heavy loads over a long design period. The surrounding gravel road network (Gariep and Transnet Service Roads) have not been designed to carry many repetitions of heavy loads as they cater specifically for local farmers and for the maintenance access to the Sishen-Saldanha railway line. There is a high possibility that the gravel roads will sustain damage during the construction period. The significance of the impact is reduced from a **moderate** impact **(*SP = 50*)** before mitigation to a **low** impact **(*SP = 24*)** with the following mitigation:

- The Transnet Service Road must be re-gravelled (150 mm thick over width) before construction commences of the PV facilities. The prevention of dust, maintenance of the gravel road and re-gravelling of the road to be coordinated with Transnet. Once re-gravelled, the road should be regraded on a monthly basis to prevent the deterioration of the road condition.

b) Increase in dust

This impact is only applicable to the gravel roads. Dust is generated due to heavy vehicles and high speeds; therefore, the impact is more significant during the construction phase than during the operational phase. Farmers in the area are concerned about potential dust generated due to the increase in vehicles on the nearby roads. Transnet is also concerned regarding dust on their railway lines.

Dust impacts will be reduced from a ***moderate (SP = 50)*** to a ***low (SP = 18)*** significance by regularly (at least daily, depending on the wind intensity and direction as well as rain conditions) suppressing the dust especially in the road section adjacent to the Bokpoort I Plant and proposed PV facilities.

c) Increase in traffic volumes impacting on LOS

The increase of traffic during the peak hour of 90 vehicles for simultaneous construction i.e. a maximum of 3 PV facilities being constructed at one time, will have a significant impact on the LOS of the roads or intersections during the construction period, with the LOS being maintained at a LOS D for the southern approach (Gariep Road) at the Gariep/ Transnet Service Road intersection. The entire intersection, however, will maintain a LOS A for the simultaneous construction of the PV facilities.

The intersection was analysed for different scenarios for the construction period with the worst case being the simultaneous construction of the PV facilities as well as the Sanddraai Solar Plant. Regarding the worst-case scenario, the southern approach of the intersection will operate at a LOS E for the duration of the construction period due to high volume of vehicles as well as the dust generated.

[87] *BAMFORD, M. 2016. Palaeontological Impact Assessment for the proposed CSP and PV plants on the farm Sand Draai, near Groblershoop, Northern Cape Province, 5 pp.*

The impact significance before mitigation is **moderate (*SP = 60*)** and of a **low** significance **(*SP = 16)*** with mitigation, provided the following measures are implemented:

- The delivery of materials and equipment by trucks can be phased through the day to the reduce the impact the trucks have on traffic congestion and dust generation. The delivery of materials/ equipment by abnormal vehicles, must be scheduled during off-peak periods in order to have the least impact on traffic conditions.
- As far as possible, construction traffic should follow the route via Upington and Gariep Road northbound and avoid using the northern section of the Gariep Road between the N14 and the Transnet Service Road.
- On-site accommodation may be provided, and transport arranged for the labourers on site, to reduce the traffic volumes using the gravel roads (Gariep Road and Transnet Service Road).

d) Deterioration of road safety conditions

Road safety deterioration is due to dust and speeding, causing drivers to lose control on the gravel roads. As a result of the upgrade of the Gariep Road for the construction of Bokpoort I Plant, drivers are able to reach high speeds exceeding the recommended 80 km/ hr speed limit. High speed accidents and fatalities has occurred, including some of the construction staff.

The speed limit must be managed by the local Traffic Police on the Gariep Road, this will increase the road safety and minimize the dust impact on the farms along this section of the road and will reduce the significance of the impact from **moderate (*SP = 32*)** to **low (*SP = 18*)**.

7.3.13.2 Operation

The operational phase will not generate heavy vehicle volumes when compared to the construction phase and the impact will be of a ***low significance (SP = 16)*** before and after mitigation.

7.3.13.3 Closure and Rehabilitation

The traffic activities will be similar to those of the construction phase, but by the time of closure, it is highly likely that the local access roads will have been paved and the traffic will have an impact of ***moderate (SP = 40)*** significance, which can be mitigated to one of ***low (SP = 16)*** significance by implementing the following recommended mitigation measures:

- Using only vehicles that are in good working condition;
- Ensuring that loaded vehicles are not too heavy for the road surfaces; and
- Appropriate speed limits are enforced by the local Traffic Police.

7.3.14 Socio-Economic[88&89]

7.3.14.1 Construction

- Employment opportunities - construction of the PV plants will take about 12 - 18 months and provide about 100 to 250 employment opportunities, which has been assessed as a positive **moderate** impact ***(SP = +30)*** without mitigation and a positive **moderate** impact ***(SP = +40)***.
- Population influx - as news regarding the proposed project spreads, expectations regarding possible employment opportunities may take root. Consequently, the area surrounding the site may experience an influx of job seekers. On the Remaining Extent of the Farm Bokpoort 390, construction of the Bokpoort I facility has recently been completed and there has been an influx of people and heavy equipment to the south of the project area. The proposed project would similarly result in the influx of potential job seekers to this area. Population influx is rated as a **moderate** impact ***(SP = 52)*** before mitigation and **moderate** ***(SP = 30)*** with mitigation.

[88] *Schlechter, M., & Baxter, B. 2016. Final EIA Report: Proposed 75MW Photovoltaic (PV1) Solar Development on the Remaining Extent of the Farm Bokpoort 390, Northern Cape. Golder Associates. Ref 14/12/16/3/3/2/881.*
[89] *Smith, T; de Waal, D. 2016. Socio-economic Impact Assessment for the proposed 75 MW Photovoltaic (PV2) Solar Facility (Bokpoort II Solar Development). Golder Associates Africa (Pty) Ltd.*

- Economic benefits - as this is a small-scale operation, the economic benefits associated with the proposed project are expected to be somewhat limited but nevertheless positive. Agriculture, forestry and fishing (33%) and Wholesale and retail trade, catering and accommodation (19%) are the highest GVA in the !Kheis LM as of 2010. Renewable solar activities will enhance this contribution and is likely to have multiplier effects at regional and national level. This impact is rated as a positive **moderate** impact ***(SP = +39)*** before mitigation and positive **moderate** ***(SP = +64)*** with mitigation.
- Change in land use - should the project be commissioned, the land use will change from grazing land to solar energy production. The site will be cleared of all vegetation during the construction phase and top soil will be subjected to wind erosion, possibly resulting in displacement for other land uses during the project's construction and operational phases. This impact is rated as **moderate** ***(SP = 52***) before mitigation and **moderate** ***(SP = 30)*** with mitigation.

The following mitigation measures are proposed:

- Appointing one or more community liaison officers to manage the interaction with the neighbouring residents, other members of the public and the authorities.
- Source local labour as far as possible with an emphasis on employing youth and women.
- If specific skilled positions cannot be sourced within the local municipality, they should be sourced at district, province or national level first before looking at international workers.
- Development of recruitment and procurement policies for ACWA Power and all Contractors, which include maximising the usage of local service providers and utilisation of local labour should be a key requirement in the tender documentation.
- Launch an awareness/ educational campaign in conjunction with the local municipality and health authority to address the social and health issues in the local communities associated with the influx of foreign workers.
- Communicating information regarding the transport routes, peak operational times, associated hazards and precautionary measures to the Ward councillor as well as any relevant community organisations;
- Ensuring that project information is communicated formally, consistently and responsibly to avoid misunderstandings and the creation of unrealistic expectations.
- Setting up a formal grievance mechanism for the public to lodge issues. All complaints must be recorded, followed up and resolved as expeditiously as possible.
- Preventing the development of ad-hoc roadside dwellings, shops and so forth on or adjacent to the project site.
- The Contractor, in line with the relevant socio-economic focus of the !Kheis LM and ACWA Power's personnel policies, must develop an appropriate exit strategy for temporary employees.
- Construction traffic past community infrastructures such as schools, crèches, sporting facilities, etc. must be properly managed and the rules of the road should be strictly enforced.
- Limiting construction-related road use to daylight hours and avoiding the movement of heavy vehicles during peak traffic hours as far as practicable.
- Developing a database of local job seekers, with skills levels and employment history, before commencing with personnel recruitment for the operational phase.

7.3.14.2 Operation

The operational phase will require about 20 - 40 employees. Job creation in the medium to long-term during the operational phase is generated by operational components including security, drivers, administration, and operator's positions. This means that local communities can potentially take maximum advantage of any potential employment opportunities to be created by the proposed activities. It should be noted that some positions may require scarce skills, which may not be readily available in the labour sending area. Therefore, a certain percentage of the workforce will potentially be recruited from elsewhere in the district or province. At this stage of the project, the number of foreign employment opportunities is uncertain. The increase in generation capacity from 75 to 200 MW contribution to the country's power generation capacity will contribute towards the overall stability of the national grid and a reduction in the greenhouse gas output

per MWH generated. The resultant socio-economic benefits will depend on the country's effective generation capacity, which will vary over time.

The project will be of economic benefit to some local businesses, but the environmental impacts described in the preceding sections of this report, will be experienced or perceived as negative socio-economic impacts by some local residents. The project will also attract job seekers, which may result in the formation of one or more informal settlements associated with social pathologies such as crime, prostitution, communicable disease and substance abuse.

The nett socio-economic impact has been assessed as positive, but of ***low (SP = +8)*** significance. The following measures are recommended to enhance the impact to one of ***High (SP = +80)*** significance:

- Recruiting personnel from the local labour pool to the extent practicable;
- Preferentially procuring goods and services from local suppliers wherever practicable;
- Establishing a skills development programme to increase employees' value to ACWA Power and their employability in the broader labour market;
- Implementing effective traffic management measures to minimise the impact of project-related traffic on other road users;
- Prioritising safety for employees and visitors;
- Maintaining the grievance management system;
- Developing a retrenchment plan and procedures in consultation with employees;
- Keeping employees, including service providers under contract, informed about the general financial health of Bokpoort II and the remaining life of the project; and
- Developing a post-closure land use plan in consultation with local authorities and members of the public.

7.3.14.3 Closure and Rehabilitation

The activities undertaken during this phase will be similar to those of the construction phase, but the duration will be shorter. Most of the negative environmental impacts experienced during the construction and operational phases will be reversed over time, but the positive socio-economic impacts of job creation and cash injection into the local economy will fall away upon closure of the operation.

A reduction in employment is rated as a **moderate** impact ***(SP = 56)*** before mitigation and a **low** impact ***(SP = 20)*** with mitigation. The change in economic benefits from energy generation to agriculture is rated as a **high** impact ***(SP = 80)*** before mitigation and a **moderate** impact ***(SP = 52)*** with mitigation. The dependency on the project sustaining the local economy would be **moderate** impact ***(SP = 48)*** before mitigation and a **low** impact ***(SP = 22)*** provided that alternative funding is sourced.

The following mitigation measures are recommended:

- Proactive skills development and training of employees to enhance their value in the labour market and thereby their chances of finding employment after project closure.
- Development of a retrenchment plan in consultation with employees, starting at least five years before closure.
- Assisting redundant employees to find alternative employment as far as practicable.
- Providing training and start-up assistance to employees who want to start their own businesses.
- Leaving intact such infrastructure as can be used by the subsequent landowner(s).

7.3.14.4 Cumulative

- Employment opportunities - the combined project indicates employment opportunities for approximately 400 local unskilled workers during construction peak. Although it is uncertain at this stage, what the duration of the construction peak will be, 400 local employment opportunities will

contribute significantly to livelihoods and the local economy. This conclusion is based on the assumption that by far the majority (if not all) of the 400 opportunities will be sourced from the local communities, focused on Groblershoop and Wegdraai, and other communities within a radius of 20 to 30 km from the site. Using local employees must be a key focus area, if the positive impacts are to be maximised. The use of local employees also minimise the range of potential adverse social impacts, such as cultural disparity between local people and large numbers of newcomers, social mobilisation to protect local jobs and health, safety and security concerns. Even though the number of direct job opportunities will be temporary, there is the potential for increased indirect employment through the supply chain vendors and service providers and associated increased local spend as a result of the project activities.

- Population influx - the influx of temporary workers in search of jobs is a reality in the Northern Cape. It has significant impacts to the existing communities based on limited available resources to service a larger population in a stark and arid landscape. An impact directly linked to foreign workers, is related to social and intimate relations between the foreigners, who are here for only a short duration, and the local population. This often results in family stress, health impacts, and the socio-economic load on households to look after children, whose fathers have departed and make little contribution to their emotional and financial upkeep. Although any influx of workers into the area may result in such impacts, experience has shown that this is most prominent in the case of foreign workers.
- Continued economic benefits - The use of renewable energy resources like solar power contributes to diversifying the fuel sources used for energy production which improves electricity production efficiency. The proposed project can add an additional 1600 MW into the Eskom grid. The development will generate electricity from a renewable energy resource which has nearly zero carbon dioxide emissions, unlike coal fired power plants.

7.4 Summary of the Impact Assessment

7.4.1 Construction Phase

Table 42 below summarises those impacts directly related to the construction phase of the proposed project and provides a significance rating for each impact before and after mitigation. The construction period will be approximately 12-18 months.

Table 42: Summary of Construction Phase Impacts

Aspect	Impact	Mitigation	Magnitude (M)	Duration (D)	Scale (S)	Probability (P)	Significance Point (M+D+S) x P	
Geology	Excavations for foundations for the PV plants and associated structures will permanently disturb the near-surface geology over parts of the site	**Without**	**2**	**5**	**1**	**5**	**40**	**Moderate**
		With	**2**	**5**	**1**	**5**	**40**	**Moderate**
Aspect	**Impact**	**Mitigation**	**Magnitude (M)**	**Duration (D)**	**Scale (S)**	**Probability (P)**	**Significance Point (M+D+S) x P**	
Topography	Excavating for building foundations and landscaping to position the PV panels and create runoff management berms will result in minor changes to the existing topography of the site	**Without**	**2**	**4**	**1**	**3**	**21**	**Low**
		With	**2**	**4**	**1**	**3**	**21**	**Low**
Aspect	**Impact**	**Mitigation**	**Magnitude (M)**	**Duration (D)**	**Scale (S)**	**Probability (P)**	**Significance Point (M+D+S) x P**	
Air Quality	The following possible sources of PM emissions have been identified for the construction phase:	**Without**	**5**	**2**	**2**	**2**	**30**	**Moderate**

Aspect	Impact	Mitigation	Magnitude (M)	Duration (D)	Scale (S)	Probability (P)	Significance Point (M+D+S) x P	
	▪ Vehicle activities associated with the transport of equipment to the site; ▪ Preparation of the surface area prior to development; and ▪ The removal of construction equipment from site after the set-up of new infrastructure	With	5	2	2	2	30	Moderate
Aspect	**Impact**	**Mitigation**	**Magnitude (M)**	**Duration (D)**	**Scale (S)**	**Probability (P)**	**Significance Point (M+D+S) x P**	
Agricultural Potential, Soil, Land Capability and Land Use	Loss of Agricultural Land Use	Without	2	4	1	5	35	Moderate
		With	2	4	1	5	35	Moderate
	Soil Degradation	Without	2	3	1	3	18	Low
		With	2	3	1	2	32	Low
Aspect	**Impact**	**Mitigation**	**Magnitude (M)**	**Duration (D)**	**Scale (S)**	**Probability (P)**	**Significance Point (M+D+S) x P**	
Ecology	Loss of extent of modified habitats within the Project footprint	Without	4	5	1	5	50	Moderate
		With	2	4	1	5	35	Moderate
	Introduction/Spread of exotic invasive species	Without	6	5	2	4	52	Moderate
		With	2	2	1	3	15	Low

Aspect	Impact	Mitigation	Magnitude (M)	Duration (D)	Scale (S)	Probability (P)	Significance Point (M+D+S) x P	
	Loss/disturbance of flora and fauna species of conservation concern	Without	8	4	2	4	56	Moderate
		With	4	4	1	4	36	Moderate
	Loss/disturbance of other fauna species	Without	6	4	1	5	55	Moderate
		With	4	4	1	3	27	Low
Ecology	Reduction in extent of natural habitats	Without	8	5	1	3	42	Moderate
		With	4	5	0	4	18	Low
	Soil erosion and sediment loading of surface water runoff	Without	4	4	2	4	40	Moderate
		With	2	2	2	2	12	Low
Aspect	**Impact**	**Mitigation**	**Magnitude (M)**	**Duration (D)**	**Scale (S)**	**Probability (P)**	**Significance Point (M+D+S) x P**	
Avifauna	Habitat Destruction	Without	8	4	2	5	70	Moderate
		With	8	3	1	5	60	Moderate
		Without	8	2	2	4	48	Moderate

Aspect	Impact	Mitigation	Magnitude (M)	Duration (D)	Scale (S)	Probability (P)	Significance Point (M+D+S) x P	
	Disturbance and Displacement	With	6	2	2	3	30	Moderate
Aspect	**Impact**	**Mitigation**	**Magnitude (M)**	**Duration (D)**	**Scale (S)**	**Probability (P)**	**Significance Point (M+D+S) x P**	
Bat	Reduction in foraging habitat due to vegetation clearance	Without	6	4	1	5	55	Moderate
		With	2	4	1	4	28	Low
	Disturbance and displacement due to construction noise and lighting	Without	6	2	1	4	36	Moderate
		With	4	1	1	4	24	Low
Aspect	**Impact**	**Mitigation**	**Magnitude (M)**	**Duration (D)**	**Scale (S)**	**Probability (P)**	**Significance Point (M+D+S) x P**	
Surface Water	The construction activities could lead to erosion from de-vegetated areas and runoff carrying a high silt load and contaminants such as fuel, hydraulic fluids, degreasing and other chemicals and cement.	Without	6	2	2	4	40	Moderate
		With	4	2	1	3	21	Low
Aspect	**Impact**	**Mitigation**	**Magnitude (M)**	**Duration (D)**	**Scale (S)**	**Probability (P)**	**Significance Point (M+D+S) x P**	
Groundwater	The groundwater quality can be impacted by spillage of fuels, lubricants, chemicals from construction equipment, vehicles and temporary workshop during the construction phase or from leakage from the BESS.	Without	6	3	1	4	40	Moderate
		With	4	2	2	3	24	Low
Aspect	**Impact**	**Mitigation**	**Magnitude (M)**	**Duration (D)**	**Scale (S)**	**Probability (P)**	**Significance Point (M+D+S) x P**	
Visual	Local residents and travellers along local roads will initially see vehicles	Without	6	2	2	3	30	Moderate

Aspect	Impact	Mitigation	Magnitude (M)	Duration (D)	Scale (S)	Probability (P)	Significance Point (M+D+S) x P	
	transporting personnel, equipment and materials to the Bokpoort II site. Dust plumes resulting from travel along unpaved roads and earthmoving activities on the site would be visible from distances of several kilometres.	With	2	2	1	3	15	Low
Aspect	**Impact**	**Mitigation**	**Magnitude (M)**	**Duration (D)**	**Scale (S)**	**Probability (P)**	**Significance Point (M+D+S) x P**	
Heritage	As no sites, features or objects of cultural significance are known to exist in the development area, there would be no impact as a result of the proposed development.	Without	n/a	n/a	n/a	n/a	n/a	n/a
		With	n/a	n/a	n/a	n/a	n/a	n/a
Aspect	**Impact**	**Mitigation**	**Magnitude (M)**	**Duration (D)**	**Scale (S)**	**Probability (P)**	**Significance Point (M+D+S) x P**	
Palaeontology	The Precambrian metamorphic bedrocks underling the study area at depth are unfossiliferous while the overlying Late Caenozoic superficial sediments are generally fossil-poor.	Without	2	5	1	2	16	Low
		With	2	5	1	1	8	Low
Aspect	**Impact**	**Mitigation**	**Magnitude (M)**	**Duration (D)**	**Scale (S)**	**Probability (P)**	**Significance Point (M+D+S) x P**	
Traffic	Deterioration of road network condition	Without	6	2	2	5	50	Moderate
		With	4	2	2	3	24	Low
	Increase in dust	Without	6	2	2	5	50	Moderate
		With	2	2	2	3	18	Low

Aspect	Impact	Mitigation	Magnitude (M)	Duration (D)	Scale (S)	Probability (P)	Significance Point (M+D+S) x P	
	Increase in traffic volumes	Without	8	2	2	5	60	Moderate
		With	2	4	2	2	16	Low
	Deterioration of road safety conditions	Without	2	4	2	4	32	Moderate
		With	2	2	2	3	18	Low
Aspect	**Impact**	**Mitigation**	**Magnitude (M)**	**Duration (D)**	**Scale (S)**	**Probability (P)**	**Significance Point (M+D+S) x P**	
Socio-Economic	Employment opportunities	Without	6	2	2	3	+30	Moderate
		With	6	2	2	4	+40	Moderate
	Population influx	Without	8	3	2	4	52	Moderate
		With	6	2	2	3	30	Moderate
	Economic benefits	Without	6	4	3	3	+39	Moderate
		With	8	4	4	4	+64	Moderate
	Change in land use	Without	6	4	3	4	52	Moderate
		With	4	4	2	3	30	Moderate

7.4.2 Operational Phase

Table 43 below summarises those impacts directly related to the operations phase of the proposed project and provides a significance rating for each impact before and after mitigation. The operational period of individual plant will be in accordance with the power purchase agreement i.e. 20 years but the design of the plant will be for 30 plus years.

Table 43: Summary of Operational Phase Impacts

Aspect	Impact	Mitigation	Magnitude (M)	Duration (D)	Scale (S)	Probability (P)	Significance Point (M+D+S) x P	
Geology	No Impacts	**Without**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**
		With	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**
Aspect	**Impact**	**Mitigation**	**Magnitude (M)**	**Duration (D)**	**Scale (S)**	**Probability (P)**	**Significance Point (M+D+S) x P**	
Topography	No Impacts	**Without**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**
		With	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**
Aspect	**Impact**	**Mitigation**	**Magnitude (M)**	**Duration (D)**	**Scale (S)**	**Probability (P)**	**Significance Point (M+D+S) x P**	
Air Quality	▪ If areas exposed during the construction phases are promptly revegetated, emissions during the operational phase of the facility are expected to be insignificant. ▪ Loss of containment of BESS due to corrosion or fires, or during maintenance procedures poses risks to ambient air quality	**Without**	**2**	**4**	**2**	**2**	**16**	**Low**
		With	**2**	**4**	**2**	**2**	**16**	**Low**

Aspect	Impact	Mitigation	Magnitude (M)	Duration (D)	Scale (S)	Probability (P)	Significance Point (M+D+S) x P	
	Vehicles travelling to and from the site will emit PM and gases. Expected vehicle volumes, however, will not result in any significant impact on local air quality beyond the direct vicinity of the main access road and access gate	**Without**	**2**	**4**	**2**	**5**	**40**	**Moderate**
		With	**2**	**4**	**2**	**5**	**40**	**Moderate**
	Containment loss is the greatest concern in relation to the storage of hazardous chemicals onsite	**Without**	**10**	**4**	**3**	**1**	**17**	**Low**
		With	**10**	**4**	**3**	**1**	**17**	**Low**
Aspect	**Impact**	**Mitigation**	Magnitude (M)	Duration (D)	Scale (S)	Probability (P)	**Significance Point (M+D+S) x P**	
Agricultural Potential, Soil, Land Capability and Land Use	No Impacts	**Without**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**
		With	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**
Aspect	**Impact**	**Mitigation**	Magnitude (M)	Duration (D)	Scale (S)	Probability (P)	**Significance Point (M+D+S) x P**	
Ecology	Spread of invasive plant species	**Without**	**6**	**5**	**2**	**4**	**52**	**Moderate**
		With	**2**	**2**	**1**	**3**	**15**	**Low**
		Without	**8**	**4**	**2**	**8**	**70**	**Moderate**

Aspect	Impact	Mitigation	Magnitude (M)	Duration (D)	Scale (S)	Probability (P)	Significance Point (M+D+S) x P	
	Direct loss (injury/mortality) of fauna species via roadkill	With	4	4	2	4	40	Moderate
	Disturbance of faunal species of conservation concern – site lighting	Without	6	4	2	5	60	Moderate
		With	4	4	2	2	20	Low
	Disturbance of faunal species of conservation concern – barrier to movement	Without	6	4	2	4	48	Moderate
		With	6	4	2	3	36	Moderate
Aspect	**Impact**	**Mitigation**	**Magnitude (M)**	**Duration (D)**	**Scale (S)**	**Probability (P)**	**Significance Point (M+D+S) x P**	
Avifauna	Disturbance and Displacement	Without	8	4	2	4	56	Moderate
		With	6	4	2	2	24	Low
	Collision with Infrastructure (Excluding Power Lines)	Without	6	4	1	5	55	Moderate
		With	4	4	1	3	27	Low
	Water Pollution	Without	4	4	2	3	30	Moderate
		With	2	4	2	2	16	Low
	Excessive Use of Water	Without	4	4	3	3	33	Moderate
		With	2	4	3	2	18	Low
		Without	6	4	3	3	39	Moderate
		With	4	4	2	2	20	Low

Aspect	Impact	Mitigation	Magnitude (M)	Duration (D)	Scale (S)	Probability (P)	Significance Point (M+D+S) x P	
Aspect	Impact	Mitigation	Magnitude (M)	Duration (D)	Scale (S)	Probability (P)	Significance Point (M+D+S) x P	
Bat	Barrier effect of PV plants to normal foraging and commuting behaviours	Without	8	4	1	4	52	Moderate
		With	4	4	1	3	27	Low
	Change of bat community utilizing development area due to security lighting	Without	6	4	1	4	44	Moderate
		With	2	4	1	4	28	Low
	Collision of bats with PV panels	Without	4	1	1	2	12	Low
		With	4	1	1	1	6	Low
Aspect	Impact	Mitigation	Magnitude (M)	Duration (D)	Scale (S)	Probability (P)	Significance Point (M+D+S) x P	
Surface Water	▪ Once operational, the 200MW Ndebele and Xhosa PV Plant installation will require a slight change in water demand which will be affected positively ▪ During the operational phase there is a possibility of increased spillage of fuels, lubricants and other chemicals from the BESS. ▪ The installation and operation of the PV plants will result in the creation of some relatively small impervious areas	Without	10	3	2	3	45	Moderate
		With	6	1	2	3	27	Low
Aspect	Impact	Mitigation	Magnitude (M)	Duration (D)	Scale (S)	Probability (P)	Significance Point (M+D+S) x P	

Aspect	Impact	Mitigation	Magnitude (M)	Duration (D)	Scale (S)	Probability (P)	Significance Point (M+D+S) x P	
Groundwater	If leakage from the BESS reach the groundwater, contamination can be expected. Unsatisfactory water quality (containing elevated counts of microbiological determinants or metal concentrations for example) is used to clean the solar cells this could infiltrate into the subsurface and possibly pollute the groundwater.	Without	6	4	3	6	65	Moderate
		With	2	4	2	2	16	Low
Aspect	**Impact**	**Mitigation**	**Magnitude (M)**	**Duration (D)**	**Scale (S)**	**Probability (P)**	**Significance Point (M+D+S) x P**	
Visual	The PV arrays would not be visible to the vast majority of the receptor locations in the study area, and thus would not cause any visual impact for the majority of the study area. Lighting at the Solar Power Plant could create a visual impact on the night-time environment by introducing new sources of lighting to a relatively unlit night-time environment.	Without	8	4	2	4	56	Moderate
		With	6	4	22	3	36	Moderate
Aspect	**Impact**	**Mitigation**	**Magnitude (M)**	**Duration (D)**	**Scale (S)**	**Probability (P)**	**Significance Point (M+D+S) x P**	
Heritage	As no sites, features or objects of cultural significance are known to exist in the development area, there would be no impact as a result of the proposed development.	Without	n/a	n/a	n/a	n/a	n/a	n/a
		With	n/a	n/a	n/a	n/a	n/a	n/a
Aspect	**Impact**	**Mitigation**	**Magnitude (M)**	**Duration (D)**	**Scale (S)**	**Probability (P)**	**Significance Point (M+D+S) x P**	

Aspect	Impact	Mitigation	Magnitude (M)	Duration (D)	Scale (S)	Probability (P)	Significance Point (M+D+S) x P	
Palaeontology	No significant further impacts on fossil heritage are anticipated operational phase of the solar power facility.	Without	n/a	n/a	n/a	n/a	n/a	n/a
		With	n/a	n/a	n/a	n/a	n/a	n/a
Aspect	**Impact**	**Mitigation**	**Magnitude (M)**	**Duration (D)**	**Scale (S)**	**Probability (P)**	**Significance Point (M+D+S) x P**	
Traffic	The operational phase will not generate heavy vehicle volumes when compared to the construction phase	Without	2	4	2	2	16	Low
		With	2	4	2	2	16	Low
Aspect	**Impact**	**Mitigation**	**Magnitude (M)**	**Duration (D)**	**Scale (S)**	**Probability (P)**	**Significance Point (M+D+S) x P**	
Socio-Economic	The increase in generation capacity from 75 to 200MW contribution to the country's power generation capacity will contribute towards the overall stability of the national grid and a reduction in the greenhouse gas output per MWH generated.	Without	1	4	3	1	+8	Low
		With	8	4	4	5	+80	High

7.4.3 Closure and Rehabilitation Phase

Table 44 below summarises those impacts directly related to the closure and rehabilitation phase of the proposed project and provides a significance rating for each impact before and after mitigation. The closure and demolition of the infrastructure will take approximately 3 - 6 months. The rehabilitation period to restore the area to grazing will be approximately 6 - 12 months.

Table 44: Summary of the Closure and Rehabilitation Phase

Aspect	Impact	Mitigation	Magnitude (M)	Duration (D)	Scale (S)	Probability (P)	Significance Point (M+D+S) x P	
Geology	No Impacts	Without	n/a	n/a	n/a	n/a	n/a	n/a
		With	n/a	n/a	n/a	n/a	n/a	n/a
Aspect	**Impact**	**Mitigation**	**Magnitude (M)**	**Duration (D)**	**Scale (S)**	**Probability (P)**	**Significance Point (M+D+S) x P**	
Topography	Due to the low rainfall and the sandy soils, the site is naturally not very prone to erosion, but inappropriate closure and rehabilitation could increase the erosion potential, leading to a topographical impact	Without	6	4	1	2	22	Low
		With	2	4	1	3	+21	Low
Aspect	**Impact**	**Mitigation**	**Magnitude (M)**	**Duration (D)**	**Scale (S)**	**Probability (P)**	**Significance Point (M+D+S) x P**	
Air Quality	Particulate emissions during the closure and post-closure phase	Without	2	2	2	5	30	Moderate
		With	2	2	2	5	30	Moderate
	Decommissioning of BESS can also result in emissions to atmosphere due to containment issues	Without	10	4	3	1	17	Moderate
		With	10	4	3	1	17	Moderate
Aspect	**Impact**	**Mitigation**	**Magnitude (M)**	**Duration (D)**	**Scale (S)**	**Probability (P)**	**Significance Point (M+D+S) x P**	
Agricultural	Soil Degradation	Without	2	3	1	3	18	Low
		With	2	3	1	2	12	Low
Aspect	**Impact**	**Mitigation**	**Magnitude (M)**	**Duration (D)**	**Scale (S)**	**Probability (P)**	**Significance Point (M+D+S) x P**	

Aspect	Impact	Mitigation	Magnitude (M)	Duration (D)	Scale (S)	Probability (P)	Significance Point (M+D+S) x P	
Ecology	Spread of invasive plant species	Without	6	4	3	5	65	Moderate
		With	4	2	1	3	21	Low
	Soil erosion and sediment loading of surface water runoff	Without	6	5	2	3	39	Moderate
		With	6	5	3	1	14	Low
Aspect	**Impact**	**Mitigation**	**Magnitude (M)**	**Duration (D)**	**Scale (S)**	**Probability (P)**	**Significance Point (M+D+S) x P**	
Avifauna	No Impacts	Without	n/a	n/a	n/a	n/a	n/a	n/a
		With	n/a	n/a	n/a	n/a	n/a	n/a
Aspect	**Impact**	**Mitigation**	**Magnitude (M)**	**Duration (D)**	**Scale (S)**	**Probability (P)**	**Significance Point (M+D+S) x P**	
Bat	Disturbance and displacement due to decommission noise and lighting	Without	6	2	1	4	36	Moderate
		With	4	1	1	4	24	Low
Aspect	**Impact**	**Mitigation**	**Magnitude (M)**	**Duration (D)**	**Scale (S)**	**Probability (P)**	**Significance Point (M+D+S) x P**	
Surface Water	During the closure there is a possibility of increased Spillage of fuels, lubricants and other chemicals from previously bunded and contained areas	Without	6	2	2	4	40	Moderate
		With	4	2	1	3	21	Low
Aspect	**Impact**	**Mitigation**	**Magnitude (M)**	**Duration (D)**	**Scale (S)**	**Probability (P)**	**Significance Point (M+D+S) x P**	
Groundwater	During the closure there is a possibility of increased Spillage of fuels, lubricants and other chemicals from previously bunded and contained areas	Without	6	3	1	4	40	Moderate
		With	2	2	1	3	15	Low
Aspect	**Impact**	**Mitigation**	**Magnitude (M)**	**Duration (D)**	**Scale (S)**	**Probability (P)**	**Significance Point (M+D+S) x P**	

Aspect	Impact	Mitigation	Magnitude (M)	Duration (D)	Scale (S)	Probability (P)	Significance Point (M+D+S) x P	
Visual	The site would not be visible to the vast majority of the receptor locations in the study area, and thus dust plumes generated at the closure site would be unlikely to cause any visual impact for the majority of the study area.	Without	6	2	2	4	40	Moderate
		With	4	2	2	3	24	Low
Aspect	**Impact**	**Mitigation**	**Magnitude (M)**	**Duration (D)**	**Scale (S)**	**Probability (P)**	**Significance Point (M+D+S) x P**	
Heritage	As no sites, features or objects of cultural significance are known to exist in the development area, there would be no impact as a result of the proposed development.	Without	n/a	n/a	n/a	n/a	n/a	n/a
		With	n/a	n/a	n/a	n/a	n/a	n/a
Aspect	**Impact**	**Mitigation**	**Magnitude (M)**	**Duration (D)**	**Scale (S)**	**Probability (P)**	**Significance Point (M+D+S) x P**	
Palaeontology	No significant further impacts on fossil heritage are anticipated operational phase of the solar power facility.	Without	n/a	n/a	n/a	n/a	n/a	n/a
		With	n/a	n/a	n/a	n/a	n/a	n/a
Aspect	**Impact**	**Mitigation**	**Magnitude (M)**	**Duration (D)**	**Scale (S)**	**Probability (P)**	**Significance Point (M+D+S) x P**	
Traffic	The traffic activities will be similar to those of the construction phase, but by the time of closure, it is highly likely that the local access roads will have been paved	Without	4	2	2	5	40	Moderate
		With	4	2	2	2	16	Low
Aspect	**Impact**	**Mitigation**	**Magnitude (M)**	**Duration (D)**	**Scale (S)**	**Probability (P)**	**Significance Point (M+D+S) x P**	
Socio-Economic	Reduced employment	Without	8	4	2	4	56	Moderate

Aspect	Impact	Mitigation	Magnitude (M)	Duration (D)	Scale (S)	Probability (P)	Significance Point (M+D+S) x P	
		With	6	2	2	2	20	Low
Socio-Economic	Reduced economic benefit	Without	8	5	3	5	80	High
		With	6	5	2	4	52	Moderate
Socio-Economic	Dependency on project sustaining local economy	Without	8	5	3	3	48	Moderate
		With	6	3	2	2	22	Low

7.4.4 Summary of the Cumulative Impacts

Table 45 provides a summary of the summary of the cumulative impacts.

Table 45: Summary of Cumulative Impacts

Aspect	Impact
Agricultural Potential, Soil, Land Capability and Land Use	▪ In order for South Africa to achieve its renewable energy generation goals, agriculturally zoned land will need to be used for renewable energy generation. It is far more preferable to incur a cumulative loss of agricultural land in a region such as the one being assessed, which has no cultivation potential, and low grazing capacity, than to lose agricultural land that has a higher potential, and that is much scarcer, to renewable energy development elsewhere in the country. The limits of acceptable agricultural land loss are therefore far higher in this region than in regions with higher agricultural potential. ▪ It is also preferable, from an impact point of view as well as from practical considerations, to rather have a concentrated node of renewable energy development within one area, as is the case around this project, than to spread out the same number of developments over a larger area.

Ecology	The Project is located adjacent to the existing Bokpoort I development. In addition, the proposed SolAfrica Sanddraai 75 MW PV Project in !Kheis LM is situated on the farm directly adjacent to the Project, and the proposed Kheis Solar Park 1 PV project is located in similar habitat approximately 20 km north of the Project (refer to Figure 31). Potential residual (post-mitigation) impacts of the Bokpoort II PV Project that may contribute to the cumulative effects of other proposed and permitted solar developments in the region relate to potential indirect impacts on fauna and exacerbation of the loss of remaining areas of natural habitat. The Project may contribute to cumulative impacts on fauna through increased incidences of road kill as a result of increased vehicular traffic and the creation of a barrier to normal movement of medium-large mammals and reptiles due to the physical barrier that will be created by the site security fencing. Incremental losses of remaining areas of natural (untransformed) habitat is anticipated due to the continual increase of human/ industrial related activities on a regional scale.
Avifauna	Approximately 16 solar energy projects in various stages of the EIA application process fall within this 50 km radius of the project site (Table 1 in appendix B4). Should 50% or more of these projects be constructed the cumulative impact of the residual impacts may have a significance rating of ***85 (High).*** Depending on the type of solar technology employed and the level of mitigation implemented at each of the developments the cumulative impacts may have had a significance rating of ***65 (Moderate)*** after mitigation. It is difficult to say with high confidence at this stage what the cumulative impact of all the proposed developments will be on birds as the specifics of the final technologies to be utilised at each site, and levels of habitat rehabilitation within the project sites, is unknown.
Bats	The proposed Bokpoort solar facility amendment and the other solar developments will primarily negatively impact bats by reducing foraging areas and roosting resources within the greater area. However, the Orange River and its riparian vegetation is a more important source of drinking water and prime foraging grounds for bats than the surrounding areas that the Bokpoort development is located within. It is essential for each facility to apply site specific mitigation measures recommended by relevant specialists to mitigate the cumulative impacts of renewable energy developments in the region. Thus, the proposed Bokpoort solar facility must adhere to the outlined mitigation measures listed above to reduce cumulative impacts of development in the greater area.

Visual	▪ The proposed development will be located immediately adjacent to the Bokpoort Solar Power Facility, so when viewed from the surrounds it will form part of a visual environment that is already transformed from a natural context. The proposed development will add to the transformation of the landscape in the local area, thus increasing the cumulative visual effect on the landscape. However, the remoteness of the location lowers the overall cumulative visual impact in a wider study area context. ▪ The proposed development will be located immediately adjacent to the Bokpoort Solar Power Facility and lighting at the new plant would increase the number of lighting sources able to be viewed from this area. Permanent lighting at the new plant would thus increase the number of light sources, albeit in a cluster rather than adding diffuse lighting sources to the landscape, further altering the overall dark night time environment to a more lit one. ▪ Generation of dust plumes is not incongruous to this hot arid environment, but the area surrounding the development site is not characterised by the large-scale generation of large dust plumes on a regular basis. Such an impact would not further an existing impact.
Heritage	The cumulative impact of the proposed Bokpoort project is assessed by adding impacts from this proposed development to existing and other proposed developments with similar impacts within a 60 km radius. The existing and proposed developments that were taken into consideration for cumulative impacts include a total of six other plants and are listed in Table 41. From the map 'South African Generation Projects' (Figure 34), it can be seen that the Bokpoort project is located in an area where little such development has taken place, with the implication that the cumulative impact would be very low.
Palaeontology	Given the low impact significance assessed for all solar energy developments concerned which are all underlain by very similar geology, it is likely that cumulative impacts associated with the development are **low**. Very few palaeontological impact assessments for other developments in the wider project area near Groblershoop have been undertaken (SAHRIS website); one exception - for solar projects on the farm Sand Draai by Bamford (2016)[90] - also concluded that the palaeontological sensitivity of the region is low.

[90] *BAMFORD, M. 2016. Palaeontological Impact Assessment for the proposed CSP and PV plants on the farm Sand Draai, near Groblershoop, Northern Cape Province, 5 pp.*

Socio-Economic	▪ Employment opportunities - the combined project indicates employment opportunities for approximately 400 local unskilled workers during construction peak. Although it is uncertain at this stage, what the duration of the construction peak will be, 400 local employment opportunities will contribute significantly to livelihoods and the local economy. This conclusion is based on the assumption that by far the majority (if not all) of the 400 opportunities will be sourced from the local communities, focused on Groblershoop and Wegdraai, and other communities within a radius of 20 to 30 km from the site. Using local employees must be a key focus area, if the positive impacts are to be maximised. The use of local employees also minimise the range of potential adverse social impacts, such as cultural disparity between local people and large numbers of newcomers, social mobilisation to protect local jobs and health, safety and security concerns. Even though the number of direct job opportunities will be temporary, there is the potential for increased indirect employment through the supply chain vendors and service providers and associated increased local spend as a result of the project activities. ▪ Population influx - the influx of temporary workers in search of jobs is a reality in the Northern Cape. It has significant impacts to the existing communities based on limited available resources to service a larger population in a stark and arid landscape. An impact directly linked to foreign workers, is related to social and intimate relations between the foreigners, who are here for only a short duration, and the local population. This often results in family stress, health impacts, and the socio-economic load on households to look after children, whose fathers have departed and make little contribution to their emotional and financial upkeep. Although any influx of workers into the area may result in such impacts, experience has shown that this is most prominent in the case of foreign workers. ▪ Continued economic benefits - The use of renewable energy resources like solar power contributes to diversifying the fuel sources used for energy production which improves electricity production efficiency. The proposed project can add an additional 1600 MW into the Eskom grid. The development will generate electricity from a renewable energy resource which has nearly zero carbon dioxide emissions, unlike coal fired power plants.

8 IMPACT STATEMENT

8.1 Key Findings

8.1.1 Geology and Topography

Excavations for foundations for the PV panels and associated infrastructure will have a highly localised and negligible effect on the geology and topography of the site.

8.1.2 Air Quality

The facility does not require an Atmospheric Emissions Licence as no listed activities are triggered under section 21 of the NEM:AQA (Act 39 of 2004). The closest sensitive receptor identified is a farmhouse, approximately 2 km south-west of the proposed site. Surrounding towns are at least 17 km away from the site. Local existing air pollution sources include agricultural activities, domestic fuel burning and veld fires. The key pollutant from the proposed site during the construction and decommissions phases would be PM.

Various PM control measures for the construction phase are presented, the key being wet suppression. During the operational phase, there should be very limited air quality impacts, if any, beyond exhaust emissions and wheel entrainment of dust by traffic to and from the site. Strict BESS management and maintenance procedures will ensure containment and prevent any significant air quality impacts. On decommissioning, the BESS should be promptly removed offsite in line with manufacturer guidance and taken to the nearest appropriate recycling facility. While there are recycling options for lead-acid batteries in South Africa, opportunities for the recycling of lithium ion batteries needs further investigation.

8.1.3 Agricultural Potential, Soil, Land Capability and Land Use

The proposed development is on land zoned as ‘Special’. South Africa has very limited arable land and it is therefore critical to ensure that development does not lead to an inappropriate loss of land that may be valuable for cultivation. This assessment has found that the investigated site is on land which is of low agricultural potential and is not suitable for cultivation.

It is preferable to incur a loss of agricultural land on such a site, without cultivation potential, than to lose agricultural land that has a higher potential, to renewable energy development elsewhere in the country. No agriculturally sensitive areas occur within the proposed site and no part of it is therefore required to be set aside from the development.

8.1.4 Ecology

The various assessments of the ecological receiving environment that were accessed revealed a moderate, at best, ecological sensitivity of remaining and untransformed portions of the site. The photovoltaic plant development will potentially affect biodiversity in three main ways; loss in extent of vegetation communities and loss and associated disturbance of species of conservation concern during construction; effects on fauna species of conservation concern as a result of site lighting, security fencing and increased road traffic during operation, and the spread of invasive species and potential contamination of remaining natural (surrounding) ecosystems during closure. Biological attributes of the site exhibit typical diversity and status of natural spaces in the region of the site, which is ultimately characterised by limited and low intensity, albeit long-term, anthropogenic impacts that have caused a moderate decline in the status and natural diversity. Despite a moderate to high correlation with regional ecological types, only a moderate diversity was recorded on the site, which provides an indication of the relentless nature of existing impacts, and surrounding developments.

A review of the anticipated impacts associated with the development on the ecological environment indicates that none of the anticipated impacts can be highlighted or construed to represent an unacceptable or severe threat to sensitive biological or biodiversity components within the study area and wider region. Ecological attributes and characteristics and biological components that were recorded on the site during the brief survey period are regarded common and typical of the larger region and are not restricted to the site, i.e. no plant or animal species or habitat type will be affected in such a manner that the conservation status (local, regional, global) will be affected adversely.

Although several species of conservation concern have been recorded within the study area, no species were recorded that would trigger 'Critical Habitat' as defined by IFC. As with any type of anthropogenic development, the decimation of natural habitat is an unfortunate result and the reduction in the local abundance of animals and plants represent natural and anticipated consequences.

8.1.5 Avifauna

The proposed PV development would also allow for additional bird flight deterrent devices to be investigated to reduce the potential impact of collisions with overhead power lines as well as reduced habitat fragmentation and disruption of bird movements across the project site for a number of ground dwelling species.

If temperatures rise in the medium to long term, some species will be living closer to the limits of their thermal tolerances, with species in arid environments expected to be among the first to reach the limits of their thermoregulatory capacities[91]. It is anticipated that much of the Kalahari's avian biodiversity will be lost by the end of the century due to loss of body condition, delayed fledging, reduced fledging size, and outright breeding failure as a result of increased exposure to higher temperatures[92]. PV panels may provide more shaded environments (thermal refugia) for ground dwelling and ground nesting birds near their thermal limits and also offer a certain amount of protection to more open habitat species against bush encroachment[93].

The proposed PV development, if mitigation such as the rehabilitation of natural vegetation under solar panels is implemented, could potentially therefore even provide an improvement of the habitat for certain important bird species such as coursers, francolins and other open-country birds by offering shade and grassland in the face of potentially rising temperatures and bush encroachment.

8.1.6 Bat

The PV plants should have fewer negative impacts on bats. The impact assessment ratings of ten PV plants for the development are all reduced to a low significance impact rating after application of mitigation measures listed in Section 7.3.7 of this report. Surface Water

8.1.7 Surface Water

The change in water demand which will be affected positively with the total demand changing to 0.22 million cubic metres per annum (Mm^3/a) (10 x 0.022 Mm^3/a) for the 10 PV solar facilities (of which PV 1 and 2 forms part of) instead of the 0.3 Mm3/a (0.25 + 2 x 0.025 Mm^3/a) for the CSP and two (2) PV solar facilities.

[91] *van de Ven, T.M.F.N. 2017. Implications of climate change on the reproductive success of the Southern Yellow-billed Hornbill, Tockus leucomelas. PhD Thesis. Percy FitzPatrick Institute of African Ornithology, DST-NRF Centre of Excellence, Department of Biological Sciences, Faculty of Science, University of Cape Town.*
[92] *Conradie, S.R., Woodborne, S.M., Cunningham, S.J. and McKechnie, A.E. 2019. Chronic, sublethal effects of high temperatures will cause severe declines in southern African arid-zone birds during the 21st century.*
[93] *Towards a policy on indigenous bush encroachment in South Africa (2019), Department of Environmental Affairs, Pretoria, South Africa.*

8.1.8 Groundwater

Overall the accumulative risk associated with the project (when operational) is of low environmental significance from a groundwater perspective. With proper mitigations in place the significance of the impact is likely to be low.

8.1.9 Visual

The visual impact from the solar installation will be cumulative to the existing visual transformation of anthropological origin (Bokpoort I installation, farm buildings, power lines, railway line, roads) and will be present for the operational life of the facility (estimated at 30 years). The impact will be totally reversible upon decommissioning and closure of the solar facility.

8.1.10 Heritage

From a heritage point of view, it is recommended that the proposed development be allowed to continue on acceptance of the proposed mitigation measures and the conditions proposed for inclusion in the environmental authorisation:

- Should archaeological sites or graves be exposed in other areas during construction work, it must immediately be reported to a heritage practitioner so that an investigation and evaluation of the finds can be made.

8.1.11 Palaeontology

No significant fossil heritage resources have been recorded within the Bokpoort II solar power facility study area. The area is inferred to be of low sensitivity in terms of palaeontological heritage and no sensitive or no-go areas have been identified within it during the present desktop assessment. The proposed solar power facility is of LOW (negative) impact significance before mitigation with respect to palaeontological heritage resources. This assessment applies to all the planned infrastructure within the project area – including the water pipeline to the Orange River (already authorised) as well as the 132kV overhead line connection to the Eskom Garona Substation - and applies equally to all PV plants under consideration for the Bokpoort II Solar Power Facility. Cumulative impacts associated with the ten PV solar energy developments are probably low, given the similar regional geology, and there are no fatal flaws in the development proposal as far as fossil heritage is concerned. The no-go alternative is of neutral significance for palaeontology. Providing that the recommendations outlined below for palaeontological monitoring and mitigation are followed through, there are no objections on palaeontological heritage grounds to authorisation of this alternative energy project.

Pending the potential discovery of significant new fossil remains during development - notably fossil vertebrate bones & teeth - no further specialist palaeontological studies or mitigation are considered necessary for this project.

8.1.12 Traffic

Travel to and from the facility by personnel, deliveries and visitors will add to the existing traffic on the approach roads, affecting road safety, create dust from unpaved roads and road surface quality as experienced by existing road users. The cumulative impact due to the solar facility will be completely reversible upon decommissioning and closure.

8.1.13 Socio-Economic

The proposed increase in capacity from 75 to 200MW will be a positive impact as this will provide further support to the national grid therefore aiding in provide electricity security to the region and the country. The potential job creation at the construction phase of the project will be a positive for the local and regional

economy as unemployment in the country is increasing. An assured and diversified electricity generation mix is a key step in attracting investors into South Africa and is key for the growth and development.

8.2 Sensitivity Map

Figure 35: Overall Sensitivity Map

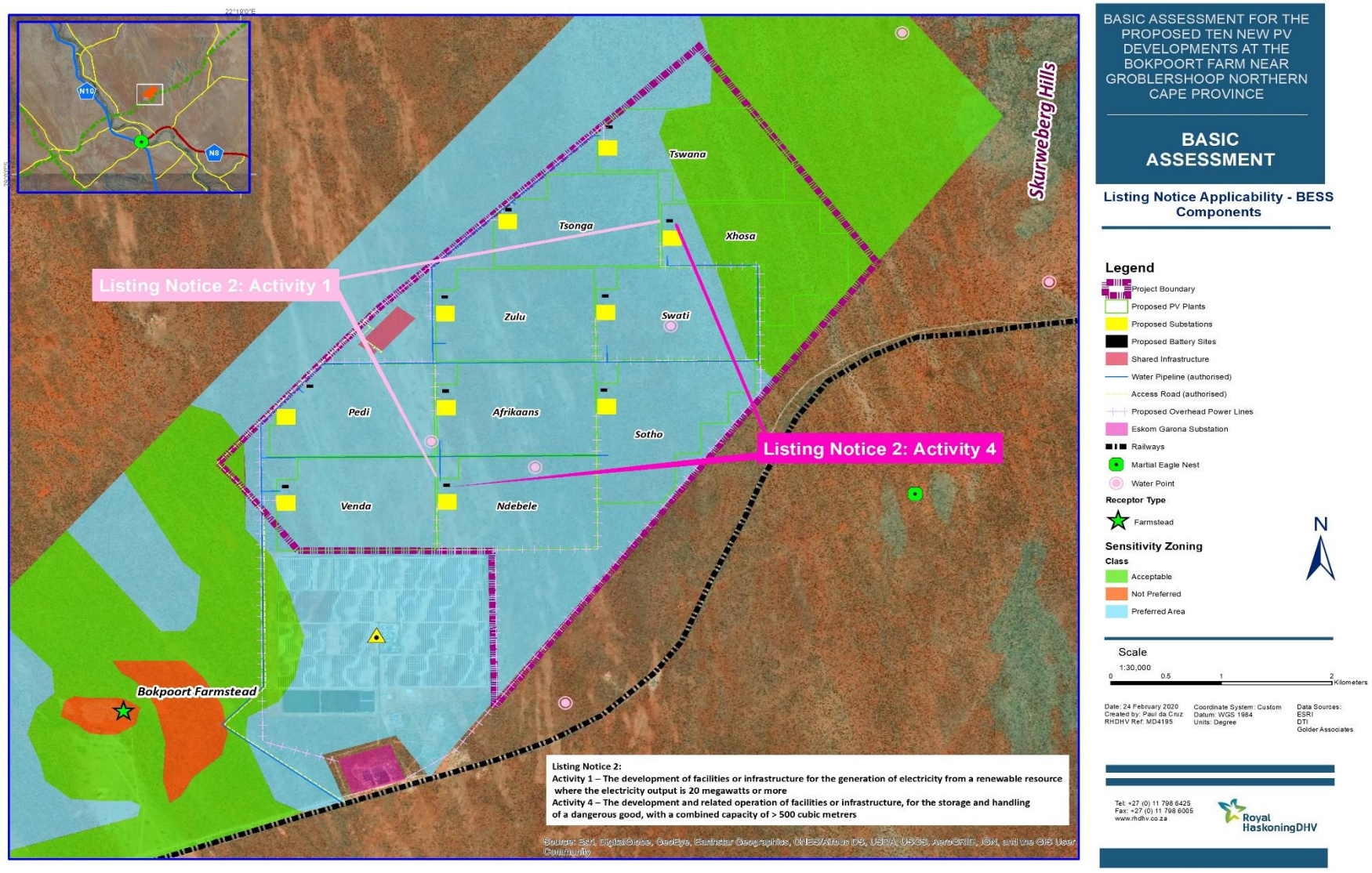

Figure 36: Annotated Listing Notice Map

8.3 Conclusion and Recommendations

The BA Study has been undertaken in accordance with the EIA Regulations 2014 (as amended in 2017) in terms of Section 24(5) of the National Environmental Management Act (Act No. 107 of 1998) (as amended).

In order to protect the environment and ensure that the proposed project is undertaken in an environmentally responsible manner, there are a number of significant environmental legislation that have been taken into account during this study. These include:

LEGISLATION
The Constitution of South Africa (No. 108 of 1996)
National Environmental Management Act (Act No. 107 of 1998) (as amended) and EIA Regulations 2014 (as amended in 2017)
National Environmental Management: Waste Act (Act No. 59 of 2008) (as amended)
National Environmental Management Biodiversity Act (Act No. 10 of 2004)
National Environmental Management: Protected Areas Act (Act No. 57 of 2003)
National Water Act (Act No. 36 of 1998) (as amended)
National Forests Act (Act No. 84 of 1998)
National Heritage Resources Act (Act No. 25 of 1999)
Minerals and Petroleum Resources Development Act (Act No. 28 of 2002)
Hazardous Substance Act (Act No. 15 of 1973) and Regulations
Occupational Health and Safety Act (Act No. 85 of 1993)

This relevant legislation has informed the identification and development of appropriate management and mitigation measures that should be implemented in order to minimise potentially significant impacts associated with the project.

8.4 Assumptions, Uncertainties or Gaps in Knowledge

8.4.1 Agriculture Assessment

The assessment rating of impacts is not an absolute measure. It is based on the subjective considerations and experience of the specialist but is done with due regard and as accurately as possible within these constraints. The study makes the assumption that water for irrigation is not available across the site. This is based on the assumption that a long history of farming experience in an area will result in the exploitation of viable water sources if they exist, and none have been exploited in this area. There are no other specific constraints, uncertainties and gaps in knowledge for this study.

8.4.2 Ecological Assessment

It is assumed that:

- all observations, identifications, calculations and opinions, as presented in the principal ecological reports (refer Section 4.4 of Appendix B1) are accurate and correct.
- all drawings, illustrations and documentation presented to the specialist are correct and accurate.
- all information that were sourced for this project are accurate and comprehensive at the time of extraction.
- no field surveys were conducted for this particular report and it comprises a desktop evaluation of existing

- information that included previous baseline reports for the larger study area. (DHV, 2014a; DHV, 2014b; BEC, 2010) and supplementary studies that were conducted to address identified gaps in the baseline dataset for the project.

8.4.3 Avifaunal Assessment

The SABAP1 data covers the period 1986-1997. Bird distribution patterns can change regularly according to availability of food and nesting substrate. (For a full discussion of potential limitations in the SABAP1 data, see Harrison et al. 199794).

The two post-construction studies on impacts of solar energy facilities in the Northern Cape, South Africa have increased the confidence of impact assessments for birds in the area, but these studies were limited in that they only covered a period of three-months each. The overall environmental impacts of solar energy facilities remain relatively poorly understood as do the specific impacts of these facilities on habitat destruction and fragmentation particularly with reference to birds.

While sampling effort was as recommended in the solar guidelines, to achieve statistically powerful results it would need to be increased beyond practical possibilities. The data was therefore analysed at a relatively basic level and interpreted using a precautionary approach. Relatively dry, drought conditions were experienced during the year of monitoring, and the study was therefore not able to consider the effects of inter-annual variation in avifauna, for example following a good rain season.

8.4.4 Visual Assessment

The addendum report is not a stand-alone visual impact report and has been prepared to update the two (2) visual impact reports prepared by Golder Associates for the original basic assessment processes completed in 2016. As such this report assumes that the original two visual impact assessment reports adequately and accurately described the baseline visual environment of the study area and accurately undertook the assessment of viewsheds associated with the proposed development.

This addendum report has utilised the original reports' assessment of viewsheds associated with the original northern and southern PV plants. These viewsheds were generated for the northern and southern PV plants respectively. As the overall footprint of the development has not changed, and as the design (height) of the PV components has not changed markedly these viewsheds represent the northern and southern extents of the current development. Accordingly, the viewsheds are an accurate representation of the southern and northern extents of the ten proposed PV facilities.

It should be noted that the 'experiencing' of visual impacts is subjective and largely based on the perception of the viewer or receptor. The presence of a receptor in an area potentially affected by the proposed solar power development does not thus necessarily mean that a visual impact would be experienced.

It has been assumed that households and farmsteads located within the study area are sensitive receptors – i.e. receptor locations at which a perception of visual impact could be generated. Existing Power Generation / power transmission infrastructure and the people that work at such locations in the study area have not been classified as being sensitive receptors in a visual impact context.

8.4.5 Heritage Assessment

The investigation has been influenced by the following factors:

- It is assumed that the description of the proposed project, provided by the client, is accurate.
- The unpredictability of buried archaeological remains.

[94] *Harrison, J.A., Allan, D.G., Underhill, L.G., Herremans, M., Tree, A.J., Parker, V & Brown, C.J. (eds). 1997. The atlas of southern African birds. Vol. 1&2. BirdLife South Africa: Johannesburg.*

- No subsurface investigation (i.e. excavations or sampling) were undertaken, since a permit from SAHRA is required for such activities.
- It is assumed that the public consultation process undertaken as part of the Environmental Impact Assessment (EIA) is sufficient and that it does not have to be repeated as part of the heritage impact assessment.

8.4.6 Palaeontological Assessment

- The accuracy and reliability of palaeontological specialist studies as components of heritage impact assessments are generally limited by the following constraints:
- Inadequate database for fossil heritage for much of the RSA, given the large size of the country and the small number of professional palaeontologists carrying out fieldwork here. Most development study areas have never been surveyed by a palaeontologist.
- Variable accuracy of geological maps which underpin these desktop studies. For large areas of terrain these maps are largely based on aerial photographs alone, without ground-truthing. The maps generally depict only significant ("mappable") bedrock units as well as major areas of superficial "drift" deposits (alluvium, colluvium) but for most regions give little or no idea of the level of bedrock outcrop, depth of superficial cover (soil etc), degree of bedrock weathering or levels of small-scale tectonic deformation, such as cleavage. All of these factors may have a major influence on the impact significance of a given development on fossil heritage and can only be reliably assessed in the field.
- Inadequate sheet explanations for geological maps, with little or no attention paid to palaeontological issues in many cases, including poor locality information.
- The extensive relevant palaeontological "grey literature" - in the form of unpublished university theses, impact studies and other reports (e.g. of commercial mining companies) - that is not readily available for desktop studies.
- Absence of a comprehensive computerized database of fossil collections in major RSA institutions which can be consulted for impact studies. A Karoo fossil vertebrate database is now accessible for impact study work.
- In the case of palaeontological desktop studies without supporting Phase 1 field assessments these limitations may variously lead to either:
    - *underestimation* of the palaeontological significance of a given study area due to ignorance of significant recorded or unrecorded fossils preserved there, or
    - *overestimation* of the palaeontological sensitivity of a study area, for example when originally rich fossil assemblages inferred from geological maps have in fact been destroyed by tectonism or weathering or are buried beneath a thick mantle of unfossiliferous "drift" (soil, alluvium *etc*).
- Since most areas of the RSA have not been studied palaeontologically, a palaeontological desktop study usually entails inferring the presence of buried fossil heritage within the study area from relevant fossil data collected from similar or the same rock units elsewhere, sometimes at localities far away. Where substantial exposures of bedrocks or potentially fossiliferous superficial sediments are present in the study area, the reliability of a palaeontological impact assessment may be significantly enhanced through field assessment by a professional palaeontologist.
- In the case of the present study area near Groblershoop in the Northern Cape preservation of potentially fossiliferous bedrocks is favoured by the arid climate but bedrock exposure is very limited indeed due to cover by extensive superficial deposits (e.g. alluvium, sandy soils, surface gravels), especially in areas of low relief, as well as by Kalahari vegetation. Very few previous palaeontological heritage assessments have been carried out in the study region

8.5 Recommendations

8.5.1 Recommendations to the CA

The project, in the EAP's opinion, does not pose a detrimental impact on the receiving environment and its inhabitants and can be mitigated significantly. The main activities associated with PV1 and PV2 have already been granted an Environmental Authorisation and the new project components (i.e. Battery Energy Storage System and increase in capacity) emanates from the technology optimisation and engineering design. In light of the opportunities that have been granted in the IRP 2019, the new project components (i.e. capacity increase and BESS) cannot be viewed in isolation to the previous authorisations as well as to the proposed 8 other PV Plants on the site. The project is critical in terms of the current energy crisis that has impacted our country and makes an important addition to sustainability goals by increasing investment and development in the renewable energy sector.

The Applicant should be bound to stringent conditions to maintain compliance and a responsible execution of the project. The actual date of construction is not available as this will depend on the DMRE. Construction is expected to commence before August 2020 and last 36 months. An EA with a validity of 5 years is recommended.

In order to achieve appropriate environmental management standards and ensure that the findings of the environmental studies are implemented through practical measures, the recommendations and mitigation measures emanating from this BA study are included within an EMPr (***Appendix G***). The EMPr must be used to ensure compliance with environmental specifications and management measures.

The implementation of this EMPr for the construction phase of the project is considered to be vital in achieving the appropriate environmental management standards as detailed for this project.

In addition, the following key conditions should be included as part of the authorisation:

a) The Developer is not negated from complying with any other statutory requirements that is applicable to the undertaking of the activity. Relevant key legislation that must be complied with by the proponent includes *inter alia*:
    i. Provisions of the National Environmental Management Waste Act (Act No. 59 of 2008) (as amended);
    ii. Provisions of the National Water Act, 1998 (Act No. 36 of 1998) (as amended);
    iii. Provisions of the National Forests Act (Act No. 84 of 1998); and
    iv. National Heritage Resources Act (Act No. 25 of 1999).
b) The Developer must appoint a suitably experienced (independent) Environmental Control Officer (ECO) for the construction phase of the development that will have the responsibility to ensure that the mitigation / rehabilitation measures and recommendations are implemented and to ensure compliance with the provisions of the EMPr.
c) All other necessary permits, licences and approvals must be obtained prior to the commencement of construction.

8.5.2 Recommendations to the Applicant

The Applicant must adhere to the recommendations provided by the specialists and the EAP. The EMPr summarises these recommendations. The Applicant must take full responsibility for the execution of the project in a manner which does not negatively impact on the environment by ensuring that responsible decisions are made.

8.6 Declaration by the EAP

The following is hereby affirmed by the EAP to be included in this report:

- the correctness of the information provided in the reports;
- the inclusion of all comments and inputs from stakeholders and I&APs;
- the inclusion of all inputs and recommendations from the specialist reports where relevant; and
- any information provided by the EAP to I&APs and any responses by the EAP to comments or inputs made by interested and affected parties.

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Signed: Malcolm Roods *EAPASA*