



FINAL ENVIRONMENTAL IMPACT
ASSESSMENT REPORT
12 August 2016

**THE PROPOSED KHUBU SOLAR POWER PLANT NEAR VRYBURG,
NORTH WEST PROVINCE**



PROJECT DETAIL

DEA Reference No. : 14/12/16/3/3/2/912

Project Title : Proposed Khubu Solar Power Plant near Vryburg, North West Province

Authors : Mrs. Carli Otte
Ms. Marelise Griesel

Client : Khubu Solar Power Plant (RF) (Pty) Ltd.

Report Status : Final Environmental Impact Report

Submission date : 12 August 2016

When used as a reference this report should be cited as: Environamics (2016) Final Environmental Impact Report: Proposed Khubu Solar Power Plant near Vryburg, North West Province.

COPYRIGHT RESERVED

This technical report has been produced for Khubu Solar Power Plant (RF) (Pty) Ltd. The intellectual property contained in this report remains vested in Environamics and Khubu Solar Power Plant (RF) (Pty) Ltd. No part of the report may be reproduced in any manner without written permission from Environamics or Khubu Solar Power Plant (RF) (Pty) Ltd.

TABLE OF CONTENTS

PROJECT DETAIL.....	1
TABLE OF CONTENTS.....	2
LIST OF TABLES	5
LIST OF FIGURES.....	6
LIST OF TABLES	7
APPENDICES	7
GLOSSARY OF TERMS AND ACRONYMS.....	8
EXECUTIVE SUMMARY	9
EXECUTIVE SUMMARY	10
1 INTRODUCTION	14
1.1 LEGAL MANDATE AND PURPOSE OF THE REPORT	14
1.2 DETAILS OF THE ENVIRONMENTAL ASSESSMENT PRACTITIONER (EAP)	17
1.3 DETAILS OF SPECIALISTS.....	17
1.4 STATUS OF THE EIA PROCESS	19
1.5 STRUCTURE OF THE REPORT	20
2 ACTIVITY DESCRIPTION	25
2.1 THE LOCATION OF THE ACTIVITY AND PROPERTY DESCRIPTION.....	25
2.2 ACTIVITY DESCRIPTION.....	27
2.3 PHOTOVOLTAIC TECHNOLOGY.....	29
2.4 LAYOUT DESCRIPTION	30
2.5 SERVICES PROVISION.....	33
2.5.1 Water.....	33
2.5.2 Storm water	34
2.5.3 Sanitation and waste removal	34
2.5.4 Electricity.....	34
2.6 DECOMMISSIONING OF THE FACILITY.....	35

3	LEGISLATIVE AND POLICY CONTEXT	36
3.1	INTRODUCTION	36
3.2	LEGISLATIVE CONTEXT.....	38
3.3	POLICY CONTEXT	42
4	THE NEED AND DESIRABILITY.....	50
4.1	THE NEED FOR THE PROPOSED ACTIVITY.....	50
4.2	THE DESIRABILITY OF THE PROPOSED ACTIVITY	50
5	DESCRIPTION OF ENVIRONMENTAL ISSUES.....	53
5.1	CONSIDERATION OF ALTERNATIVES.....	53
5.1.1	No-go alternative.....	54
5.1.2	Location alternatives	54
5.1.3	Activity alternatives.....	55
5.1.4	Technical alternatives.....	56
5.1.5	Design and layout alternatives	57
5.1.6	Technology alternatives	58
5.2	PUBLIC PARTICIPATION PROCESS.....	59
5.2.1	General	59
5.2.2	Consultation process	66
5.2.3	Registered I&APs	66
5.2.4	Issues raised by IAPs and consultation bodies	67
5.3	THE ENVIRONMENTAL ATTRIBUTES ASSOCIATED WITH THE PREFERRED ALTERNATIVE	70
5.3.1	Biophysical environment.....	71
5.3.2	Description of the socio-economic environment.....	81
5.4	SITE SELECTION MATRIX.....	85
5.5	CONCLUDING STATEMENT ON ALTERNATIVES	86
6	DESCRIPTION OF THE IMPACTS AND RISKS.....	87
6.1	SCOPING METHODOLOGY	88
6.1.1	Checklist analysis.....	88
6.1.2	Matrix analysis.....	90

6.2	KEY ISSUES IDENTIFIED	104
6.2.1	Impacts during the construction phase.....	104
6.2.2	Impacts during the operational phase	105
6.2.3	Impacts during the decommissioning phase	105
6.1	ASPECTS TO BE ASSESSED	105
6.2.4	Issue 4: Avifaunal Impacts	109
6.2.5	Issue 5: Visual Impacts	109
6.2.6	Issue 6: Agricultural / impacts on the soil	110
6.2.7	Issue 7: Socio-economic impacts.....	110
6.2.8	Issue 8: Wetland Impacts	111
6.2.9	Issue 9: Hydrological Impacts	111
6.2.10	Issue 10: Paleontological Impacts	111
6.2.11	Issue 11: Traffic Impacts.....	112
6.3	METHOD OF ENVIRONMENTAL ASSESSMENT	112
6.3.1	Impact Rating System	113
7	CUMULATIVE EFFECTS ASSESSMENT	118
7.1	INTRODUCTION	118
7.2	GEOGRAPHIC AREA OF EVALUATION	118
7.3	TEMPORAL BOUNDARY OF EVALUATION.....	119
7.4	OTHER PROJECTS IN THE AREA	120
7.4.1	Existing projects in the area	120
7.1.2	Projects in the foreseeable future.....	120
7.5	SPECIALIST INFORMATION ON CUMULATIVE EFFECTS	122
7.5.1	Geology.....	124
7.5.2	Soil, Land Capability and Agricultural Potential	125
7.5.3	Hydrology	125
7.5.4	Ecology	126
7.5.5	Birds.....	126
7.5.6	Social Impact Assessment	127

7.5.7	Visual	128
7.5.8	Heritage	129
7.5.9	Traffic.....	129
7.6	IMPACT ASSESSMENT.....	129
7.6.1	Potential Cumulative Effects	130
7.7	CONCLUSION	133
8	ENVIRONMENTAL IMPACT STATEMENT	135
8.1	SUMMARY OF KEY FINDINGS AND ASSESSMENT RESULTS	135
8.2	RECOMMENDATION OF EAP	136
9	REFERENCES.....	138

LIST OF TABLES

Table 1.1: Listed activities

Table 1.2: Details of specialists

Table 1.3: Project schedule

Table 1.4: Structure of the report

Table 2.1: General site information

Table 2.2: Listed activities

Table 2.3: Technical details for the proposed facility

Table 2.4: Coordinates

Table 3.1: Legislative context for the establishment of Solar PV Plant

Table 3.2: Policy context for the establishment of a Solar PV Plant

Table 5.1: Issues raised by key consultation bodies

Table 5.2: Trip Summary for Long Distance Route

Table 5.3: Trip Summary with delivery from Durban

Table 5.4: Trip Summary with delivery from Cape Town

Table 5.5: Summary of identified heritage resources in the area

Table 6.1: Environmental checklist

Table 6.2: Matrix analysis

Table 6.3: Aspects to be assessed

Table 6.4: The rating system

Table 7.1: Specialist Assessments obtained

Table 7.2: Cumulative Trip Summary

Table 7.3: Potential Cumulative Effects for the proposed project

LIST OF FIGURES

Figure 1: Locality Map

Figure 2: Regional Map

Figure 3: Development Footprint map

Figure 4: Land capability classification Map

Figure 5: Vegetation Map

Figure 6: Sensitivity Map

Figure 7: Cumulative Impacts Map

Figure 8: Property owners on the proposed connection line

Figure 9: Proposed layout on Portion 5 of the farm Champions Kloof 731, avoiding the non-perennial stream

Figure 10: Map indicating Coordinate Points

Figure 11: Single preferred alternative on Portion 5 of the farm Champions Kloof 731

Figure 12: Horizontal irradiation for South Africa (SolarGIS, 2011)

Figure 13: Laydown area on Portion 5 of the farm Champions Kloof 731

Figure 14: Surrounding Land Owners

Figure 15: Satellite image of assessed site (300 hectares) with soil information and soil sample numbers

Figure 16: Exotic weeds on site *Agremone ochroleuca* (White-flowered Mexican Poppy), *Chenopodium album* (Goosefoot), *Opuntia ficus-indica* (Prickly Pear) and *Schkuhria pinnata* (Dwarf Marigold)

Figure 17: Critical biodiversity areas located on the site

Figure 18: Zone of theoretical visibility

Figure 19: Map indicating the track log of the field survey

Figure 20: Renewable Energy Development Zones (REDZ)

Figure 21: Geographic area of evaluation

Figure 22: Utility-scale Renewable Energy Generation Sites

Figure 23: National Wind and Solar PV SEA: Renewable Energy EIA Application Received before Dec. 2014

PLATES

Plate 1: The site (taken towards the north)

Plate 2: The site (taken towards the north-east)

Plate 3: The site (taken towards the east)

Plate 4: The site (taken towards the south-east)

Plate 5: The site (taken towards the south)

Plate 6: The site (taken towards the south-west)

Plate 7: The site (taken towards the west)

Plate 8: The site (taken towards the north-west)

Plate 9: Gravel access road (taken towards the south)

Plate 10: Gravel access road (taken towards the north)

Plate 11: Power line

Plate 12: Current land use

Plate 13: Non-perennial stream (taken towards the east)

Plate 14: Non-perennial stream (taken towards the south-west)

APPENDICES

Appendix A: EAP declaration

Appendix B: Press advertisement

Appendix C: On site notice

Appendix D: List of I&APs

Appendix E: Proof of correspondence

Appendix F: Written comments

Appendix G: Assessment

Appendix H: Specialist Reports

H1: Geotechnical Study

H2: Ecological Fauna and Flora Habitat Survey & Wetland Assessment

H3: Wetland Assessment

H4: Hydrological Impact Assessment

H5: Avifaunal Study

H6: Visual Impact Assessment

H7: Soil, Land Capability and Agricultural Potential Study

H8: Heritage Impact Assessment

H9: Palaeontological Heritage Assessment

H10: Social Impact Assessment

H11: Traffic Impact Study

Appendix I: Environmental Management Programme (EMPr)

Appendix J: Public Meeting

Appendix K: Additional Information

Appendix L: Specialist Cumulative Assessment

GLOSSARY OF TERMS AND ACRONYMS

BA	Basic Assessment
BAR	Basic Assessment Report
DEA	Department of Environmental Affairs
DM	District Municipality
DoE	Department of Energy
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
EP	Equator Principles
EPFI	Equator Principles Financial Institutions
Environmental impact	Any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organization's environmental aspects.
GNR	Government Notice Regulation
I&AP	Interested and affected party

IDP	Integrated Development Plan
IFC	International Finance Corporation
IPP	Independent Power Producer
NLM	Naledi Local Municipality
kV	Kilo Volt
Mitigate	Activities designed to compensate for unavoidable environmental damage.
MW	Megawatt
NEMA	National Environmental Management Act No. 107 of 1998
NERSA	National Energy Regulator of South Africa
NWA	National Water Act No. 36 of 1998
PPP	Public Participation Process
PV	Photovoltaic
REIPPP	Renewable Energy IPP Procurement Process
SAHRA	South African Heritage Resources Agency
SDF	Spatial Development Framework
SPP	Solar Power Plant

CONTEXT FOR THE DEVELOPMENT

According to Eskom, the demand for electricity in South Africa has been growing at approximately 3% per annum. This growing demand, fueled by increasing economic growth and social development, is placing increasing pressure on South Africa's existing power generation capacity. Coupled with this, is the growing awareness of environmentally responsible development, the impacts of climate change and the need for sustainable development. The use of renewable energy technologies, as one of a mix of technologies needed to meet future energy consumption requirements is being investigated as part of the national Department of Energy's (DoE) long-term strategic planning and research process.

The primary rationale for the proposed solar photovoltaic (PV) facility is to add new generation capacity from renewable energy to the national electricity mix and to aid in achieving the goal of 42% share of all new installed generating capacity being derived from renewable energy forms, as targeted by DoE (Integrated Resource Plan Update 2010-2030). In terms of the Integrated Resource Plan Update (IRP Update, 2010-2030), over the short term (of the next two or three years), clear guidelines arose; namely to continue with the current renewable bid programme with additional annual rounds of 1000 MW PV, with approximately 8.4GW of the renewable energy capacity planned to be installed from PV technologies over the next twenty years.

To contribute towards this target and to stimulate the renewable energy industry in South Africa, the need to establish an appropriate market mechanism was identified, and the Renewable Energy IPP Procurement (REIPPP) process was announced in August 2012, with the intention of DoE to purchase 3,750MW of renewable energy from IPPs to be delivered to the national grid by end of 2016 under a 20-year Power Purchase Agreement to be signed with Eskom. The establishment of the REIPPP process in South Africa provides the opportunity for an increased contribution towards the sustained growth of the renewable energy sector in the country, the region and internationally, and promote competitiveness for renewable energy with conventional energies in the medium- and long-term.

In response to the above, Khubu Solar Power Plant (RF) (Pty) Ltd. is proposing the development of a photovoltaic solar facility and associated infrastructure for the purpose of commercial electricity generation on an identified site located near Vryburg in the North West Province (refer to figure 1 for the locality map). From a regional site selection perspective, this region is preferred for solar energy development due to its global horizontal irradiation value of 1740 kWh/m²/annum.

EXECUTIVE SUMMARY

Like many other small and developing municipalities in the country, the Naledi Local Municipality faces a number of challenges in addressing the needs of the community while planning for a sustainable future (IDP, 2012-17). The Naledi Local Municipality's (NLM) Integrated Development Plan (IDP, 2012-17) reveals the following key weaknesses for the municipality: municipal financial viability; growing unemployment; generally declining economy; lack of industrial development in Vryburg; infrastructural neglect and service backlogs; and lack of a proper Land Use Management System. The following key threats are also identified: increasing urbanization of rural part of NLM population; environmental degradation; high unemployment and poverty levels; large housing backlogs; lack of capital to provide and maintain services infrastructure. The IDP does not explicitly deal with renewable energy development, but the Naledi local economic development (LED) however identifies carbon-footprint reduction, including supporting alternative energies, as LED programmes for the NLM.

In response to the above Khubu Solar Power Plant (RF) (Pty) Ltd. intends to develop up to 115MW photovoltaic solar facility and associated infrastructure on Portion 5 (Shadow Eve) (Portion of Portion 4) of the farm Champions Kloof 731, Registration Division HN, North West situated within the Naledi Local Municipality area of jurisdiction. The town of Vryburg is located approximately 12km north west of the proposed development (refer to Figure 1 and 2 for the locality and regional map). The total footprint of the project will approximately be 300 hectares (including supporting infrastructure on site). The site was identified as being highly desirable due to its suitable climatic conditions, topography (i.e. in terms of slope), environmental conditions (i.e. agricultural potential, ecological sensitivity and archaeology), proximity to a grid connection point (i.e. for the purpose of electricity evacuation), as well as site access (i.e. to facilitate the movement of machinery, equipment, infrastructure and people during the construction phase).

The Environmental Impact Assessment (EIA) Regulations, 2014 (Regulation 982) determine that an environmental authorisation is required for certain listed activities, which might have

detrimental effects on the environment. The following activities have been identified with special reference to the proposed development and are listed in the EIA Regulations:

- Activity 11(i) (GN.R. 983): *“The development of facilities or infrastructure for the transmission and distribution of electricity outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts.”*
- Activity 12(xii)(c) (GN.R. 983): *“The development of- (xii) infrastructure or structures with a physical footprint of 100 square metres or more; where such development occurs- (c) ...within 32 metres of a watercourse, measured from the edge of a watercourse.”*
- Activity 19 (GN.R. 983): *“The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 5 cubic metres from- (i) a watercourse...”*
- Activity 28(ii) (GN.R. 983): *“Residential, mixed, retail, commercial, industrial or institutional developments where such land was used for agriculture or afforestation on or after 1998 and where such development (ii) will occur outside an urban area, where the total land to be developed is bigger than 1 hectare.”*
- Activity 1 (GN.R. 984): *“The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20 megawatts or more...”*
- Activity 15 (GN.R. 984): *“The clearance of an area of 20 hectare or more of indigenous vegetation...”*
- Activity 4(e)(i)(ee) (GN.R. 985): *“The development of a road wider than 4 metres with a reserve less than 13.5 metres (e) in North West (i) outside urban areas, in (ee) critical biodiversity areas as identified in bioregional plans..”*
- Activity 12(a)(ii) (GN.R. 985): *“The clearance of an area of 300 square metres or more of indigenous vegetation...(a) in North West (ii) within critical biodiversity areas identified in bioregional plans.”*

Being listed under Listing Notice 1, 2 and 3 (Regulation 983, 984 & 985) implies that the development is considered as potentially having a significant impact on the environment. Subsequently a ‘thorough assessment process’ is required as described in Regulations 21-24. Environamics has been appointed as the independent consultant to undertake the EIA on Khubu Solar Power Plant’s behalf.

Appendix 3 to GNR982 requires that the EIA process be undertaken in line with the approved plan of study for EIA and that the environmental impacts, mitigation as well as the residual risks of the proposed activity be set out in the environmental impact assessment report (EIR). The potential positive and negative impacts associated with the proposed development have been assessed and the potentially most significant environmental impacts associated with the development are briefly summarised below:

Impacts during the construction phase:

During the construction phase minor negative impacts are foreseen over the short term. The latter refers to a period of months. The potentially most significant impacts relate to the impacts on the fauna and flora, soils, geology, surface water (non-perennial stream and wetland), existing services infrastructure, traffic impacts, socio-economic impacts such as the provision of temporary employment and other economic benefits, and the impacts on health and safety and heritage resources.

Impacts during the operational phase:

During the operational phase the study area will serve as a solar PV energy facility and the potential impacts will take place over a period of 20 – 25 years. The negative impacts are generally associated with impacts on the fauna and flora, soils, geology, surface water (non-perennial stream and wetland), the pressure on existing services infrastructure, and visual impacts. The provision of sustainable services delivery also needs to be confirmed. The operational phase will have a direct positive impact through the provision of employment opportunities for its duration, and the generation of income to the local community.

Impacts during the decommissioning phase:

The physical environment will benefit from the closure of the solar facility since the site will be restored to its natural state. The decommissioning phase will however potentially result in impacts on soils, existing services infrastructure, surface water (non-perennial stream and wetland), heritage objects, and the loss of permanent employment. Skilled staff will be eminently employable and a number of temporary jobs will also be created in the process.

Cumulative impacts:

Cumulative impacts could arise as other similar projects are constructed in the area. According to the Energy Blog's database only one other solar PV plant has been granted preferred bidder status within close proximity to the proposed Khubu PV plant, namely the Waterloo Solar Park with a capacity of 75MW near Vryburg, North West Province (Approvals, planning and financing phase). However, according to the Department's database fifteen (15) other solar plants have been proposed in relative close proximity to the proposed activity. Environamics and other environmental consultants are also in the process of applying for Environmental Authorisation for ten (10) additional PV projects in the area.

The potential for cumulative impacts may therefore exist. The Final EIR includes a detailed assessment of the potential cumulative impacts associated with the proposed development. Potential cumulative impacts with a significance rating of negative medium during the construction phase relate to: loss or fragmentation of indigenous natural fauna and flora, loss or fragmentation of habitats, generation of waste, temporary employment opportunities, impact of construction workers on local communities, and an influx of job seekers and traffic impacts. Cumulative impacts (-Medium) during the operational phase relate to: visual intrusion, soil erosion, generation of additional electricity, the establishment of a community trust and the development of infrastructure for the generation of clean, renewable energy. The cumulative

effect of the generation of waste was identified as potentially significant during the decommissioning phase.

Regulation 23 of the EIA Regulations determine that an EIA report be prepared and submitted for the proposed activity after the competent authority approves the final scoping report. The EIA report will evaluate and rate each identified impact, and identify mitigation measures that may be required. The EIA report contains information that is necessary for the competent authority to consider the application and to reach a decision contemplated in Regulation Appendix 3 of the EIA Regulations. The EIA report contains information that is necessary for the competent authority to consider the application and to reach a decision contemplated in Regulation Appendix 3 of the EIA Regulations.

1 INTRODUCTION

This section aims to introduce the Environmental Impact Report (EIR) and specifically to address the following requirements of the regulations:

Appendix 3. (3) A environmental impact assessment report contains the information that is necessary for the competent authority to consider and come to a decision on the application, and must include-(a) details of:

- (i) the EAP who prepared the report; and
- (ii) the expertise of the EAP, including a curriculum vitae.

1.1 LEGAL MANDATE AND PURPOSE OF THE REPORT

Regulations No. 982, 983, 984 and 985 (of 4 December 2014) promulgated in terms of Section 24(5) and 44 of the National Environmental Management Act, (107 of 1998) determine that an EIA process should be followed for certain listed activities, which might have a detrimental impact on the environment. According to Regulation No. 982 the purpose of the Regulations is: *“...to regulate the procedure and criteria as contemplated in Chapter 5 of the Act relating to the preparation, evaluation, submission, processing and consideration of, and decision on, applications for environmental authorisations for the commencement of activities, subjected to environmental impact assessment, in order to avoid or mitigate detrimental impacts on the environment, and to optimise positive environmental impacts, and for matters pertaining thereto”*.

The EIA Regulations No. 983, 984 and 985 outline the activities for which EIA should apply. The following activities with special reference to the proposed activity are listed in the EIA Regulations:

Table 1.1: Listed activities ¹

Relevant notice:	Activity No (s)	Description of each listed activity as per project description:
GNR. 983, 4 December 2014	Activity 11(i)	<ul style="list-style-type: none"> • <i>“The development of facilities or infrastructure for the transmission and distribution of electricity (i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts.”</i> • Activity 11(i) is triggered since the proposed photovoltaic solar facility will transmit and distribute electricity of 132 kilovolts outside an urban area.
GNR. 983, 4 December 2014	Activity 12(xii)(a)(c)	<ul style="list-style-type: none"> • <i>“The development of- (xii) infrastructure or structures with a physical footprint of 100 square metres or more; where such development occurs- (a)</i>

¹ Please refer to Table 6.2 for a detailed description of the relevant aspects of the development that will apply to each specific listed activity.

		<p><i>within a watercourse or (c) ...within 32 metres of a watercourse, measured from the edge of a watercourse."</i></p> <ul style="list-style-type: none"> • Activity 12(xii)(a)(c) is triggered since the development will take place within 32 metres of a non-perennial stream running through the site. The internal road will cross the stream and the transmission line will cross the Hartsriver west of the site.
GNR. 983, 4 December 2014	Activity 19(i)	<ul style="list-style-type: none"> • <i>"The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 5 cubic metres from- (i) a watercourse..."</i> • Activity 19(i) is triggered since excavations will take place in the non-perennial stream running through the site. The internal road will cross the stream and the transmission line will cross the Hartsriver west of the site.
GNR. 984, 4 December 2014	Activity 28(ii)	<ul style="list-style-type: none"> • <i>"Residential, mixed, retail, commercial, industrial or institutional developments where such land was used for agriculture or afforestation on or after 1998 and where such development (ii) will occur outside an urban area, where the total land to be developed is bigger than 1 hectare."</i> • Activity 28(ii) is triggered since portions of the farm has been previously cultivated and the property will be re-zoned to "special".
GNR. 984, 4 December 2014	Activity 1	<ul style="list-style-type: none"> • <i>"The development of facilities or infrastructure for the generation of electricity where the electricity output is 20 megawatts or more."</i> • Activity 1 is triggered since the proposed photovoltaic solar facility will generate up to 115MW megawatts electricity.
GNR. 984, 4 December 2014	Activity 15	<ul style="list-style-type: none"> • <i>"The clearance of an area of 20 hectares or more of indigenous vegetation."</i> • In terms of vegetation type the site falls within the Ghaap Platau Vaalbosveld vegetation type, which is described by Mucina and Rutherford (2006) as 'least threatened'. Portions of the site has not been lawfully disturbed during the preceding ten years; therefore, more than 20 hectares of indigenous vegetation will be removed.

GNR. 985, 4 December 2014	Activity 4(e)(i)(ee)	<ul style="list-style-type: none"> • <i>“The development of a road wider than 4 metres with a reserve less than 13.5 metres (e) in North West (i) outside urban areas, in (ee) critical biodiversity areas as identified in bioregional plans...”</i> • The site is located in a critical biodiversity area as described in the relevant bioregional plans, and will require an internal road network, between 5 and 6 metres.
GNR. 985, 4 December 2014	Activity 12(a)(ii)	<ul style="list-style-type: none"> • <i>“The clearance of an area of 300 square metres or more of indigenous vegetation...(a) in North West (ii) within critical biodiversity areas identified in bioregional plans.”</i> • The site is located in a critical biodiversity area as described in the relevant bioregional plans. Portions of the site has not been lawfully disturbed during the preceding ten years; therefore, more than 300 square metres of indigenous vegetation will be removed.

Being listed under Listing Notices 1, 2 and 3 (Regulation 983, 984 & 985) implies that the proposed activity is considered as potentially having a significant impact on the environment. Subsequently a ‘thorough assessment process’ is required as described in Regulations 21-24. According to Appendix 3 of Regulation 982 the objective of the EIR is to, through a consultative process:

- Determine the policy and legislative context within which the activity is located and document how the proposed activity complies with and responds to the policy and legislative context;
- Describe the need and desirability of the proposed activity, including the need and desirability of the activity in the context of the preferred location;
- Identify the location of the development footprint within the preferred site based on an impact and risk assessment process inclusive of cumulative impacts and a ranking process of all the identified development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects of the environment;
- Determine the—
 - nature, significance, consequence, extent, duration and probability of the impacts occurring to inform identified preferred alternatives; and
 - degree to which these impacts-
 - can be reversed;
 - may cause irreplaceable loss of resources, and
 - can be avoided, managed or mitigated;

- identify the most ideal location for the activity within the preferred site based on the lowest level of environmental sensitivity identified during the assessment; identify, assess, and rank the impacts the activity will impose on the preferred location through the life of the activity;
- identify suitable measures to avoid, manage or mitigate identified impacts; and
- identify residual risks that need to be managed and monitored.

This report is the Final Environmental Impact Report (EIR) to be submitted to the Department of Environmental Affairs. According to Regulation 982 all registered I&APs and relevant State Departments must be allowed the opportunity to review the reports. The draft EIR was made available to registered I&APs and all relevant State Departments. They were requested to provide written comments on the draft EIR within 30 days of receiving it. All issues identified during this review period are documented and compiled into a Comments and Response Report as part of the Final EIR.

1.2 DETAILS OF THE ENVIRONMENTAL ASSESSMENT PRACTITIONER (EAP)

Environamics was appointed by the applicant as the independent EAP to conduct the EIA and prepare all required reports. All correspondence to the EAP can be directed to:

Contact person: Marélie Griesel
 Postal Address: PO Box 6484, Baillie Park, 2526
 Telephone: 018-290 8228 (w) 086 762 8336 (f) 081 477 9545 (c)
 Electronic Mail: marelie@environamics.co.za

Regulation 13(1)(a) and (b) determines that an independent and suitably qualified and experienced EAP should conduct the EIA. In terms of the independent status of the EAP a declaration is attached as Appendix A to this report. The expertise of the EAP responsible for conducting the EIA is also summarized in a curriculum vitae included as part of Appendix A.

1.3 DETAILS OF SPECIALISTS

Table 1.2 provides information on the specialists that have been appointed as part of the EIA process. Regulation 13(1)(a) and (b) determines that an independent and suitably qualified, experienced and independent specialist should conduct the specialist study, in the event where the specialist is not independent, a specialist should be appointed to externally review the work of the specialist as contemplated in sub regulation (2), must comply with sub regulation 1. In terms of the independent status of the specialists, their declarations are attached as Appendix H to this report. The expertise of the specialists is also summarized in their respective reports.

Table 1.2: Details of specialists

Study	Prepared by	Contact Person	Postal Address	Tel	e-mail
Avifaunal Study	Dr. Williams Bird Surveys	Dr A. J. Williams	52 Circle Road, Tableview, 7441	Tel. 021 556 1284 Cell 084 50 55 450	capeokapi@gmail.com
Wetland Assessment	Anthene Ecological CC	R. F Terblanche	P. O. Box 20488 Noordbrug, 2522	Cell 082 614 6684	reinierf.terblanche@gmail.com
Ecological Fauna & Flora Habitat Survey	Anthene Ecological CC	R. F Terblanche	P. O. Box 20488 Noordbrug, 2522	Cell 082 614 6684	reinierf.terblanche@gmail.com
Heritage Impact Assessment	J van Schalkwyk Heritage Consultant	J van Schalkwyk	62 Coetzer Avenue, Monument Park, 0181	Cell 076 790 6777	jvschalkwyk@mweb.co.za
Paleontological Study	Natura Viva CC	Dr. John E. Almond	P. O. Box 12410 Cape Town, 8010	-	naturaviva@universe.co.za
Agricultural & Soils Impact Assessment	Johann Lanz Soil Scientist	Johann Lanz	P. O. Box 6209 Stellenbosch, 7612	Tel. 021 866 1518 Cell 082 927 9018	johann@johannlanz.co.za
Geotechnical Study	Johann Lanz Soil Scientist	Johann Lanz	P. O. Box 6209 Stellenbosch, 7612	Tel. 021 866 1518 Cell 082 927 9018	johann@johannlanz.co.za
Visual Impact Assessment	Phala Environmental Consultants	Johan Botha	7a Burger Street Potchefstroom, 2531	Tel. 082 316 7749	johan@phala-environmental.co.za
Traffic Assessment Study	BVi Consulting Engineers	Dirk van der Merwe	Edison Square, Century City, 7441	-	dirkvdm@bviwc.co.za
Social Impact Assessment	Leandri Kruger Research & SIA Consultant	Mrs. L. Kruger	27 Tuscan Views, Ditedu Ave 51, Potchefstroom, 2520	Cell: 082 447 1455	leandrihildebrandt@gmail.com
Hydrological Impact Assessment	Eco Monitoring CC	Mr. P. H. Van Eeden	P. O. Box 1343, Norkem Park, 1931	Cell: 083 379 4419	pieter@ecomonitor.co.za

1.4 STATUS OF THE EIA PROCESS

The EIA process is conducted strictly in accordance with the stipulations set out in Regulations 21-24 of Regulation No. 982. Table 1.3 provides a summary of the EIA process and future steps to be taken. It can be confirmed that to date:

- A site visit was conducted on 26 October 2015 to discuss the proposed development and assess the site.
- The public participation process was initiated on 11 November 2015 and all I&APs were requested to submit their comments by 11 December 2015.
- The public participation process was initiated once more on 13 January 2016, in order to provide I&APs with a revised Background Information Document (BID) which incorporated some minor information changes. I&APs were requested to send their comments by 12 February 2016.
- A fully completed application form and Draft Scoping report was submitted to the Department on 26 February 2016 and the Department acknowledged receipt of the report on 7 March 2016.
- The Draft Scoping Report was made available to all registered I&APs and relevant State Departments on 26 February 2016 and they were requested to provide their comments on the report within 30 days of the notification (22 March 2016).
- A Public Meeting was held on 21 April 2016 and all registered I&APs were invited to attend through emails and a newspaper advertisement on 6 April 2016.
- The Final Scoping Report (FSR) was submitted to the Department of environmental Affairs on 11 April 2016.
- The Department of Environmental Affairs accepted the final scoping report in a letter dated 17 May 2016.
- The Draft EIR Report was submitted to the Department of Environmental Affairs on 17 June 2016.

It is envisaged that the EIA process should be completed within approximately five months of submitting the Final EIR, i.e. by December 2016 – see Table 1.3.

Table 1.3: Project schedule

Activity	Prescribed timeframe	Timeframe
Site visit		26 Oct. 2015
Appoint Avifaunal Specialist	6 Months	Oct. 2015 – April 2016
Public participation (BID)	30 Days	11 Nov. – 11 Dec. 2015

Pre-application meeting with DEA	-	19 Nov. 2015
Conduct specialist studies	-	Nov. 2015 – Feb. 2016
Public participation (BID) Round 2	30 Days	13 Jan. – 12 Feb. 2016
Submit application form and DSR	-	26 Feb. 2016
Public participation (DSR)	30 Days	26 Feb. – 30 March 2016
Submit FSR	-	11 April 2016
Department acknowledges receipt	10 Days	April 2016
Department approved FSR	43 Days	17 May 2016
Public participation (DEIR)	30 Days	13 June – 13 July 2016
Submission of FEIR & EMPr	-	12 August 2016
Department acknowledges receipt	10 Days	August 2016
Decision	107 Days	November 2016
Department notifies of decision	5 Days	November 2016
Registered I&APs notified of decision	14 Days	November 2016
Appeal	20 Days	December 2016

1.5 STRUCTURE OF THE REPORT

This report is structured in accordance with the prescribed contents stipulated in Appendix 3 of Regulation No.982. It consists of seven sections demonstrating compliance to the specifications of the regulations as illustrated in Table 1.4.

Table 1.4: Structure of the report

Requirements for the contents of a scoping report as specified in the Regulations		Section in report	Pages
Appendix 3. (3) - An environmental impact assessment report must contain the information that is necessary for the competent authority to consider and come to a decision on the application, and must include-			
(a)	details of -	1	15-24
	(i) the EAP who prepared the report; and ii) the expertise of the EAP, including a curriculum vitae.		
(b)	the location of the activity, including-	2	25-37
	(i) the 21-digit Surveyor General code of each cadastral land parcel;		
	(ii) where available, the physical address and farm name; (iii) where the required information in items (i) and (ii) is not available, the coordinates of the boundary of the property or properties;		
(c)	a plan which locates the proposed activity or activities applied for as well as the associated structures and infrastructure at an appropriate scale, or, if it is-	2	25-37
	(i) a linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken; or (ii) on land where the property has not been defined, the coordinates within which the activity is to be undertaken;		
(d)	a description of the scope of the proposed activity, including-	3	38-54
	(i) all listed and specified activities triggered and being applied for; and (ii) a description of the associated structures and infrastructure related to the development.		
(e)	a description of the policy and legislative context within which the development is located and an explanation of how the proposed development complies with and responds to the legislation and policy context.	3	38-54
(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;	4	55-57
(g)	A motivation for the preferred development footprint within the approved site.	5	58-92
(h)	a full description of the process followed to reach the proposed development footprint within the approved site, including – (i) details of all the development footprint 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;		

	<p>(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.</p> <p>(iv) the environmental attributes associated with the development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;</p> <p>(ix) if no alternative development locations for the activity were investigated, the motivation for not considering such; and</p> <p>(x) a concluding statement indicating the preferred alternative development location within the approved site.</p>		
	<p>(v) the impacts and risks identified 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;</p> <p>(vi) the methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks;</p> <p>(vii) positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;</p> <p>(viii) the possible mitigation measures that could be applied and level of residual risk;</p>		
(i)	<p>a full description of the process undertaken to identify, assess and rank the impacts the activity and associated structures and infrastructure will impose on the preferred location through the life of the activity, including-</p> <p>(i) a description of all environmental issues and risks that were identified during the EIA process; and</p> <p>(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.</p>	6	93-124
(j)	<p>an assessment of each identified potentially significant impact and risk, including-</p> <p>(i) cumulative impacts;</p> <p>(ii) the nature, significance and consequences of the impact and risk;</p> <p>(iii) the extent and duration of the impact and risk;</p> <p>(iv) the probability of the impact and risk occurring;</p> <p>(v) the degree to which the impact and risk can be reversed;</p> <p>(vi) the degree to which the impact and risk may cause irreplaceable loss of resources; and</p>		

	(vii) the degree to which the impact and risk can be mitigated;		
(k)	(k) where applicable, a summary of the findings and recommendations of 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 assessment report;	6	93-124
(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;	8	138-141
(m)	based on the assessment, and where applicable, recommendations from specialist reports, the recording of proposed impact management objectives, and the impact management outcomes for the development for inclusion in the EMPr as well as for inclusion as conditions of authorisation;		
(n)	the final proposed alternatives which respond to the impact management measures, avoidance, and mitigation measures identified through the assessment;	Not applicable	
(o)	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	Not applicable	
(p)	a description of any assumptions, uncertainties and gaps in knowledge which relate to the assessment and mitigation measures proposed;		
(q)	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;	8	138-141
(r)	where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required and the date on which the activity will be concluded and the post construction monitoring requirements finalised;	Not applicable	
(s)	an undertaking under oath or affirmation by the EAP in relation to- (i) the correctness of the information provided in the report; (ii) the inclusion of comments and inputs from stakeholders and interested and affected parties (I&APs); (iii) the inclusion of inputs and recommendations from the specialist reports where relevant; and	Appendix A to the report	

	(iv) any information provided by the EAP to I&APs and any responses by the EAP to comments or inputs made by I&APs;	
(t)	where applicable, details of any financial provisions for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts;	Not applicable
(u)	an indication of any deviation from the approved scoping report, including the plan of study, including-	Not applicable
	(i) any deviation from the methodology used in determining the significance of potential environmental impacts and risks; and	
	(ii) a motivation for the deviation;	
(v)	any specific information that may be required by the CA; and	Not applicable
(w)	any other matters required in terms of section 24(4)(a) and (b) of the Act.	Not applicable

2 ACTIVITY DESCRIPTION

This section aims to address the following requirements of the regulations:

- Appendix 3.** (3) An EIR (...) must include-
- (b) the location of the activity, including-
 - (i) the 21-digit Surveyor General code of each cadastral land parcel;
 - (ii) where available, the physical address and farm name;
 - (iii) where the required information in items (i) and (ii) is not available, the coordinates of the boundary of the property or properties;
 - (c) a plan which locates the proposed activity or activities applied for as well as the associated structures and infrastructure at an appropriate scale, or, if it is-
 - (i) a linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken; or
 - (ii) on land where the property has not been defined, the coordinates within which the activity is to be undertaken;
 - (d) a description of the scope of the proposed activity, including-
 - (i) all listed and specified activities triggered and being applied for;
 - (ii) a description of the associated structures and infrastructure related to the development.

2.1 THE LOCATION OF THE ACTIVITY AND PROPERTY DESCRIPTION

The activity entails the development of a photovoltaic solar facility and associated infrastructure on Portion 5 (Shadow Eve) (Portion of Portion 4) of the farm Champions Kloof 731, Registration Division HN, North West Province situated within the Naledi Local Municipality area of jurisdiction. The proposed development is located in the North West Province in the northern central interior of South-Africa (refer to Figure 2 for the regional map). The town of Vryburg is located approximately 12km north west of the proposed development (refer to Figure 1 for the locality map).

The project entails the generation of up to 115MW electrical power through photovoltaic (PV) panels. The total footprint of the project will approximately be 300 hectares (including supporting infrastructure on site) – refer to table 2.1 for general site information. The property on which the facility is to be constructed will be leased by Khubu Solar Power Plant (RF) (Pty) Ltd. from the property owner Meyer Trust, for the life span of the project (minimum of 20 years), should the project be selected as a preferred bidder. It is expected that generation from the facility will tie in with the Mookodi-Mogopela 132kV transmission line, which will also traverse five additional

properties. The property owners of these farm portions are Tiger Kloof Educational Institute and Transnet Ltd. – refer to figure 8 below. Both farm owners have been registered as I&APs.

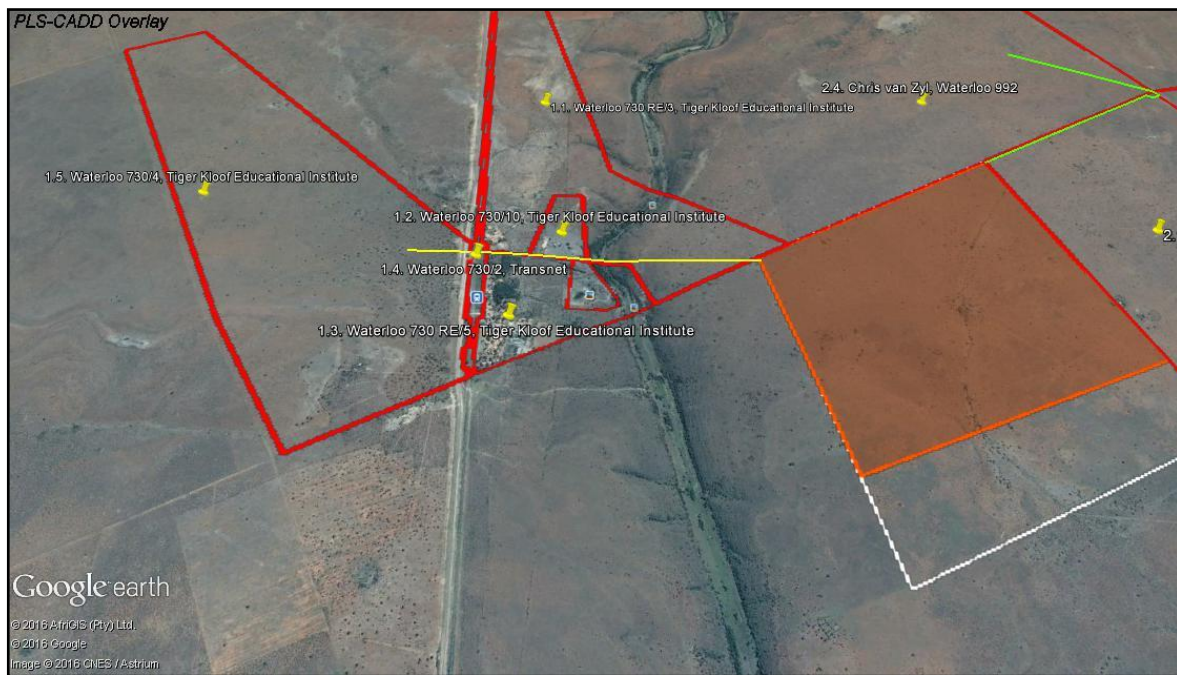


Figure 8: Property owners on the proposed connection line

Table 2.1: General site information

Description of affected farm portion (PV array)	Portion 5 (Shadow Eve) (Portion of Portion 4) of the farm Champions Kloof 731, Registration Division HN, North West
Description of affected farm portion (powerline)	-Waterloo 730 RE/3, Registration Division IN, North West -Waterloo 730 portion 10, Registration Division IN, North West -Waterloo 730 RE/5, Registration Division IN, North West -Waterloo 730 portion 2, Registration Division IN, North West -Waterloo 730 portion 4, Registration Division IN, North West
21 Digit Surveyor General codes	TOHN00000000073000005 TOHN00000000073000003 TOHN00000000073000010 TOHN00000000073000005 TOHN00000000073000002 TOHN00000000073000004
Title Deed	T1648/2012
Photographs of the site	Refer to the Plates
Type of technology	Photovoltaic solar facility
Structure Height	Panels ~3.5m, buildings ~ 4m and power lines ~32m
Surface area to be covered	Approximately 300 hectares

Structure orientation	The panels will either be fixed to a single-axis horizontal tracking structure where the orientation of the panel varies according to the time of the day, as the sun moves from east to west or tilted at a fixed angle equivalent to the latitude at which the site is located in order to capture the most sun.
Laydown area dimensions	Approximately 300 hectares
Generation capacity	115MW
Expected production	Up to 300 GWh per annum

The site is located in a rural area and is bordered by farms. The site survey revealed that the site currently consists of grazing for cattle – refer to plates 1-15 for photographs of the development area. The property on which the development is to be established is owned by Meyer Trust.

On 9 December 2015 a letter was received by the North West Department of Mineral Resources confirming that according to their office records, no applications or existing rights were found on Portion 5 of the farm Champions Kloof 731 IN – Refer to Appendix K.

2.2 ACTIVITY DESCRIPTION

The proposed development will trigger the following activities:

Table 2.2: Listed activities ²

Relevant notice:	Activity No (s)	Description of each listed activity as per project description:
GNR. 983, 4 December 2014	Activity 11(i)	<ul style="list-style-type: none"> “The development of facilities or infrastructure for the transmission and distribution of electricity (i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts.” Activity 11(i) is triggered since the proposed photovoltaic solar facility will transmit and distribute electricity of 132 kilovolts outside an urban area.
GNR. 983, 4 December 2014	Activity 12(xii)(a)(c)	<ul style="list-style-type: none"> “The development of- (xii) infrastructure or structures with a physical footprint of 100 square metres or more; where such development occurs- (a) within a watercourse or (c) ...within 32 metres of a watercourse, measured from the edge of a watercourse.” Activity 28(xii)(a)(c) is triggered since the development will take place within 32 metres of a non-perennial stream running through the site. The

² Please refer to Table 6.2 for a detailed description of the relevant aspects of the development that will apply to each specific listed activity.

		<p>internal road will cross the stream and the transmission line will cross the Hartsriver west of the site.</p>
GNR. 983, 4 December 2014	Activity 19(i)	<ul style="list-style-type: none"> • <i>“The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 5 cubic metres from- (i) a watercourse...”</i> • Activity 19(i) is triggered since excavations will take place in the non-perennial stream running through the site. The internal road will cross the stream and the transmission line will cross the Hartsriver west of the site.
GNR. 984, 4 December 2014	Activity 28(ii)	<ul style="list-style-type: none"> • <i>“Residential, mixed, retail, commercial, industrial or institutional developments where such land was used for agriculture or afforestation on or after 1998 and where such development (ii) will occur outside an urban area, where the total land to be developed is bigger than 1 hectare.”</i> • Activity 28(ii) is triggered since portions of the farm have been previously cultivated and the property will be re-zoned to “special”.
GNR. 984, 4 December 2014	Activity 1	<ul style="list-style-type: none"> • <i>“The development of facilities or infrastructure for the generation of electricity where the electricity output is 20 megawatts or more.”</i> • Activity 1 is triggered since the proposed photovoltaic solar facility will generate up to 115MW megawatts electricity.
GNR. 984, 4 December 2014	Activity 15	<ul style="list-style-type: none"> • <i>“The clearance of an area of 20 hectares or more of indigenous vegetation.”</i> • In terms of vegetation type the site falls within the Ghaap Plateau Vaalbosveld vegetation type, which is described by Mucina and Rutherford (2006) as ‘least threatened’. Portions of the site has not been lawfully disturbed during the preceding ten years; therefore, more than 20 hectares of indigenous vegetation will be removed.
GNR. 985, 4 December 2014	Activity 4(e)(i)(ee)	<ul style="list-style-type: none"> • <i>“The development of a road wider than 4 metres with a reserve less than 13.5 metres (e) in North West (i) outside urban areas, in (ee) critical biodiversity areas as identified in bioregional plans..”</i> • The site is located in a critical biodiversity area as described in bioregional plans, and will require an internal road network, between 5 and 6 meters.

GNR. 985, 4 December 2014	Activity 12(a)(ii)	<ul style="list-style-type: none"> • <i>“The clearance of an area of 300 square metres or more of indigenous vegetation...(a) in North West (ii) within critical biodiversity areas identified in bioregional plans.”</i> • The site is located in a critical biodiversity area as described in bioregional plans. Portions of the site has not been lawfully disturbed during the preceding ten years; therefore, more than 300 square metres of indigenous vegetation will be removed.
---------------------------------	-----------------------	--

The potentially most significant impacts will occur during the construction phase of the development, which will include the following activities:

- Site clearing and preparation: Certain areas of the site will need to be cleared of vegetation and some areas may need to be levelled.
- Civil works to be conducted:
 - Terrain levelling if necessary– Levelling will be minimal as the potential site chosen is relatively flat.
 - Laying foundation- The structures will be connected to the ground through cement pillars, cement slabs or metal screws. The exact method will depend on the detailed geotechnical analysis.
 - Construction of access and inside roads/paths – existing paths will be used where reasonably possible. Additionally, the turning circle for trucks will also be taken into consideration.
 - Trenching – all Direct Current (DC) and Alternating Current (AC) wiring within the PV plant will be buried underground. Trenches will have a river sand base, space for pipes, backfill of sifted soil and soft sand and concrete layer where vehicles will pass.

2.3 PHOTOVOLTAIC TECHNOLOGY

The term photovoltaic describes a solid-state electronic cell that produces direct current electrical energy from the radiant energy of the sun through a process known as the Photovoltaic Effect. This refers to light energy placing electrons into a higher state of energy to create electricity. Each PV cell is made of silicon (i.e. semiconductors), which is positively and negatively charged on either side, with electrical conductors attached to both sides to form a circuit. This circuit captures the released electrons in the form of an electric current (direct current). The key components of the proposed project are described below:

- PV Panel Array - To produce up to 115MW, the proposed facility will require numerous linked cells placed behind a protective glass sheet to form a panel. Multiple panels will be required to form the solar PV array which will comprise the PV facility. The PV modules will either be tilted at a fixed angle, or mounted on trackers tracking from east to west during the day in order to capture the most solar energy.

- Wiring to Central Inverters - Sections of the PV array will be wired to central inverters. The inverter is a pulse width mode inverter that converts direct current (DC) electricity to alternating current (AC) electricity at grid frequency.
- Connection to the grid - Connecting the array to the electrical grid requires transformation of the voltage from 480V to 33kV to 132kV. The normal components and dimensions of a distribution rated electrical substation will be required. Output voltage from the inverter is 480V and this is fed into step up transformers to 132kV. An onsite substation will be required on the site to step the voltage up to 132kV, after which the power will be evacuated into the national grid. Whilst Khubu Solar Power Plant (RF) (Pty) Ltd. has not yet received a cost estimate letter from Eskom, it is expected that generation from the facility will tie in with the Mookodi-Magopela 132kV transmission line. The Project will inject up to 100MW into the transmission line. The installed capacity will be up to approximately 115MW.
- Electrical reticulation network – An internal electrical reticulation network will be required and will be laid ~2-4m underground as far as practically possible.
- Supporting Infrastructure – The following auxiliary buildings with basic services including water and electricity will be required on site:
 - Office (~16m x 9.85m);
 - Switch gear and relay room (~25m x 14m);
 - Staff lockers and changing room (~21.7m x 9.85m); and
 - Security control (~11.8m x 5.56m)
- Roads – Access will be obtained via a gravel road off the R34. An internal site road network will also be required to provide access to the solar field and associated infrastructure. The access road will have a width of ~6m and the internal road/track ~5m.
- Fencing - For health, safety and security reasons, the facility will be required to be fenced off from the surrounding farm. Cochrane Clearvu fencing with a height of 2.5 meters will be used.

2.4 LAYOUT DESCRIPTION

The layout plan will follow the limitations of the site and aspects such as environmentally sensitive areas (non-perennial stream), roads, fencing, servitudes and the farm infrastructure on site will be considered – refer to figure 9 below. The total surface area proposed for layout options include the PV panel arrays spaced to avoid shadowing, access and maintenance roads and associated infrastructure (buildings, power inverters, transmission lines and perimeter fences). Due to the nature of the site being used for grazing (refer to the Plates), limited features of environmental significance exist on site. A final layout plan is included as Facility Illustrations in the report.

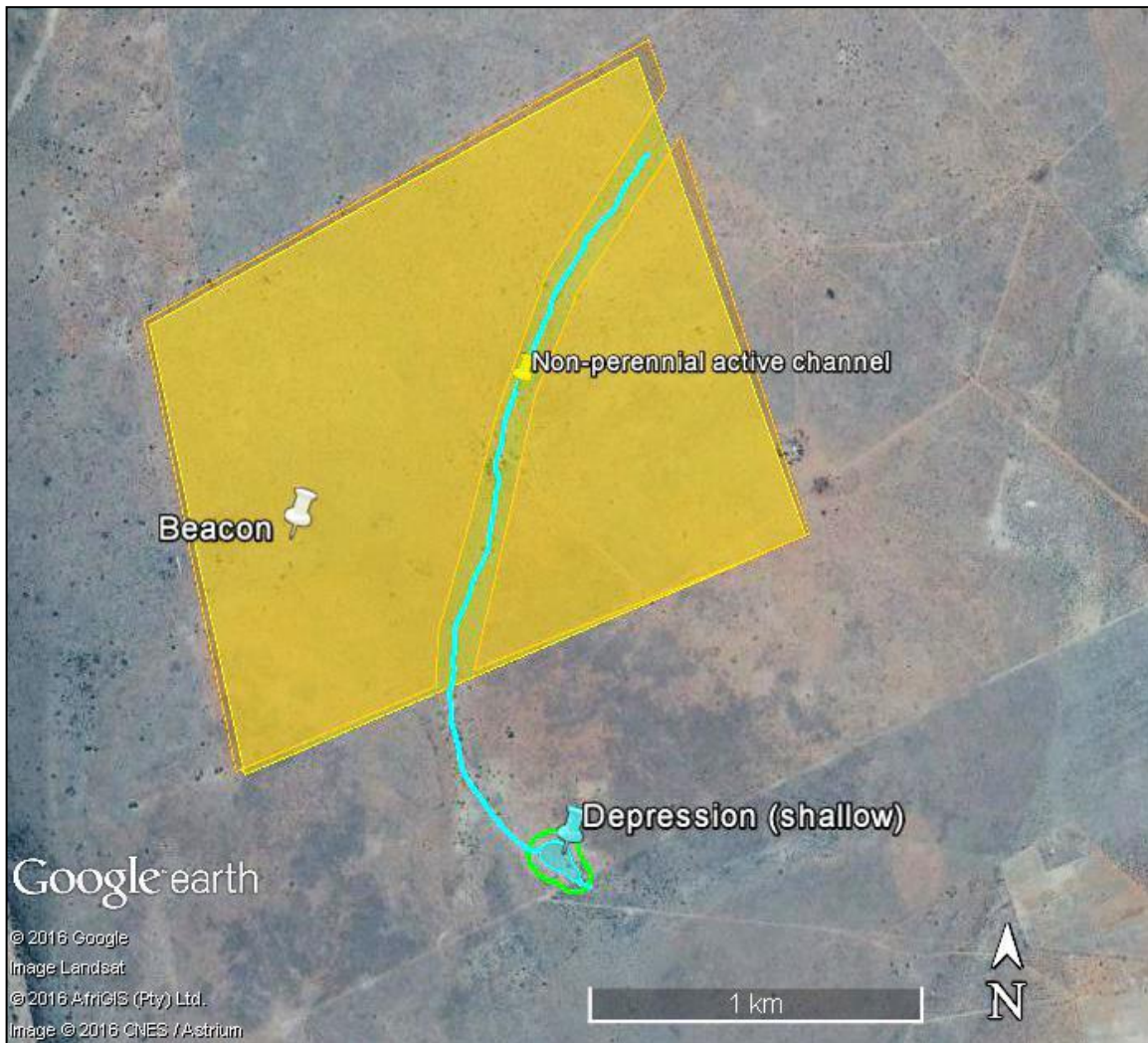


Figure 9: Proposed layout on Portion 5 of the farm Champions Kloof 731, avoiding the non-perennial stream

Table 2.3 below provides detailed information regarding the layout for the proposed facility as per DEA specifications.

Table 2.3: Technical details for the proposed facility

Component	Description / dimensions
Height of PV panels	3.5 meters
Area of PV Array	300 hectares
Number of inverters required	Minimum 34
Area occupied by inverter / transformer stations / substations	Inverter Transformer Station: 2.5 x 7.6 meters (19m ²) Substation: 25 x 14 meters (350m ²)
Capacity of on-site substation	132kV
Area occupied by both permanent and construction laydown areas	Permanent Laydown Area: Hectares Construction Laydown Area: 713.11 meters

Area occupied by buildings	Security Room: 66.74 m ² Office: 157.6 m ² Staff Locker and Changing Room: 213.745 m ²
Length of internal roads	Approximately 13 km
Width of internal roads	Approximately 6 meters
Proximity to grid connection	Approximately 2.1 km
Height of fencing	Approximately 2.5 meters
Type of fencing	Cochrane Clearvu

Table 2.4 and figure 10 provide and illustrate the corner coordinate points for the proposed development site as well as start, middle and end point coordinates for linear activities.

Table 2.4: Coordinates

Coordinates			
EIA Footprint	1	27° 2'34.12"S	24°47'14.10"E
	2	27° 3'3.22"S	24°46'17.51"E
	3	27° 3'51.98"S	24°46'30.08"E
	4	27° 3'27.95"S	24°47'34.33"E
Access Road	1	27° 3'28.01"S	24°47'34.10"E
	2	27° 3'41.37"S	24°47'39.17"E
	3	27° 3'21.73"S	24°48'14.46"E
	4	27° 2'58.27"S	24°48'38.36"E
	5	27° 2'39.99"S	24°49'4.53"E
Power Line	1	27° 3'3.44"S	24°46'18.15"E
	2	27° 3'2.30"S	24°45'41.08"E
	3	27° 3'1.16"S	24°45'4.45"E

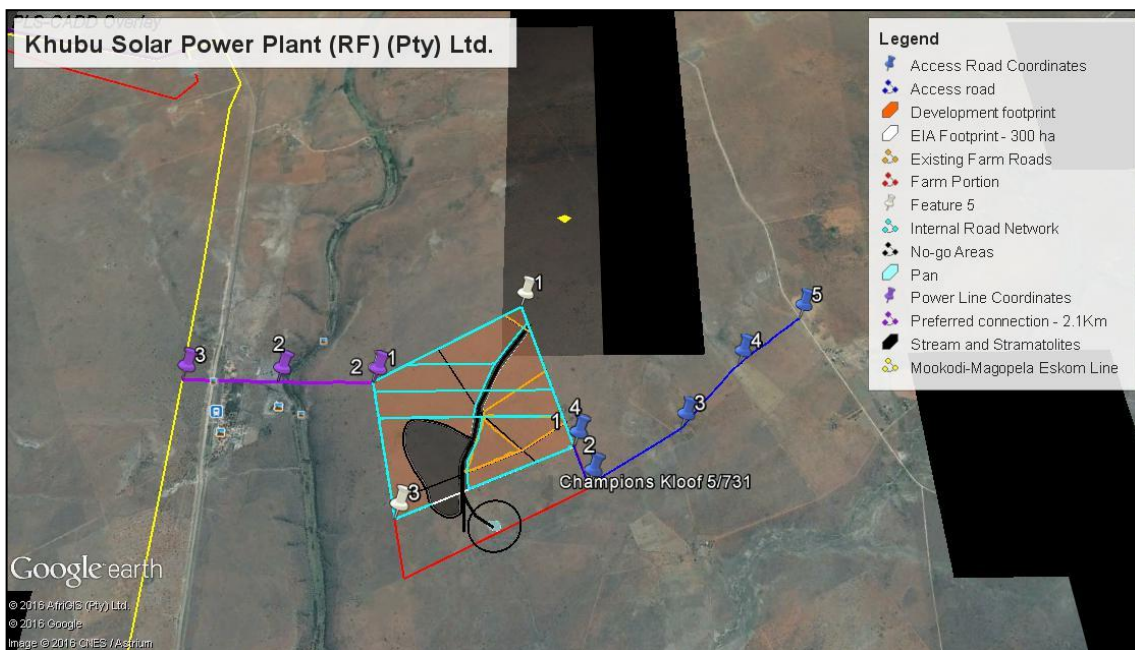


Figure 10: Map indicating Coordinate Points

2.5 SERVICES PROVISION

The following sections provides information on services required on the site e.g. water, sewage, refuse removal, and electricity.

2.5.1 Water

Adequate provision of water will be a prerequisite for the development. Water for the proposed development will most likely be obtained from ground water resources, or alternatively from the local municipality. The Department of Water and Sanitation has been asked to confirm the water resource availability in the relevant catchment management area in order to ensure sustainable water supply. A full assessment of the application for water use authorisation will only be undertaken in the event that the project proponent has been appointed as a preferred bidder by the Department of Energy.

The site falls within the C32 quaternary drainage region, this drainage region falls under Zone C, which refers to the amount of water that may be taken from the ground water resource per hectare, per annum. According to the Revision of General Authorisations in terms of Section 39 of the National Water Act of 1998 (Act No. 36 of 1998), Zone C indicates that 75m³ of water per hectare may be taken from these drainage regions per annum. The proposed site will cover an area of approximately 300 hectares, which in effect means that a total of 22 500m³ of water may be abstracted from a ground water resource without applying for a Water Use License.

The estimated maximum amount of water required during construction is 200m³ per month during the 12 months of construction. The estimated maximum amount of water required during the facility's 20 years of production is 3 880m³ per annum. The majority of this usage is for the cleaning of the solar panels. Since each panel requires approximately 2 liters of water for cleaning, the total amount of 460 000 panels will require 920 000 liters per wash. It is estimated that the panels may only need to be washed twice per annum, but provision is made for quaternary

cleaning (March, May, July, and September). This totals approximately 3,680,000 liters per annum for washing, and allows 200,000 liters per annum (or 548 liters per day) for toilet use, drinking water, etc. This totals to approximately 3 880m³ of water required per annum. Drinking water supplied will comply with the SANS:241 quality requirements and it is noted that the Naledi Local Municipality remains the Water Service Authority in that area of jurisdiction.

Generally, the water supply does not require the construction of a reverse osmosis plant. This is however dependant on the quality of the water, or what the mineral content is. Should a reverse osmosis plant be required, brine (the excess minerals) will be formed during the filtration process that will be stored and then removed. Determining baseline water quality conditions is important in order to appropriately manage incidents in the future. The quality of the water will however only undergo testing if the project is selected as preferred bidder by the Department of Energy. Water saving devices and technologies such as the use of dual flush toilets and low-flow taps, the management of storm water, the capture and use of rainwater from gutters and roofs should be considered by the developer. Furthermore, indigenous vegetation will be used during landscaping and the staff will be trained to implement good housekeeping techniques.

2.5.2 Storm water

To avoid soil erosion, it is recommended that the clearing of vegetation be limited. It will also be good practice to design storm water canals into which the water from the panels can be channelled. These canals should reduce the speed of the water and allow the water to drain slowly onto the land. Storm water management and mitigation measures are included in the Environmental Management Programme (EMPr) – refer to Appendix I.

2.5.3 Sanitation and waste removal

Portable chemical toilets will be utilized, that will be serviced privately or by the local municipality. Waste will be disposed at the Naledi landfill site. The construction and hazardous waste will be removed to licensed landfill sites accepting such kinds of wastes. During the operational phase household waste will be removed to a licensed landfill site by a private contractor or by the local municipality. The relevant Local Municipality(s) was asked in a letter dated 14 December 2015, to formally confirm that it has the capacity to provide the proposed development with these services for the lifetime of the project (20 years). In a letter dated 17 December 2015 the Naledi Local Municipality formally informed that they would not be able to collect the construction solid waste and general waste due to the fact that the municipality does not have enough capacity within the current operational fleet, but the licensed Naledi landfill site (License No.: NW/WM/DR1/2009/01) has the capacity (1200m³) to accommodate the refuse generated.

2.5.4 Electricity

Electricity use will be limited, and will primarily be related to the lighting of the facility and domestic use. Design measures such as the use of energy saving light bulbs would be considered by the developer. During the day, electricity will be sources by the photovoltaic plant, and from the electricity connection at night.

2.6 DECOMMISSIONING OF THE FACILITY

The operating period will be 20 years from the commencement date. Thereafter two rights of renewal periods of 40 years and 20 years will be relevant. It is anticipated that new PV technologies and equipment will be implemented, within the scope of the Environmental Authorisation, when influencing the profitability of the solar facility.

A likely extension of the plant's lifetime would involve putting new, more efficient, solar panels on the existing structures. The specifications of these new panels will be the same as the current one, but for that the conversion efficiency of sunlight to energy will be greater (comparable to new computer chips, that the same, but faster and more efficient). If, for whatever reason the plant halts operations, the Environmental Authorisation and contract with the landowner will be respected during the decommissioning phase. The following clauses are an extract from the contract indicating the commitment to the rehabilitation of the area.

Lessee's obligation on termination:

Subject to any Environmental Approval being required and subject to any condition attaching to an existing Environmental Approval, if any, the Lessee shall upon the termination of this Agreement be entitled to remove any Project Equipment, which equipment shall at all times be regarded as movable, notwithstanding the manner and method by which it is affixed or shall otherwise have acceded to the Leased Premises. If the Lessee fails to remove any Project Equipment within a period of 6 (six) months of this Agreement terminating, the same shall become the property of the Lessor (as far as permitted in Law) and the Lessee shall not have any claim against the Lessor for compensation or otherwise in respect of any Project Equipment not removed. However, if the Lessee fails to remove any Project Equipment despite being requested to do so, in writing, the Lessor may remove the same and restore the Leased Premises at the expense of the Lessee.

Notwithstanding the provisions of the clause above and subject to compliance with Environmental Law, the Lessee shall take such measures to rehabilitate the Leased Premises as the Lessor directs, in writing, for the purpose of restoring the Leased Premises to the condition in which it was before the commencement of any Works, including amongst others, decommissioning the Energy Facility. The Lessee undertakes to complete any such rehabilitation or decommissioning within 6 (six) months after the Termination Date.

As security for the above and to the extent required by the Lessor, the Lessee shall furnish to, or in favour of, the Lessor, such security (and for such amount) as is acceptable to the Lessor. The Parties specifically agree that the amount of security required by the Lessor should at all times be reasonable and should under no circumstances whatsoever exceed an amount reasonably deemed acceptable and appropriate to cover the total cost of rehabilitation of the Leased Premises.

3 LEGISLATIVE AND POLICY CONTEXT

This section aims to address the following requirements of the regulations:

Appendix 3. (3) An EIR (...) must include-

(e) a description of the policy and legislative context within which the development is located and an explanation of how the proposed development complies with and responds to the legislation and policy context.

3.1 INTRODUCTION

Environmental decision making with regards to solar PV plants is based on numerous policy and legislative documents. These documents inform decisions on project level environmental authorisations issued by the National Department of Environmental Affairs (DEA) as well as comments from local and district authorities. Moreover, it is significant to note that they also inform strategic decision making reflected in IDPs and SDFs. Therefore, to ensure streamlining of environmental authorisations it is imperative for the proposed activity to align with the principles and objectives of key national, provincial and local development policies and legislation. The following acts and policies are briefly summarised:

- The Constitution of the Republic of South Africa, 1996 (Act No. 108 of 1996)
- National Environmental Management Act, 1998 (Act No. 107 of 1998) [NEMA]
- The National Energy Act, 2008 (Act 34 of 2008)
- National Water Act, 1998 (Act No. 36 of 1998)
- National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008)
- National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004)
- The National Heritage Resources Act, 1999 (Act No. 25 of 1999)
- Conservation of Agricultural Resources Act, 1983 (Act No. 85 of 1983)
- Strategic Plan, 2015 – 2020 (2015)
- The White Paper on the Energy Policy of the Republic of South Africa (1998)
- The White Paper on Renewable Energy (2003)
- Integrated Resource Plan (IRP) for South Africa (2010-2030)
- North West Province Growth and Development Strategy (2004-2014)
- Dr Ruth Segomotsi Mompati District Municipality Integrated Development Plan (IDP) 2010/2011
- Naledi Local Municipality Integrated Development Plan (IDP) 2015/2016

- Naledi Spatial Development Framework (SDF)

The key principles and objectives of each of the legislative and policy documents are briefly summarised in Tables 3.1 and 3.2 to provide a reference framework for the implications for the proposed activity.

3.2 LEGISLATIVE CONTEXT

Table 3.1: Legislative context for the construction of photovoltaic solar plants

LEGISLATION	ADMINISTERING AUTHORITY	DATE	SUMMARY / IMPLICATIONS FOR PROPOSED DEVELOPMENT
The Constitution of South Africa (Act No. 108 of 1996)	National Government	1996	The Constitution is the supreme law of the Republic and all law and conduct must be consistent with the Constitution. The Chapter on the Bill of Rights contains a number of provisions, which are relevant to securing the protection of the environment. Section 24 states that “everyone has the right to (a) an environment that is not harmful to their health or well-being and (b) to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that – (i) prevent pollution and ecological degradation; (ii) promote conservation; and (iii) secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development. The Constitution therefore, compels government to give effect to the people’s environmental right and places government under a legal duty to act as a responsible custodian of the countries environment. It compels government to pass legislation and use other measures to protect the environment, to prevent pollution and ecological degradation, promote conservation and secure sustainable development.
The National Environmental Management Act (Act No. 107 of 1998)	National and Provincial Department of Environmental Affairs	1998	NEMA provides for co-operative governance by establishing principles and procedures for decision-makers on matters affecting the environment. An important function of the Act is to serve as an enabling Act for the promulgation of legislation to effectively address integrated environmental management. Some of the principles in the Act are accountability; affordability; cradle to grave management; equity; integration; open information; polluter pays; subsidiary; waste avoidance and minimisation; co-operative governance; sustainable development; and environmental protection and justice. The mandate for EIA lays with the National Environmental Management Act (107 of 1998) and the EIA Regulations No. 982, 983, 984, and 985 promulgated in terms of Section 24 of NEMA. The EIA Regulations determine that an Environmental Authorisation is required for certain listed activities, which might have a detrimental effect on the environment. This EIA was triggered by activity 11(i),

Activity 12(xii)(a)(c), 19(i) and 28(ii) listed in Regulation R983, activities 1 and 15 listed in Regulation R984 and Activity 4(e)(i)(ee) and Activity 12 (a)(ii) listed in Regulation 983, which requires a ‘scoping and environmental impact assessment process.’

The National Energy Act (Act No. 34 of 2008)	Department of Minerals and Energy	2008	One of the objectives of the National Energy Act was to promote diversity of supply of energy and its sources. In this regard, the preamble makes direct reference to renewable resources, including solar: “To ensure that diverse energy resources are available, in sustainable quantities, and at affordable prices, to the South African economy, in support of economic growth and poverty alleviation, taking into account environmental management requirements (...); to provide for (...) increased generation and consumption of renewable energies...” (Preamble).
The National Water Act (Act No. 36 of 1998)	Department of Water and Sanitation (DWA)	1998	Sustainability and equity are identified as central guiding principles in the protection, use, development, conservation, management and control of water resources. The intention of the Act is to promote the equitable access to water and the sustainable use of water, redress past racial and gender discrimination, and facilitate economic and social development. The Act provides the rights of access to basic water supply and sanitation, and environmentally, it provides for the protection of aquatic and associated ecosystems, the reduction and prevention of pollution and degradation of water resources.

As this Act is founded on the principle that National Government has overall responsibility for and authority over water resource management, including the equitable allocation and beneficial use of water in the public interest, a person can only be entitled to use water if the use is permissible under the Act. Chapter 4 of the Act lays the basis for regulating water use.

The site falls within the C32 quaternary drainage region, this drainage region falls under Zone C, which refers to the amount of water that may be taken from the ground water resource, per hectare. According to the Revision of General Authorisations in terms of Section 39 of the National Water Act of 1998 (Act No. 36 of 1998), Zone C indicates that 75m³ of water per hectare may be taken from these drainage regions per annum. The proposed site will cover an area of approximately 300 hectares, which in effect means that a total of 22 500m³ of water may be abstracted from a ground water resource without applying for a Water Use License. It should be noted that if the development

			occurs within 500m from a wetland or within a stream, a WULA may be required. Since the internal road will cross the non-perennial stream and the transmission line will cross the Harts river west of the site, the development will trigger a Section 19; 21 (c) and (i) activities listed in the NWA.
National Environmental Management: Waste Act (Act No. 59 of 2008)	Department of Environmental Affairs (DEA)	2008	<p>NEMWA has been developed as part of the law reform process enacted through the White Paper on Integrated Pollution and Waste Management and the National Waste Management Strategy (NWMS). The objectives of the Act relate to the provision of measures to protect health, well-being and the environment, to ensure that people are aware of the impact of waste on their health, well-being and the environment, to provide for compliance with the measures, and to give effect to section 24 of the Constitution in order to secure an environment that is not harmful to health and well-being.</p> <p>Regulations No. R921 (of 2013) promulgated in terms of Section 19(1) of the National Environmental Management: Waste Act (59 of 2008) determine that no person may commence, undertake or conduct a waste management activity listed in this schedule unless a license is issued in respect of that activity. It is not envisaged that a waste permit will be required for the proposed development.</p>
National Environment Management: Air Quality Act (Act No. 39 of 2004)	Department of Environmental Affairs (DEA)	2004	<p>The object of this Act is to protect the environment by providing reasonable measures for the protection and enhancement of the quality of air in the Republic; the prevention of air pollution and ecological degradation; and securing ecologically sustainable development while promoting justifiable economic and social development.</p> <p>Regulations No. R248 (of 31 March 2010) promulgated in terms of Section 21(1)(a) of the National Environmental Management Act: Air Quality Act (39 of 2004) determine that an Atmospheric Emission License (AEL) is required for certain listed activities, which result in atmospheric emissions which have or may have a detrimental effect on the environment. The Regulation also sets out the minimum emission standards for the listed activities. It is not envisaged that an Atmospheric Emission License will be required for the proposed development.</p>
The National Heritage Resources Act	South African Heritage Resources Agency (SAHRA)	1999	The Act aims to introduce an integrated and interactive system for the management of the heritage resources, to promote good government at all levels, and empower civil society to nurture and conserve heritage resources so that they may be bequeathed to future generations and to lay down principles for governing heritage resources management throughout the Republic. It also aims to

(Act No. 25 of 1999)			<p>establish the South African Heritage Resources Agency together with its Council to co-ordinate and promote the management of heritage resources, to set norms and maintain essential national standards and to protect heritage resources, to provide for the protection and management of conservation-worthy places and areas by local authorities, and to provide for matters connected therewith.</p>
			<p>The Act protects and manages certain categories of heritage resources in South Africa. For the purposes of the Heritage Resources Act, a “heritage resource” includes any place or object of cultural significance. In this regard the Act makes provision for a person undertaking an activity listed in Section 28 of the Act to notify the resources authority. The resources authority may request that a heritage impact assessment be conducted if there is reason to believe that heritage resources will be affected.</p>
			<p>A case file has been opened on SAHRIS and all relevant documents will be submitted for their comments and approval.</p>
Conservation of Agricultural Resources Act (Act No. 85 of 1983)	National and Provincial Government	1983	<p>The objective of the Act is to provide for control over the utilization of the natural agricultural resources of the Republic in order to promote the conservation of the soil, the water sources and the vegetation and the combating of weeds and invader plants; and for matters connected therewith.</p> <p>Consent will be required from the Department of Agriculture in order to confirm that the proposed development is not located on high potential agricultural land and to approve the long term lease agreement.</p>

3.3 POLICY CONTEXT

Table 3.2: Policy context for the construction of solar PV plants

POLICY	ADMINISTERING AUTHORITY	DATE	SUMMARY / IMPLICATIONS FOR PROPOSED DEVELOPMENT
Strategic Plan, 2015 – 2020	Department of Energy	2015	<p>The strategic plan identifies six departmental programmes. Programme 6 relates to clean energy. The purpose of this programme is to manage and facilitate the development and implementation of clean and renewable energy initiatives as well as Energy Efficiency Demand-Side Management (EEDSM). Strategic objective 6.3 relates to effective renewable energy: To ensure the integration of renewable energy into the mainstream energy supply of South Africa by planning & coordinating initiatives & interventions focused on the development & improvement of the renewable energy market through:</p> <ul style="list-style-type: none"> • facilitating the incorporation of renewable energy technologies into the Integrated Energy Plan (IEP) & other key energy policy documents; • resource mapping; • establishing a conducive environment for the growth of decentralised (renewable energy based) embedded electricity generation; • providing up-to-date data on performance & costs of renewable energy technologies as inputs to the IEP; • identify further development opportunities & providing necessary support to other renewable energy technologies that have the potential to contribute to the electricity, heat & transport sectors; • continuing support & monitoring of renewable energy initiatives & programmes that are already under way; & • implementing awareness campaigns to increase awareness of renewable energy & its benefits within the public sector & the general public.
The White Paper on the Energy Policy of	Department of Minerals and Energy	1998	<p>The White Paper on the Energy Policy of the Republic of South Africa establishes the international and national policy context for the energy sector, and identifies the following energy policy objectives:</p> <ul style="list-style-type: none"> • Increasing access to affordable energy services • Improving energy governance

the Republic of South Africa

- Stimulating economic development
- Managing energy-related environmental and health impacts
- Securing supply through diversity
- Energy policy priorities

The White Paper sets out the advantages of renewable energy and states that Government believes that renewables can in many cases provide the least cost energy service, particularly when social and environmental costs are included. The White Paper acknowledges that South Africa has neglected the development and implementation of renewable energy applications, despite the fact that the country's renewable energy resource base is extensive and many appropriate applications exist.

The White Paper notes that renewable energy applications have specific characteristics that need to be considered. Advantages include:

- Minimal environmental impacts in operation in comparison with traditional supply technologies; and
- Generally lower running costs, and high labour intensities.

Disadvantages include:

- Higher capital costs in some cases;
- Lower energy densities; and
- Lower levels of availability, depending on specific conditions, especially with sun and wind based systems.

The White Paper on Renewable Energy

Department of Minerals and Energy

2003

This White Paper on Renewable Energy supplements the *White Paper on Energy Policy*, which recognizes that the medium and long-term potential of renewable energy is significant. This Paper sets out Government's vision, policy principles, strategic goals and objectives for promoting and implementing renewable energy in South Africa.

The White Paper notes that while South Africa is well-endowed with renewable energy resources that have the potential to become sustainable alternatives to fossil fuels, these have thus far remained largely

untapped. Government’s long-term goal is the establishment of a renewable energy industry producing modern energy carriers that will offer in future years a sustainable, fully non-subsidised alternative to fossil fuels. The medium-term (10-year) target set in the White Paper is: *10 000 GWh (0.8 Mtoe) renewable energy contribution to final energy consumption by 2013, to be produced mainly from biomass, wind, solar and small-scale hydro. The renewable energy is to be utilised for power generation and non-electric technologies such as solar water heating and bio-fuels. This is approximately 4% (1667 MW) of the projected electricity demand for 2013 (41539 MW)* (Executive Summary, ix).

Integrated Resource Plan (IRP) for South Africa	Department of Minerals and Energy	2010-2030	<p>The current iteration of the Integrated Resource Plan (IRP) for South Africa, after a first round of public participation in June 2010, led to the Revised Balanced Scenario (RBS) that was published in October 2010. The document outlines the proposed generation new build fleet for South Africa for the period 2010 to 2030. This scenario was derived based on the cost-optimal solution for new build options, which was then “balanced” in accordance with qualitative measures such as local job creation. In addition to all existing and committed power plants, the RBS included a nuclear fleet of 9,6GW; 6,3GW of coal; 11,4GW of renewables; and 11,0GW of other generation sources.</p> <p>A second round of public participation was conducted in November/December 2010, which led to several changes to the IRP model assumptions. The main changes were the disaggregation of renewable energy technologies to explicitly display solar photovoltaic (PV), concentrated solar power (CSP) and wind options; the inclusion of learning rates, which mainly affected 44renewable; and the adjustment of investment costs for nuclear units (a possible increase of 40%).</p> <p>Additional cost-optimal scenarios were generated based on the changes. The outcomes of these scenarios, in conjunction with the following policy considerations, led to the Policy-Adjusted IRP:</p> <ul style="list-style-type: none"> • The installation of 44 renewables were brought forward in order to accelerate a local industry; • To account for the uncertainties associated with the costs of 44 renewables and fuels, a nuclear fleet of 9,6GW was included in the IRP; • The emission constraint of the RBS (275 million tons of carbon dioxide per year after 2024) was maintained; and
--	-----------------------------------	-----------	---

- Energy efficiency demand-side management (EEDSM) measures were maintained at the level of the RBS.

The Policy-Adjusted IRP includes the same amount of coal and nuclear new builds as the RBS, while reflecting recent developments with respect to prices for 45 renewables. In addition to all existing and committed power plants (including 10GW committed coal), the plan includes 9,6GW of nuclear; 6,3GW of coal; 17,8GW of 45 renewables; and 8,9GW of other generation sources. The Policy-Adjusted IRP has therefore resulted in an increase in the contribution from 45 renewables from 11,4 GW to 17,8 GW.

North West Province Growth and Development Strategy	North West Provincial Government	2004 - 2014	<p>The renewable energy strategy for the North West Province was developed in response to the need of the North West Provinces to participate meaningfully within the renewable energy sector of South Africa. The renewable energy strategy aims to improve the North West Province’s environment, reduce the North West Province’s contribution to climate change, and alleviate energy poverty, whilst promoting economic development and job creation in the province whilst developing its green economy. This strategy attempts to focus the efforts of all stakeholders and provides a foundation to make the North West Province a primary contributor towards the renewable energy sector within South Africa.</p> <p>There are a number of international, national and provincial mandates and driving forces that play a pivotal role in the development of this renewable energy strategy for the North West Provinces. These include the fact that South Africa was ranked the 12th largest emitter of CO2 emissions in 2009 and has committed to reduce its greenhouse gas emissions by 34% by 2020. The North West is rated as the fourth largest electricity consuming province in South Africa and consumes approximately 12% of the available electricity. This is mainly due to the high demand of the electrical energy-intensive mining and related industrial sector. Approximately 63% of the electricity supplied to the North West Province is consumed in its mining sector.</p> <p>South Africa has an abundance of renewable energy resources available. The applicability of these RE resources depend on a number of factors and are consequently not equally viable for the NWP. The renewable energy sources that were identified to hold the most potential and a competitive strength for the North West Province are Solar Energy (photovoltaic as well as solar water heaters), Municipal Solid Waste, hydrogen and fuel cell technologies, bio-mass, and energy efficiency. The Dr Ruth Segomotsi</p>
--	----------------------------------	-------------	--

Mompati District Municipality has an annual Solar radiation range of 8,501 MJ/m². Compared to a location such as Upington, which is considered a prime location for solar energy projects and also located within the area of maximum solar radiation, the Dr Ruth Segomotsi Mompati District Municipality receive on average only 5% less solar radiation than Upington. The North West Province consequently shows considerable potential for solar applications in renewable energy as a whole, with high potential specifically in the Dr. Ruth Mompati district municipality.

Strategic Environmental Assessment (SEA) for wind and solar PV Energy in South Africa

Department of Environmental Affairs

2014

The Department of Environmental Affairs (DEA) has committed to contribute to the implementation of the National Development Plan and National Infrastructure Plan by undertaking Strategic Environmental Assessments (SEAs) to identify adaptive processes that integrate the regulatory environmental requirements for Strategic Integrated Projects (SIPs) while safeguarding the environment. The wind and solar photovoltaic (PV) SEA was accordingly commissioned by DEA in support of SIP 8, which aims to facilitate the implementation of sustainable green energy initiatives.

This SEA identifies areas where large scale wind and solar PV energy facilities can be developed in terms of SIP 8 and in a manner that limits significant negative impacts on the environment, while yielding the highest possible socio-economic benefits to the country. These areas are referred to as Renewable Energy Development Zones (REDZs).

The REDZs also provide priority areas for investment into the electricity grid. Currently one of the greatest challenges to renewable energy development in South Africa is the saturation of existing grid infrastructure and the difficulties in expanding the grid. Proactive investment in grid infrastructure is thus likely to be the most important factor determining the success of REDZs.

Although it is intended for the SEA to facilitate proactive grid investment in REDZs, such investment should not be limited to these areas. Suitable wind and solar PV development should still be promoted across the country and any proposed development must be evaluated on its own merit. The proposed site does fall within a REDZs.

Dr. Ruth Segomotsi Mompati District Municipality Integrated Development Plan (IDP)	Dr. Ruth Segomotsi Mompati District Municipality	2012 - 2017	<p>The IDP serves as the basic developmental framework and the basis for annual reviews of municipal performance for the period up to 2017. The IDP is explicitly aligned with the requirements of the Municipal Systems Act (2000) and the developmental objectives outlined in the National Priority Outcomes, and the National Medium Term Strategic Framework (2009). Identified key intervention priority areas include:</p> <ul style="list-style-type: none"> • More inclusive economic growth, decent work and sustainable livelihoods; • Developing economic and social infrastructure; • Rural development, food security and land reform; • Improving access to quality education; • Improved health care; • Fighting crime and corruption; • Sustainable resource management and use. <p>A situation analysis of the DM indicates, amongst others, the following key developmental challenges:</p> <ul style="list-style-type: none"> • The DM’s largely African population generally suffers from low education, low income and high unemployment levels, and many have minimal access to water and sanitation; • A mainly youthful African population, with a correspondingly small labour force cohort, and hence high levels of youthful dependency; • High functional illiteracy amongst the African population group; • Great dependency upon government as employer in the DM, and therefore the crucial need to develop the private sector (mainly in agriculture and mining), and develop the Small Medium Micro Enterprise (SMME) sector both in the formal and informal sectors; <p>Renewable energy is not directly addressed, but the IDP does indicate the transition to a low carbon economy as a DM goal, and recommends that the DM speeds up and expands renewable energy (generation) (DRSMDM, 2012: 114).</p>
Naledi Local Municipality Integrated Development	Naledi Local Municipality	2012- 2017	<p>The Naledi IDP includes a municipal turnaround strategy (“Municipal Plan”) in response to the NLM’s current financial non-viability, and consequent inability to fully meet its developmental and service delivery obligations. The IDP is aligned with key national and provincial developmental policy, including the National Priority Outcomes and the NWP PGDS.</p>

Plan (IDP) Review	<p>The IDP is informed by a SWOT analysis of the Naledi LM. Key identified NLM Strengths include: a strong agricultural sector in a high capacity beef grazing area; the most diverse and dominant economy in the DRSMMDM; strategic location with regard to the N14 transport corridor; identification of the NLM as Priority Two investment area in the NWP Spatial Development Framework. Key Weaknesses include: municipal financial viability; growing unemployment; generally declining economy; lack of industrial development in Vryburg; infrastructural neglect and service backlogs; and lack of a proper Land Use Management System. Key Opportunities include: capitalizing on Vryburg’s status as Secondary Regional Centre and the NLM’s strategic location; local economic development (LED) opportunities linked to establishing Vryburg as regional beef beneficiation centre, tourism, and game farming. Key Threats include: increasing urbanization of rural part of NLM population; environmental degradation; high unemployment and poverty levels; large housing backlogs; lack of capital to provide and maintain services infrastructure.</p> <p>A summary of the 9 NLM Ward Plans indicates that key identified community needs are mainly linked to roads (1), housing (2), municipal services (3), security, and employment/ LED. The IDP notes that the NLM has been suffering from chronic water shortages since 2009; that the waste water treatment plant exceeds capacity by 40%, that many municipal roads are in a bad state; and that illegal dumping is a serious and widespread issue in the NLM.</p> <p>The IDP does not explicitly deal with renewable energy development, but identifies carbon-footprint reduction, including supporting alternative energies, as LED programmes for the NLM. The Local Economic Development (LED) Strategy is specifically aligned with National Priority Outcomes 4 (“decent employment through inclusive economic growth”); 5 (a skilled and capable economic work force to support an inclusive growth path”) and 7 (vibrant, equitable rural communities and food security for all).</p>		
Naledi Spatial Development Framework (SDF)	Naledi Local Municipality	2012-2017	As noted in the 2012-2017 IDP, the most recent approved 2007 SDF is outdated, and lacks spatial guidance in the form of maps and spatial development plans. The SDF is currently under review, and in early Final stage. The NLM planner has indicated that the Vryburg urban edge is currently in the process of being demarcated, but that no urban-edge or land use related maps were available for the Vryburg area.

3.4 OTHER LEGISLATION

Other legislation mainly refers to the following:

- Planning legislation governing the rezoning process and approval of the layout plan.
- Design standards and legislation for services provision such as water, sewerage, electricity, etc.
- Municipal bylaws related to building plans, building regulations, etc.

3.5 RELEVANT GUIDANCE

The following guidance was considered in conducting the EIA:

- The Equator principles III (2013)³
- World Bank Group Environmental, Health and Safety General Guidelines (EHS Guidelines) (2007)
- Environmental, Health, and Safety Guidelines for Electric Power Transmission and Distribution (2007)
- International Finance Corporation's Policy on Environmental and Social Sustainability (2012)
- DEA. (2013). Draft National Renewable Energy Guideline. Department of Environmental Affairs, Pretoria, South Africa
- DEA, (2012), Guideline 5 – Final companion to the National Environmental Management Act (NEMA) Environmental Impact Assessment (EIA) Regulations of 2010
- DEA, (2012), Guideline 7 – Public participation in the Environmental Impact Assessment process
- DEA, (2012), Guideline 9 – Need and desirability
- DEAT, (2006), Guideline 3 – General guide to the Environmental Impact Assessment Regulations
- DEAT, (2006), Guideline 4 – Public participation in support of the Environmental Impact Assessment Regulations
- DEAT, (2006), Guideline 5 – Assessment of alternatives and impacts in support of the Environmental Impact Assessment Regulations
- BirdLife, (2015). Guidelines to minimise the impact on birds of Solar Facilities and Associated Infrastructure in South Africa

3.6 CONCLUSION

The EIA was undertaken in accordance with the EIA Regulations (2014) published in GNR 982, in terms of Section 24(5) and 44 of the NEMA as amended as well as all relevant National legislation, policy documents, national guidelines, the World Bank EHS Guidelines, the IFC Performance Standards, and the Equator Principles.

³ Although this report is not written in terms of the Equator Principles (EPs), it fully acknowledges that the EPs will need to be complied with should funding for the project be required.

4 THE NEED AND DESIRABILITY

This section aims to address the following requirements of the regulations:

Appendix 3. (3) An EIR (...) must include-

(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;

4.1 THE NEED FOR THE PROPOSED ACTIVITY

The proposed activity is a direct result of the growing demand for electricity and the need for renewable energy in South Africa. According to Eskom, the demand for electricity in South Africa has been growing at approximately 3% per annum. This growing demand, fuelled by increasing economic growth and social development, is placing increasing pressure on South Africa's existing power generation capacity. Coupled with this, is the growing awareness of environmentally responsible development, the impacts of climate change and the need for sustainable development.

Over 90% of South Africa's electricity generation is coal based, the World bank estimates that these results in an annual, per capita carbon emission of ~8.9 tons per person. Based on 2008 fossil-fuel CO₂ emissions statistics released by the Carbon Dioxide Information Analysis Centre, South Africa is the 13th largest carbon dioxide emitting country in the world and the largest emitter in Africa.

The primary rationale for the proposed solar PV facility is to add new generation capacity from renewable energy to the national electricity mix and to aid in achieving the goal of 42% share of all new installed generating capacity being derived from renewable energy forms, as targeted by the Department of Energy (DoE) (Integrated Resource Plan 2010-2030). In terms of the Integrated Resource Plan (IRP), approximately 8.4GW of the renewable energy mix is planned to be the new installed capacity generated from solar PV technologies over the next thirty years.

The establishment of the photovoltaic solar facility will significantly contribute to achieving this objective and will also address some of the objectives identified by the Naledi Local Municipality's Integrated Development Plan (IDP, 2012-17).

4.2 THE DESIRABILITY OF THE PROPOSED ACTIVITY

The facility's contribution towards sustainable development and the associated benefits to society in general is discussed below:

- Lesser dependence on fossil fuel generated power - The deployment of the facility will have a positive macro-economic impact by reducing South Africa's dependence on fossil fuel generated power and assisting the country in meeting its growing electricity demand.
- Increased surety of supply - By diversifying the sources of power in the country, the surety of supply will increase. The power demands of South Africa are ever increasing and by adding solar power this demand can be met, even exceeded without increasing

pollution in relation to the use of fossil fuels. The project has the potential of “securing” economic activity by assisting in removing supply constraints if Eskom generation activities result in a supply shortfall. When supply is constrained it represents a limitation to economic growth. When a supply reserve is available, it represents an opportunity for economic growth.

- Local economic growth - The proposed project will contribute to local economic growth by supporting industry development in line with provincial and regional goals and ensuring advanced skills are drawn to the North West Province. The project will likely encounter widespread support from government, civil society and businesses, all of whom see potential opportunities for revenues, employment and business opportunities locally. The development of the photovoltaic solar facility will in turn lead to growth in tax revenues for local municipalities and sales of carbon credits, resulting in increased foreign direct investment.
- Lower costs of alternative energy - An increase in the number of solar facilities commissioned will eventually reduce the cost of the power generated through solar facilities. This will contribute to the country’s objective of utilising more renewable energy and less fossil fuel based power sources. It will assist in achieving the goal to generate 10 000 GWh of electricity from renewable energy by 2015 and the reduction of South Africa’s GHG emissions by approximately 34% below the current emissions baseline by 2020.
- Reduction in greenhouse gas emissions - The additional power supplied through solar energy will reduce the reliance on the combustion of fossil fuels to produce power. The South African electricity grid is predominantly coal-fired and therefore GHG emissions intensive (coal accounts for more than 92% of the fuel used in South Africa’s electricity generation). The reduction of GHG emissions as a result of the project implementation will be achieved due to reduction of CO₂ emissions from combustion of fossil fuel at the existing grid-connected power plants and plants which would likely be built in the absence of the project activity.
- CDM Project - A solar energy facility also qualifies as a Clean Development Mechanism (CDM) project (i.e. a financial mechanism developed to encourage the development of renewable technologies).
- Climate change mitigation - On a global scale, the project makes a contribution to greenhouse gas emission reduction and therefore contributes toward climate change mitigation.
- Reduced environmental impacts - The reduction in electricity consumed from the grid will not only result in a reduction in greenhouse gas emissions, but also the prevention of negative impacts associated with coal mining. For example, coal power requires high volumes of water, in areas of South Africa where water supply is already over-stretched and water availability is highly variable. Photovoltaic solar energy technology also does not produce the sulphur emissions, ash or coal mining concerns associated with conventional coal fired electricity generation technologies resulting in a relatively low level of environmental impacts. It is a clean technology which contributes toward a better quality environment for employees and nearby communities.

- Social benefits - The project activity is likely to have significant long-term, indirect positive social impacts that may extend to a regional and even national scale. The larger scale impacts are to be derived in the utilization of solar power and the experience gained through the construction and operation of the power plant. In future, this experience can be employed at other similar solar installations in South Africa.
- Provision of job opportunities - The main benefit of the proposed development operating in the area is that local companies or contractors will be hired for the duration of the construction period. The operational phase will provide permanent job opportunities to the local communities from the surrounding area since security guards and general labourers will be required on a full time basis. Approximately 453 employment opportunities will be created during the construction and operational phases.
- Indirect socio-economic benefits - The increase in the demand for services such as accommodation, transportation, security, general maintenance and catering will generate additional indirect socio-economic benefits for the local community members.
- Effective use of resources - Because of predominantly the climate limitations, the site is totally unsuitable for cultivated crops, and viable agricultural land use is limited to grazing only. The grazing capacity on AGIS is classified as 11-17 hectares per large stock unit. The proposed development in this specific area will generate alternative land use income through rental for energy facility, which will have a positive impact on agriculture. It will provide the farming enterprise with increased cash flow and rural livelihood, and thereby improve the financial sustainability of agricultural activities.
- Increased access to electricity as a source of energy: The Dr. Ruth Segomotsi Mompati District Municipality identified the provision of access to electricity as one of the objectives for addressing district wide needs and the aim is to ensure that by 2017, 25 000 households [that is 100 000 people] are connected to household energy. In 2011 the District Municipality's access to electricity stood at an average of 82% across the district with a population of 463 815. There has been an increase in electricity usage for cooking, heating and lighting in 2011 as compared to 2001 (30-69%, 30-53% and 61-82% for cooking, heating and lighting respectively) within the District municipality. The access to electricity in the Naledi Local Municipality increased from 62% in 2001 to 77% in 2011 and according to the District Municipality IDP of 2012-2017 the population of the Naledi Local Municipality increased from 54 116 in 1996 to 66 781 in 2011, placing increased strain on the need for household electricity.

5 DESCRIPTION OF ENVIRONMENTAL ISSUES

This section aims to address the following requirements of the regulations:

Appendix 3. (3) An EIR (...) must include-

- (h) a full description of the process followed to reach the proposed preferred activity, site and location within the site, including –
 - (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;
 - (x) if no alternatives, including alternative locations for the activity were investigated, the motivation for not considering such and
 - (xi) a concluding statement indicating the preferred alternative development location within the approved site;

5.1 CONSIDERATION OF ALTERNATIVES

The DEAT 2006 guidelines on ‘assessment of alternatives and impacts’ proposes the consideration of four types of alternatives namely, the no-go, location, activity, and design alternatives. It is however, important to note that the regulation and guidelines specifically state that only ‘feasible’ and ‘reasonable’ alternatives should be explored. It also recognizes that the consideration of alternatives is an iterative process of feedback between the developer and EAP, which in some instances culminates in a single preferred project proposal.

An initial site assessment (refer to Appendix G1) was conducted by the developer on Portion 5 (Shadow Eve) (Portion of Portion 4) of the farm Champions Kloof 731 and the farm was found favorable due to its proximity to grid connections, solar radiation, ecology and relative flat terrain. Some parts of the farm have been deemed not suitable for the development of a solar plant namely areas around the non-perennial stream and the stromatolites. These factors were then taken into consideration and appropriate buffers have been implemented to exclude these features from the plant layout as far as possible. The site selection also took the site geology, land capability, surface water, grazing capacity, water availability and land use into consideration before deciding on the specific site. From the information obtained, a single preferred alternative has emerged (Subsolar, 2015).

The following sections explore different types of alternative in relation to the proposed activity in more detail.

5.1.1 No-go alternative

This alternative considers the option of 'do nothing' and maintaining the status quo. The description provided in section 2.1 & 3 of this report could be considered the baseline conditions (status quo) to persist should the no-go alternative be preferred. The site is currently zoned for agricultural land uses. Should the proposed activity not proceed, the site will remain unchanged and will continue to be used for grazing for cattle (refer to the photographs of the site). However, the potential opportunity costs in terms of the supporting social and economic development in the area would be lost.

5.1.2 Location alternatives

This alternative asks the question, if there is not, from an environmental perspective, a more suitable location for the proposed activity. No other properties have at this stage been secured by Khubu Solar Power Plant (RF) (Pty) Ltd. in the Vryburg area to potentially establish solar facilities. From a local perspective, Portion 5 (Shadow Eve) (Portion of Portion 4) of the farm Champions Kloof 731 is preferred due to its suitable climatic conditions, topography (i.e. in terms of slope), environmental conditions (i.e. agricultural potential, ecological sensitivity and archaeology), proximity to a grid connection point (i.e. for the purpose of electricity evacuation), as well as site access (i.e. to facilitate the movement of machinery, equipment, infrastructure and people during the construction phase).

The proposed development falls within an area used for grazing and the site is therefore considered to have limited environmental sensitivity as a result. The National Department of Agriculture (2006) classified land capability into two broad categories, namely land suited to cultivation (Classes I – IV) and land with limited use, generally not suited to cultivation (Classes V – VIII). The site falls within Class 6 and therefore the agricultural potential of the site is limited and it is highly unlikely that the change in land use will impact significantly on agricultural production (refer to figure 3 for an illustration of the land capability classification).

The area available on Portion 5 (Shadow Eve) (Portion of Portion 4) of the farm Champions Kloof 731 is approximately 400 hectares and the Solar plant only requires 300 hectares excluding the non-perennial stream, so the site could be moved within the boundaries of the farm. However, provision was made after the initial investigation to exclude the sensitive areas surrounding the non-perennial stream. Therefore, a single preferred location alternative will be assessed – refer to figure 11.

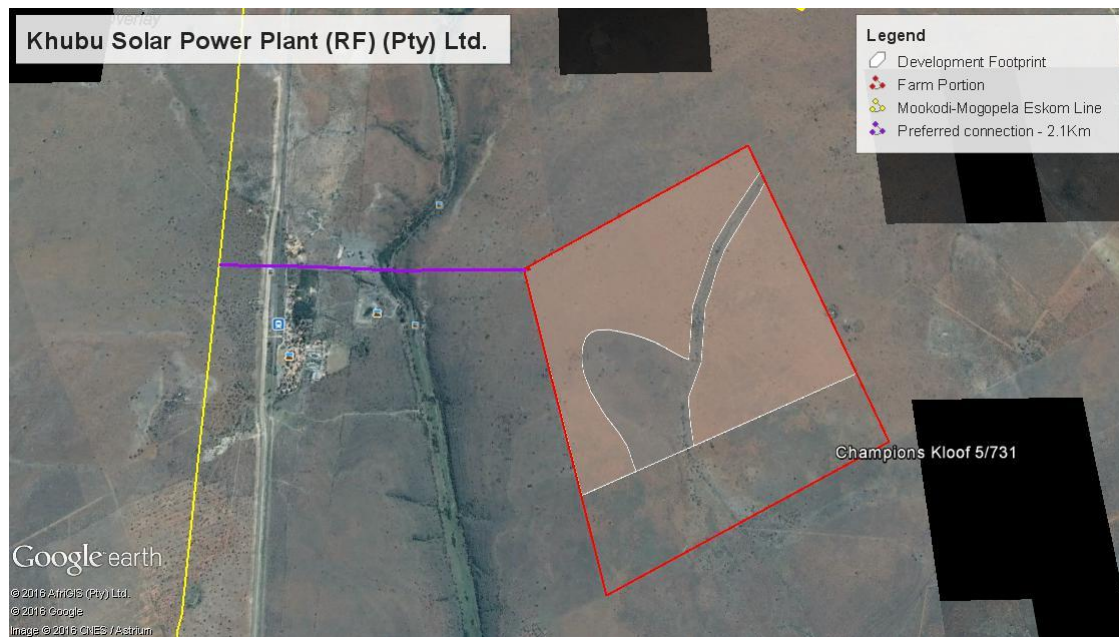


Figure 11: Single preferred alternative on Portion 5 of the farm Champions Kloof 731

5.1.3 Activity alternatives

The scoping process also needs to consider if the development of a solar PV facility would be the most appropriate land use for the particular site.

Photovoltaic (PV) solar facility – Khubu Solar Power Plant (RF) (Pty) Ltd. is part of a portfolio of solar PV projects throughout South Africa. Khubu Solar Power Plant (RF) (Pty) Ltd. is of the opinion that solar PV technology is perfectly suited to the site, given the high irradiation values for the Vryburg area – refer to figure12.

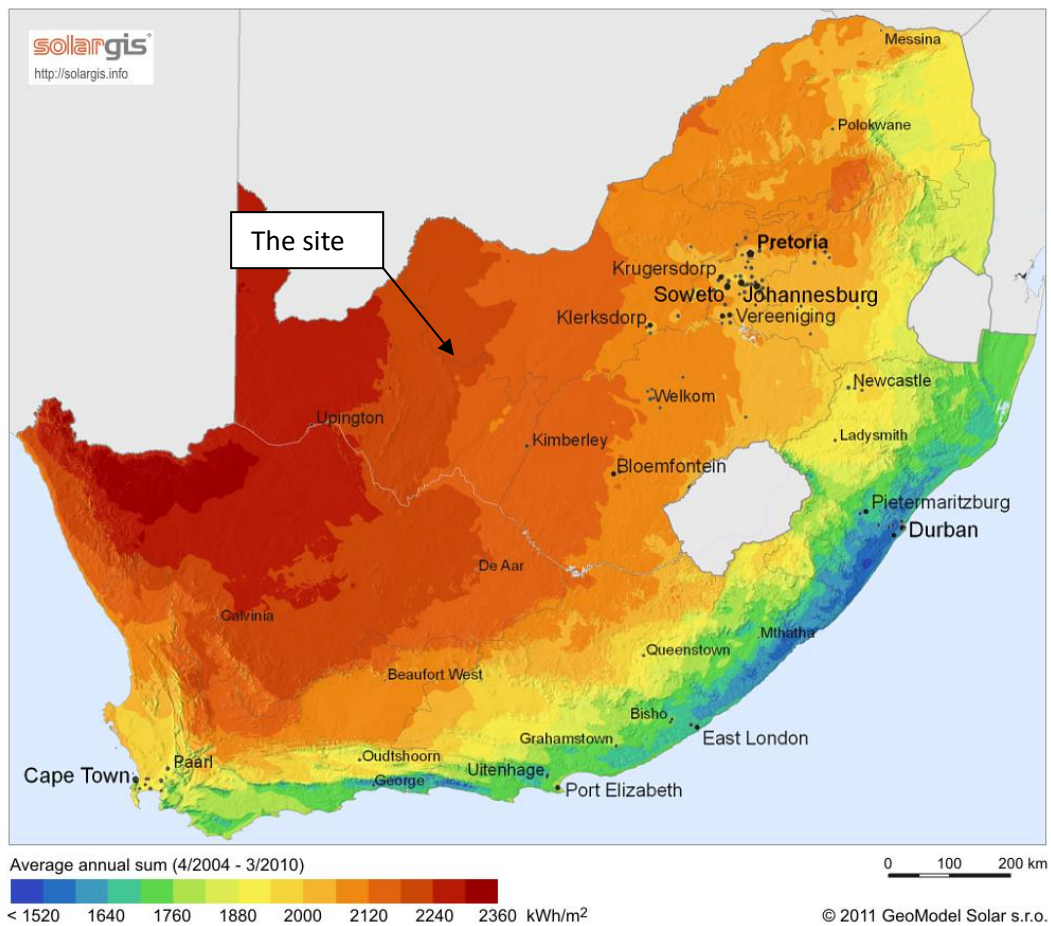


Figure 12: Horizontal irradiation for South Africa (SolarGIS, 2011)

The technology furthermore entails low visual impacts, have relatively low water requirements, is a simple and reliable type of technology and all of the components can be recycled.

Wind energy facility - Due to the local climatic conditions a wind energy facility is not considered suitable as the area does not have the required wind resource. Furthermore, the applicant has opted for the generation of electricity via solar power rather than the use of wind turbines. This alternative is therefore regarded as not feasible and will not be evaluated further in this report.

Concentrated solar power (CSP) technology - CSP technology requires large volumes of water and this is a major constraint for this type of technology. While the irradiation values are high enough to generate sufficient solar power, the water constraints render this alternative not feasible. Therefore, this alternative will not be considered further in this report.

5.1.4 Technical alternatives

Generation from the facility will either tie in with the Mookodi-Magopela 132kV power line or the DPS79 Substation. A transmission line will be constructed within 36m wide servitude towards the power line. The transmission line will cross the Hartsriver, which will constitute a Water Use License Application. The 132kV overhead transmission line is the only preferred alternative for the applicant due to the following reasons:

Overhead Transmission Lines - Overhead lines are less costly to construct than underground lines. Therefore, the preference with overhead lines is mainly on the grounds of cost. Overhead lines allow high voltage operations and the surrounding air provides the necessary electrical insulation to earth. Further, the surrounding air cools the conductors that produce heat due to lost energy (Swingler et al, 2006).

The overall weather conditions in the North West Province are less likely to cause damage and faults on the proposed overhead transmission power line. Nonetheless, if a fault occurs, it can be found quickly by visual means using a manual line patrol. Repair to overhead lines is relatively simple in most cases and the line can usually be put back into service within a few days. In terms of potential impacts caused by overhead transmission lines include visual intrusion and threats to sensitive habitat (where applicable).

The choice of structure to be used for the power line will be determined in consultation with Eskom once the Engineers have assessed the geotechnical and topographical conditions and decided on a suitable structure which meets the prescribed technical requirements. The choice of structures to be used will not have any adverse impacts on the environment. The line will be constructed according to the authorised standards for a power line approved by Eskom Holdings SoC Ltd.

Underground Transmission Lines - Underground cables have generally been used where it is impossible to use overhead lines for example because of space constraints. Underground cables are oil cooled and are also at risk of groundwater contamination. Maintenance is also very difficult on underground lines compared to overhead lines. When a fault occurs in an underground cable circuit, it is almost exclusively a permanent fault due to poor visibility. Underground lines are also more expensive to construct than overhead lines.

5.1.5 Design and layout alternatives

Design alternatives were considered throughout the planning and design phase (i.e. what would be the best design option for the development?). In this regard discussions on the design were held between the EAP and the developer. The layout plan is included as an Appendix under Facility Illustrations.

It is envisaged that the following environmental features will need to be considered:

- The non-perennial stream on site.
- Densely-packed, well-preserved stromatolite assemblages.
- The pan located approximately 300m south of the site.
- Any protected tree or plant species.

The layout of the Khubu Solar Power Plant made provision to avoid the pan south of the site, the stromatolite assemblages recorded within the Boomplaas Formation carbonate rocks in several areas of low-relief bedrock exposure just west of and along the banks of the shallow stream and the stream located on the site by enforcing buffers – refer to Figure 13 and Facility Illustrations included as an Appendix for the layout plan. Further mitigation is provided as part of the hydrological impact assessment (Appendix H4).

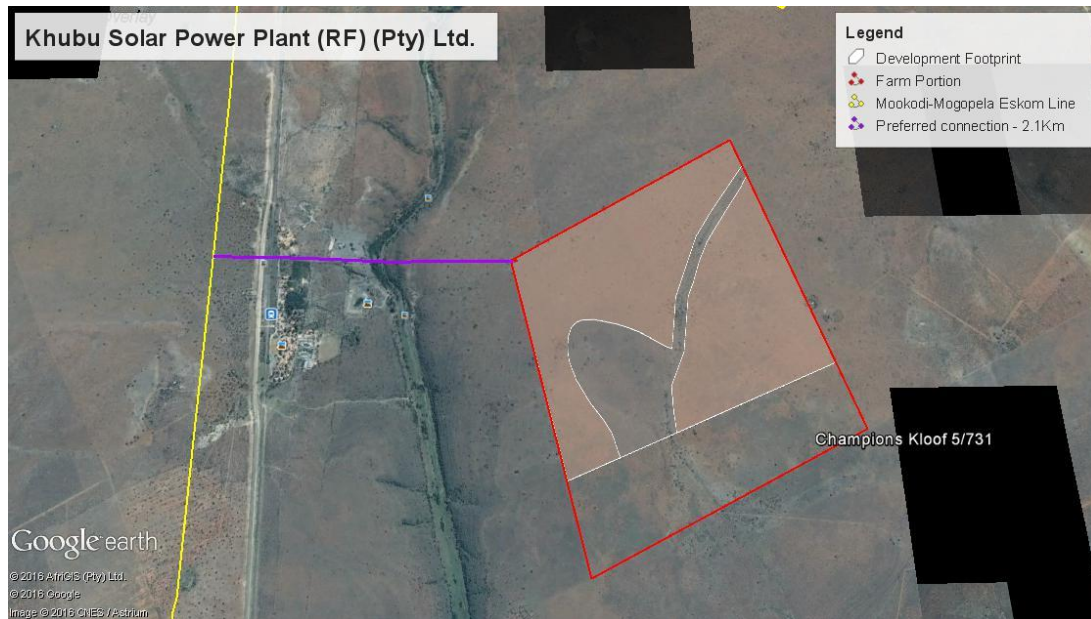


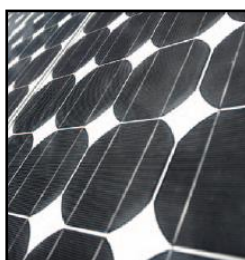
Figure 13: Laydown area on Portion (Shadow Eve) (Portion of Portion 4) 5 of the farm Champions Kloof 731

5.1.6 Technology alternatives

There are several types of semiconductor technologies currently available and in use for PV solar panels. Two, however, have become the most widely adopted, namely crystalline silicon and thin film. These technologies are discussed in more detail below:

Crystalline (high efficiency technology at higher cost):

Crystalline silicon panels are constructed by first putting a single slice of silicon through a series of processing steps, creating one solar cell. These cells are then assembled together in multiples to make a solar panel. Crystalline silicon, also called wafer silicon, is the oldest and the most widely used material in commercial solar panels. Crystalline silicon modules represent 85-90% of the global annual market today. There are two main types of crystalline silicon panels that can be considered for the solar facility:



- Mono-crystalline Silicon - mono-crystalline (also called single crystal) panels use solar cells that are cut from a piece of silicon grown from a single, uniform crystal. Mono-crystalline panels are among the most efficient yet most expensive on the market. They require the highest purity silicon and have the most involved manufacturing process.



- Poly-crystalline Silicon – poly-crystalline panels use solar cells that are cut from multifaceted silicon crystals. They are less uniform in appearance than mono-crystalline cells, resembling pieces of shattered glass. These are the most common solar panels on the market, being less expensive than mono-crystalline silicon. They are also less efficient, though the performance gap has begun to close in recent years (First Solar, 2011).

Thin film (low-cost technology with lower efficiency):

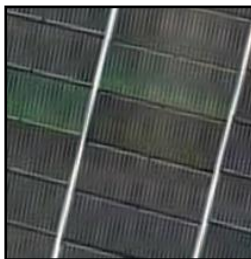
Thin film solar panels are made by placing thin layers of semiconductor material onto various surfaces, usually on glass. The term *thin film* refers to the amount of semiconductor material used. It is applied in a thin film to a surface structure, such as a sheet of glass. Contrary to popular belief, most thin film panels are not flexible. Overall, thin film solar panels offer the lowest manufacturing costs, and are becoming more prevalent in the industry. Thin films currently account for 10-15% of global PV module sales. There are three main types of thin film used:



- Cadmium Telluride (CdTe) - CdTe is a semiconductor compound formed from cadmium and tellurium. CdTe solar panels are manufactured on glass. They are the most common type of thin film solar panel on the market and the most cost-effective to manufacture. CdTe panels perform significantly better in high temperatures and in low-light conditions.



- Amorphous Silicon - Amorphous silicon is the non-crystalline form of silicon and was the first thin film material to yield a commercial product, first used in consumer items such as calculators. It can be deposited in thin layers onto a variety of surfaces and offers lower costs than traditional crystalline silicon, though it is less efficient at converting sunlight into electricity.



- Copper, Indium, Gallium, Selenide (CIGS) - CIGS is a compound semiconductor that can be deposited onto many different materials. CIGS has only recently become available for small commercial applications, and is considered a developing PV technology (First Solar, 2011).

The technology that (at this stage) proves more feasible and reasonable with respect to the proposed solar facility is crystalline silicon panels, due to it being non-reflective, more efficient, and with a higher durability. However, due to the rapid technological advances being made in the field of solar technology the exact type of technology to be used will only be confirmed at the onset of the project.

5.2 PUBLIC PARTICIPATION PROCESS

The following sections provide detailed information on the public participation process conducted in terms of Regulations 39 to 44.

5.2.1 General

The public participation process was conducted strictly in accordance with Regulations 39 to 44. The following three categories of variables were taken into account when deciding the required level of public participation:

- The scale of anticipated impacts

- The sensitivity of the affected environment and the degree of controversy of the project
- The characteristics of the potentially affected parties

Since the scale of anticipated impacts is low, the low environmental sensitivity of the site and the fact that no conflict was foreseen between potentially affected parties, no additional public participation mechanisms were considered at this stage of the process. The following actions have already been taken:

➤ Newspaper advertisement

Since the proposed development is unlikely to result in any impacts that extend beyond the municipal area where it is located, it was deemed sufficient to advertise in a local newspaper. An advertisement was placed in English in the local newspaper (Stellalander) on the 11 November 2015 (see Appendix B) notifying the public of the EIA process and requesting Interested and Affected Parties (I&APs) to register with, and submit their comments to Environamics Environmental Consultants. I&APs were given the opportunity to raise comments within 30 days of the advertisement.

➤ Site notices

Site notices were placed on site in English on 26 October 2015 to inform surrounding communities and immediately adjacent landowners of the proposed development. I&APs were given the opportunity to raise comments by 11 December 2015. Photographic evidence of the site notices is included in Appendix C.

➤ Direct notification of identified I&APs

Identified I&APs, including key stakeholders representing various sectors, were directly informed of the proposed development via registered post and emails on 11 November 2015 and were requested to submit comments by 11 December 2015. For a complete list of stakeholder details see Appendix D and for proof of registered post see Appendix E. The consultees included:

- North West Department of Rural, Environment & Agricultural Development (NWREAD)
- The Department of Energy
- The North West Department of Energy
- The Department of Water and Sanitation
- The National Department of Agriculture
- The North West Department of Agriculture
- The South African Heritage Resources Agency (SAHRA)
- The Provincial Heritage Resources Agency (PHRA), North West
- Passenger Rail Agency of South Africa (PRASA)
- South African National Roads Agency (SANRAL)
- SENTECH

- Department of Communications
- Department of Mineral Resources NW
- Transnet
- ESKOM
- National Energy Regulator of South Africa (NERSA)
- The Wildlife and Environment Society of South Africa (WESSA)
- The Municipal Manager at the Dr, Ruth Segomotsi Mompati District Municipality
- The Municipal Manager at the Naledi Local Municipality
- The Local Councilor at the Naledi Local Municipality
- The Civil Aviation Authority (CAA)
- The North West Department of Public Works, Roads and Transport

It was expected from I&APs to provide their inputs and comments by 11 November 2015. To date comments have been received from DMR, SAHRA, PRASA and NWREAD.

➤ Direct notification of surrounding land owners and occupiers

Written notices were also provided to all surrounding land owners and occupiers on 11 November 2015. The Naledi Local Municipality and other local property owners were contacted to obtain the contact details of the surrounding land owners. Six farmer's contact details could be obtained – refer to figure 14. The surrounding land owners were given the opportunity to raise comments by 11 December 2015. To date no one has registered as an I&AP (see Appendix F for written comments). To date only Mr. Lourens from Klondike Beleggings CC of the Remaining Extent of farm Klondike 670 registered as an I&AP (see Appendix F for written comments). For a list of surrounding land owners see Appendix D.

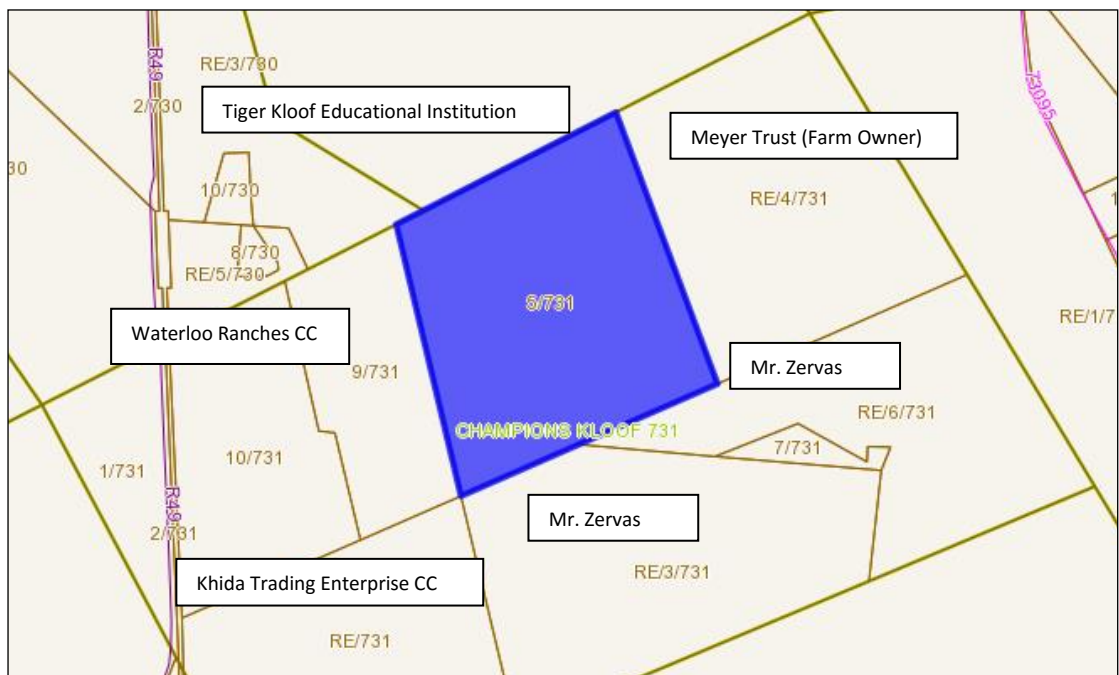


Figure 14: Surrounding Land Owners

➤ Direct notification of registered I&APs (Round 2)

Due to minor information changes incorporated after the initial notification, it was deemed necessary to circulate a revised Background Information Document (BID) to all registered I&APs. I&APs were directly informed of the information changes via email on 13 January 2016 and were requested to submit comments by 12 February 2016.

- North West Department of Rural, Environment & Agricultural Development (NWREAD)
- The Department of Energy
- The North West Department of Energy
- The Department of Water and Sanitation
- The National Department of Agriculture
- The North West Department of Agriculture
- The South African Heritage Resources Agency (SAHRA)
- The Provincial Heritage Resources Agency (PHRA), North West
- Passenger Rail Agency of South Africa (PRASA)
- South African National Roads Agency (SANRAL)
- SENTECH
- Department of Communications
- Department of Mineral Resources NW
- Transnet
- ESKOM
- National Energy Regulator of South Africa (NERSA)
- The Wildlife and Environment Society of South Africa (WESSA)
- The Municipal Manager at the Dr, Ruth Segomotsi Mompati District Municipality
- The Municipal Manager at the Naledi Local Municipality
- The Local Councilor at the Naledi Local Municipality
- The Civil Aviation Authority (CAA)
- The North West Department of Public Works, Roads and Transport
- BirdLife SA
- AMDA Developments – Mr. Charlie Berrington
- Cape EAPrac – Mr. Dale Holder

- Leads 2 Business – Mrs. Marlaine Andersen
- CVV Enviro – Mrs. Carla van der Vyver

To date, no further comments have been received.

➤ Circulation of Draft Scoping Report

The following registered I&APs and State Departments were informed of the availability of the Draft Scoping Report on 19 February 2016.

- North West Department of Rural, Environment & Agricultural Development (NWREAD)
- The Department of Energy
- The North West Department of Energy
- The Department of Water and Sanitation
- The National Department of Agriculture
- The North West Department of Agriculture
- The South African Heritage Resources Agency (SAHRA)
- The Provincial Heritage Resources Agency (PHRA), North West
- Passenger Rail Agency of South Africa (PRASA)
- South African National Roads Agency (SANRAL)
- SENTECH
- Department of Communications
- Department of Mineral Resources NW
- Transnet
- ESKOM
- National Energy Regulator of South Africa (NERSA)
- The Wildlife and Environment Society of South Africa (WESSA)
- The Municipal Manager at the Dr, Ruth Segomotsi Mompati District Municipality
- The Municipal Manager at the Naledi Local Municipality
- The Local Councilor at the Naledi Local Municipality
- The Civil Aviation Authority (CAA)
- The North West Department of Public Works, Roads and Transport
- BirdLife SA

- Klondike Beleggings CC
- AMDA Developments – Mr. Charlie Berrington
- Cape EAPrac – Mr. Dale Holder
- Leads 2 Business – Mrs. Marlaine Andersen
- CVV Enviro – Mrs. Carla van der Vyver
- Kabi Solar – Mr. Mike Levington

It was expected from I&APs to provide their inputs and comments within 30 days after receipt of the notification or copy of the Draft report (By 22 March 2016). To date only DWA, SAHRA Naledi Local Municipality and CAA provided comments (see Appendix F for written comments).

➤ Public participation meeting

All I&AP's were invited to attend the public meeting held at Castello Guest House in Vryburg on 21 April 2016 at 13:00 PM. The public meeting was an opportunity to share information regarding the proposed development and provide I&APs with an opportunity to raise any issues and provide comments. An advertisement was placed in English in the local newspaper (Stellalander) on 6 April 2016 to notify the public of the public meeting. The following key stakeholders were also directly informed of the public meeting via email on 6 April 2016:

- North West Department of Rural, Environment & Agricultural Development (NWREAD)
- The Department of Energy
- The North West Department of Energy
- The Department of Water and Sanitation
- The National Department of Agriculture
- The North West Department of Agriculture
- The South African Heritage Resources Agency (SAHRA)
- The Provincial Heritage Resources Agency (PHRA), North West
- Passenger Rail Agency of South Africa (PRASA)
- South African National Roads Agency (SANRAL)
- SENTECH
- Department of Communications
- Department of Mineral Resources NW
- Transnet
- ESKOM

- National Energy Regulator of South Africa (NERSA)
- The Wildlife and Environment Society of South Africa (WESSA)
- The Municipal Manager at the Dr, Ruth Segomotsi Mompati District Municipality
- The Municipal Manager at the Naledi Local Municipality
- The Local Councilor at the Naledi Local Municipality
- The Civil Aviation Authority (CAA)
- The North West Department of Public Works, Roads and Transport
- BirdLife SA
- Klondike Beleggings CC
- AMDA Developments – Mr. Charlie Berrington
- Cape EAPrac – Mr. Dale Holder
- Leads 2 Business – Mrs. Marlaine Andersen
- CVV Enviro – Mrs. Carla van der Vyver
- Kabi Solar – Mr. Mike Levington

Mr. Venter and Mrs. Phutieagae representing the Developers attended the public meeting, as well as Mr. Klaas-Jan Top and Mr. Winston Wadingoame from Madwin construction & Welding (Pty) Ltd.

➤ Circulation of the Draft Environmental Impact Assessment Report

The following registered I&APs and State Department were informed of the availability of the Draft EIR on 20 June 2016 (refer to Appendix E):

- North West Department of Rural, Environment & Agricultural Development (NWREAD)
- The Department of Energy
- The North West Department of Energy
- The Department of Water and Sanitation
- The National Department of Agriculture
- The North West Department of Agriculture
- The South African Heritage Resources Agency (SAHRA)
- The Provincial Heritage Resources Agency (PHRA), North West
- Passenger Rail Agency of South Africa (PRASA)
- South African National Roads Agency (SANRAL)
- SENTECH

- Department of Communications
- Department of Mineral Resources NW
- Transnet
- ESKOM
- National Energy Regulator of South Africa (NERSA)
- The Wildlife and Environment Society of South Africa (WESSA)
- The Municipal Manager at the Dr, Ruth Segomotsi Mompati District Municipality
- The Municipal Manager at the Naledi Local Municipality
- The Local Councilor at the Naledi Local Municipality
- The Civil Aviation Authority (CAA)
- The North West Department of Public Works, Roads and Transport
- BirdLife SA
- Klondike Beleggings CC
- AMDA Developments – Mr. Charlie Berrington
- Cape EAPrac – Mr. Dale Holder
- Leads 2 Business – Mrs. Marlaine Andersen
- CVV Enviro – Mrs. Carla van der Vyver
- Kabi Solar – Mr. Mike Levington
- Mr. Klaas-Jan Top
- Madwin Construction & Welding (Pty) Ltd.
- Managing Director – Biodiversity Section (Electronic copies were delivered to the department on 28 June 2016)

5.2.2 Consultation process

Regulation 41 requires that the municipality, relevant ward councillor and any organ of state having jurisdiction in respect of any aspect of the activity should be given written notice of the activity. A complete list of all the consultees who received written notice as well as proof of correspondence is attached as Appendices D and E.

5.2.3 Registered I&APs

I&APs include all stakeholders who deem themselves affected by the proposed activity. According to Regulation 43(1) *“A registered interested and affected party is entitled to comment, in writing, on all reports or plans submitted to such party during the public participation process contemplated in these Regulations and to bring to the attention of the proponent or applicant any issues which that party believes may be of significance to the consideration of the application, provided that the interested and affected party discloses any*

direct business, financial, personal or other interest which that party may have in the approval or refusal of the application.”

5.2.4 Issues raised by IAPs and consultation bodies

Table 5.1 summarises the comments received from consultation bodies. The full wording and original correspondence is included in Appendix F.

Table 5.1: Issues raised by key consultation bodies

Organisation	Person	Written comment (see Appendix F)
SAHRA	Mr. Phillip Hine	In an email dated 11 November 2015, Mr. Hine confirmed receipt of our email and indicated that he will have limited access to email between 11-13 November 2015.
Department of Mineral Resources	Mr. Pieter Swart NW Regional Manager	In an email dated 12 November 2015, Mr. Swart asked if we applied for permission in terms of Section 53 of the Mineral and Petroleum Resource Development Act, Act 28 of 2002. He stated that if this is not the case, the Department objects to this application.
PRASA	Mr. Tony Games Communications and stakeholder management	In an email dated 12 November 2015, Mr. Games forwarded the email to his colleagues and asked them to assist us with comments.
Leads 2 Business	Marlaine Andersen	In an email dated 18 November 2015, Me. Andersen registered as an I&AP and requested BID documents.
	Deputy Head of Departments	In an email dated 24 November 2015, Me. Andersen thanked us for the registration and documentation and indicated that she does not have any comments, but requested the developer’s contact details.
CVV Enviro	Mrs. Carla van der Vyver	In an email dated 18 November 2015, Mrs. Van der Vyver indicated that she saw our press notices in the Stellalander Newspaper. She further indicated that they are surrounding property owners and that the total amount of MW that are applied for in the area is around 1500 MW from which a 1000 MW is within a 15km radius of their farm. She raised her concern on how the cumulative effect of the PV plant will affect weather patterns in the area as the panels have reflective surfaces and wanted to know how these weather patterns will affect the climate in the region.
NW READ	Mrs. Ellis Thebe	In an email dated 23 November 2015, Mrs. Thebe indicated that the Department has received our notice

		<p>for comments on 11 November 2015 and that we are requested to submit a hard copy of the draft scoping report to their offices.</p> <p>She also indicated that the case has been assigned to Ms. Obitseng Moholo at the Mafikeng Office and that any further correspondence can be directed to her using the reference number: NWP/EIA/40/2015.</p>
Kabi Solar	Mr. Mike Levington	In an email dated 15 January 2016 Mr. Mike Levington asked to be registered as an I&AP on the six projects in the Vryburg area.
AMDA Developments	Mr. Charlie Berrington	<p>In an email dated 1 December 2015, Mr. Berrington Indicated that they are planning to develop three PV facilities on the farm Klondike 670 adjacent to proposed Sonbesie project on the farm Retreat 671.</p> <p>He asked to be registered as an I&AP, together with their EAP, Cape EAPrac (Dave Holder).</p>
Cape EAPrac	Mr. Dale Holder	In an email dated 2 December, Mr. Holder thanked the EAP for registering him as an I&AP, and asked that he be supplied with the relevant contact details to be registered as an I&AP on the three AMDA PV projects on the farm Klondike 670.
BirdLife South Africa	Mr. Simon Gear	<p>In an email dated 05 February 2016, Mr. Simon Gear stated that an avifaunal scoping assessment should be conducted which includes a site visit as well as a six-month survey falling within the wet and dry seasons. He stated that this should be done to determine the key species at risk from solar facilities, details and nature of that risk as well as mitigation measures.</p> <p>Mr. Simon Gear indicated that avian habitats likely to support key raptor nest sites should be surveyed and identified during early stages of monitoring and that any nest sites identified, should be mapped and included in subsequent surveys to determine if any breeding activity is taking place.</p> <p>In order to avoid birds and small animals to get stuck in fences, BirdLife South Africa encouraged that solar energy facilities not to use double fencing around the development area. They also mentioned that evaporation ponds should be designed to provide habitat for some bird species in this arid environment.</p>

South African Civil Aviation Authority	Me. Lizell Stroh	In an email dated 2 March 2016, Me. Stroh stated that there is a SACAA process whereby permission is applied for with obstacles which could pose an aviation hazard. She further stated what is required for the application, such as a Google earth document reflecting the footprint of the proposed development and the assessment fee.
Department of Water and Sanitation and sanitation	Mr. Dumisani Mchunu	In an email dated 23 March 2016 Mr. Mchunu stated that the Department of Water and Sanitation and sanitation does not have access to the Drop box and kindly requested a hard copy to be couriered. <i>(The hard copy was sent to the department).</i>
SAHRA	Me. Kathryn Smuts	In an email dated 29 February 2016 Me. Smuts asked the reports be uploaded to SAHRIS and to be removed from the list of I&AP's as she does not work at SAHRA.
Naledi Local Municipality	Mr. Segapo (Municipal Manager)	In a letter dated 17 December 2015 the Naledi Local Municipality formally informed that they would not be able to collect the construction solid waste and general waste due to the fact that the municipality does not have enough capacity within the current operational fleet, but the licensed Naledi landfill site (Licence No.: NW/WM/DR1/2009/01) has the capacity (1200m ³) to accommodate the refuse generated.
NWREAD	Mrs. Obitseng Moholo	In a letter dated 14 April 2016 the Department indicated that they received the Draft Scoping Report on 1 March 2016 and that the Department has no objection to the approval of the project. The department indicated that: <ul style="list-style-type: none"> - A permit for the removal of individual Camel Thorn trees has to be applied for with the relevant authority; - A small non-perennial wetland is present in the northern border of the site must not be impacted on by the activities. Should the development be approved a 200m buffer zone must be applied to conserve it; - The declining plant species <i>Boophane disticha</i> must be relocated to a suitable site nearby before the construction phase, should the development be approved. - All key points stipulated by Bird Life South Africa on the letter dated 5 February 2016 must be addressed in the final scoping report; and

		<ul style="list-style-type: none"> - The applicant is responsible for compliance with the provisions of Duty of Care and remediation of environmental damage contained in Section 28 of the National Environmental Act, 1998 (Act No. 107 of 1998).
SAHRA	Natasha Higgitt	<p>In a letter dated 16 May 2016 SAHRA stated the following comments are relevant to the project:</p> <ul style="list-style-type: none"> • “SAHRA APM Unit does not accept the provided HIA on the grounds that the proposed development area was not adequately surveyed. It must be stressed that a field survey, conducted on foot, must adequately assess the full extent of the development footprint, in order that any heritage resources which may be present in the area can be competently graded and the development impact assessed. Please refer to the minimum standards as issued by SAHRA in May 2007 (ASG2-2 SAHRA A&PIAs MIN STDS Ph1-2 16May07); • The impact of the layout of the proposed development needs to be assessed. During the EIA phase, the impacts to the identified heritage resources in relation to the proposed development footprint/layout must be assessed as part of a revised HIA that addresses the impacts and provides clear mitigation measures; • The nearby (approx. 1.6km) Tiger Kloof School, built in 1904 by the London Mission Society, is graded as a provincial heritage site (gazetted 27/05/1988). Additionally, the railway adjacent to Tiger Kloof School is part of the old Cape to Cairo railway and the section in question was constructed prior to 1893. The visual impacts of the proposed Khubu PV facility on these two heritage resources need to be assessed as part of the revised HIA; and • Further comment will be issued once the case is fully compliant.”
READ	Ms Obitseng Moholo	In a letter dated 22 June, READ confirmed having received the Draft EIAR.

5.3 THE ENVIRONMENTAL ATTRIBUTES ASSOCIATED WITH THE PREFERRED ALTERNATIVE

The following sections provide general information on the biophysical and socio-economic attributed associated with the preferred alternative.

5.3.1 Biophysical environment

The biophysical environment is described with specific reference to geology and soils, vegetation and landscape features, climate, biodiversity and the visual landscape. A number of specialists were consulted to assist with the compilation of this chapter of the report – refer to table 1.2. However, due to the fact that the area proposed for development exclusively consists of land used for grazing, nothing of note was identified from an ecological or conservation point of view apart from scattered *Acacia Erioloba* and a non-perennial stream on site.

5.3.1.1 Geology and soils

According to Mucina and Rutherford (2006) the site is located in an area which is characterised by surface limestone of Tertiary to Recent age, and dolomite and chert of the Campbell Group (Griqualand Wes Supergroup, Vaalian Erathem) support shallow soils (0.1 – 0.25 m) of Mispah and Hutton soil forms.

According to the Geotechnical study (refer to Appendix H1) and the Soil, Land Capability and Agricultural Potential Study (attached in Appendix H7) there is a single land type across the site and surrounding area, namely Ag10 – refer to figure 15. Soils of this land types are predominantly shallow, loamy soils on underlying rock or hardpan carbonate. These soils fall into the Lithic and Calcic soil groups according to the classification of Fey (2010). The field investigation identified that the entire site is underlain by shallow dolomite bedrock and that all soils are of the Mispah soil form. The soils are classified as having low to moderate susceptibility to water erosion, and moderate susceptibility to wind erosion.

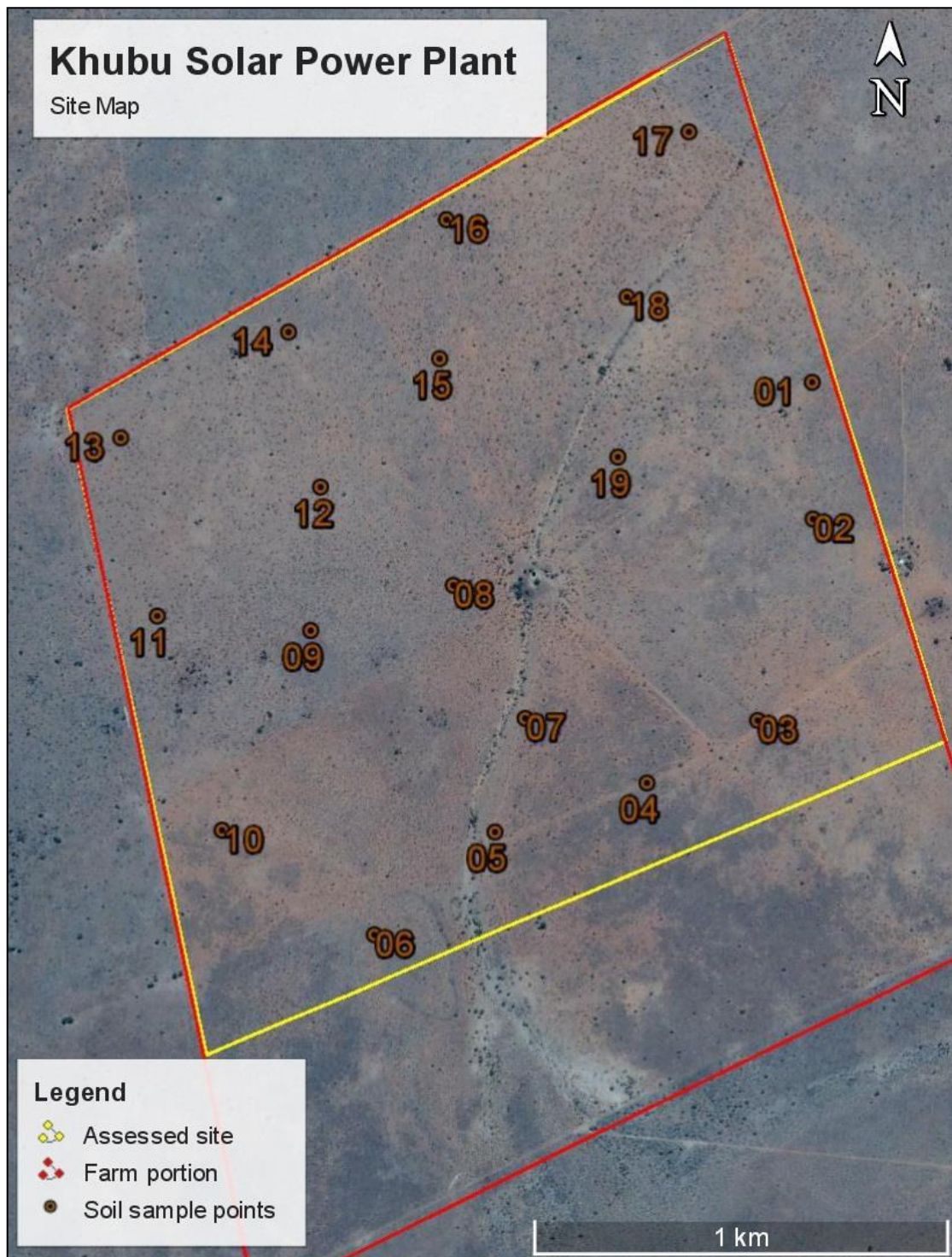


Figure 15: Satellite image of assessed site (300 hectares) with soil information and soil sample numbers

The limitations to agriculture are both climate and soil related. The moisture availability class 4 classification, with high variability of rainfall is a severe limitation to cultivation, which is not viable without irrigation. The low water holding capacity of the soils and their limited depth further limits the dryland potential. Potential maize yield on AGIS (Schulz) is given as low at 1.43 -1.51 tons per hectare and (ISCW) is given as marginal (30%). The grazing capacity is given as ranging from 11 to 17 hectares per large stock unit.

Three potential negative impacts of the development on agricultural resources and productivity were identified as:

- Loss of agricultural land use caused by direct occupation of land by the energy facility footprint.
- Loss of topsoil in disturbed areas, causing a decline in soil fertility.
- Soil erosion caused by alteration of the surface characteristics.

One potential positive impact of the development on agricultural resources and productivity was identified as:

- Generation of alternative land use income through rental for energy facility. This will provide the farming enterprise with increased cash flow and rural livelihood.

5.3.1.2 Vegetation and landscape features

In terms of vegetation type the site falls within the Ghaap Plateau Vaalbosveld vegetation type, which is described by Mucina and Rutherford (2006) as 'least threatened'. The area is characterised by flat plateau with a well-developed shrub layer with *Tarchonanthus camphorates* and *Acacia karroo*. Much of the south-central part of this unit has remarkably low cover of *Acacia* species for an arid savanna and is dominated by non-thorny trees.

Camel Thorn Trees

According to the Ecological Fauna & Flora Habitat Survey (refer to Appendix H2) during the initial surveys it was found that *Vachellia erioloba* (= *Acacia erioloba*) or Camel Thorn trees, are present at the site. Protected Tree species are listed under the National Forests Act No. 84 of 1998. In terms of a part of section 51(1) of Act No. 84 of 1998, no person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a license granted by the Minister.

Average abundance of Camel Thorn trees at the proposed footprint per hectare is 0.3 which gives an indication of the absence of this species at most of the proposed footprint. Approximately 75 Camel Thorn trees taller than 2 m have been observed for the total footprint area of which most are concentrated at the beacon area of the site. *Vachellia erioloba* individuals at the site are not particularly large (no tree taller than 10 m) and are not part of a camel thorn forest of note (Reference points: large camel thorn forest at Kathu and smaller Camel Thorn forest at Witsand visited by R.F. Terblanche during the time span of the surveys). It is recommended that a permit should be applied for at the relevant authorities in case any removal or damage of Camel Thorn trees.

A Declining plant species *Boophone disticha* (Poison Bulb) is present at the site but not in any large concentrations. If the development is approved individuals of the Declining plant species *Boophone disticha* need to be relocated to a suitable site nearby before the construction phase, this could be on site outside the proposed footprint. *Boophone disticha* (Poison Bulb) contains highly poisonous substances and the translocation operation should be done with necessary care.

Alien Invasive Species

According to the Ecological Fauna and Flora Habitat Survey (refer to Appendix H2) exotic weeds at the site include *Agremone ochroleuca* (White-flowered Mexican Poppy), *Chenopodium album* (Goosefoot), *Opuntia ficus-indica* (Prickly Pear) and *Schkuhria pinnata* (Dwarf Marigold) – refer to figure 16. Though these exotic weeds easily spring up where disturbances such as overgrazing, scraping of an area and diggings are found, at the present study area no severe infestations such as could often be observed in larger urban areas and surrounds in the North West and Gauteng Provinces, are found.

During the initial surveys it was found that *Prosopis glandulosa* (Honey Mesquite tree) thickets occur in some parts of the Naledi Local Municipality and particular consideration has been given to this highly invasive tree species at and near the proposed footprint (Mesquite tree). No *Prosopis glandulosa* have been observed at the proposed footprint. Some *Prosopis glandulosa* individuals have been observed near the boundaries of the site and therefore any establishment of this highly invasive tree should be avoided at the proposed footprint.



Figure 16: Exotic weeds on site *Agremone ochroleuca* (White-flowered Mexican Poppy), *Chenopodium album* (Goosefoot), *Opuntia ficus-indica* (Prickly Pear) and *Schkuhria pinnata* (Dwarf Marigold).

Critical Biodiversity Area

The site falls within an important habitat feature identified in accordance with the Critical Biodiversity Areas (CBAs) in the North West Province, which includes habitats, springs, and scenic landscapes, as well as a Biodiversity Corridor. Provincial-level biodiversity corridor network is aimed at retaining connectivity between all geographic areas in the province. – refer to figure 17.

Corridors are important to link ecosystems of high conservation priority. Such corridors or linkages are there to improve the chances of survival of otherwise isolated populations (Samways, 2005). How wide should corridors be? The answer to this question depends on the conservation goal and the focal species (Samways, 2005). Corridors for mammalian species are especially important for migratory species (Mwalyosi, 1991, Pullin 2002). For an African butterfly assemblage this is about 250m when the corridor is for movement as well as being a habitat source (Pryke and Samways 2003). Hill (1995) found a figure of 200m for dung beetles in tropical Australian forest.

In the agricultural context, and at least for some common insects, even small corridors can play a valuable role (Samways, 2005). Much more research remains to be done to find refined answers to the width of grassland corridors in South Africa. The width of corridors will also depend on the type of development, for instance the effects of the shade of multiple story buildings will be quite different from that of small houses. Corridors have a number of advantages related to dispersal and gene flow by avoiding isolation of ecological patches. However, corridors could also have potential drawbacks, for example creating gene flow

where none has occurred naturally in the past and also as reservoirs for pathogens or introduced species (Pullin, 2002).

Perhault and Lomolino (2000) studied corridors and mammal community structure in an old-growth forest landscape in the United States of America and their data suggest that each corridor should be valued individually. A lot of research remains to be conducted to have a better idea of the value of corridors, but in general corridors would be of considerable value. It appears that a network of wetland corridors and rocky ridges is highly likely to be of considerable benefit in environmental management and planning. Though proper management plans for habitats are not in place, setting aside special ecosystems is in line with the recent Biodiversity Act (2004) of the Republic of South Africa.

Ecological sensitivity at the site is medium: There are no indications of any particular ecosystems of conservation importance, any particular conservation corridors or a significant impact on any plant, mammal, reptile, amphibian or invertebrate species of particular conservation concern if the site is developed.

Non-perennial stream

A watercourse in the form of a non-perennial active channel and narrow riparian zone bisects parts of the site. If the development is approved exclusion of the drainage line with its narrow riparian zone at the site should be upheld. The Hydrological Assessment (Appendix H4) confirms that a small, perennial stream is present and that it can be noted that there is no clear and distinct channel that clearly defines the borders of the stream. Furthermore, no floodline information is available for this stream.

A pan is located approximately 300m south of the site. The specific wetland/pan that is referred to does not appear in the SANBI database. The reason why the wetland does not show up in the SANBI database is most likely that wetlands are extracted from satellite imagery that does not show sufficient detail to detect smaller wetlands. However, this wetland was confirmed during an on-site wetland survey. The wetland is classified as a depression (or pan). These types of shallow depressions occur on plains that have very gentle slopes. This pan clearly does have an inlet but an outlet is not evident. This depression is therefore exorheic, in that some of the water that flows into the pan during rainfall events leaves the pan through diffuse outflow (almost sheet-flow) whilst some water disappears through evaporation and infiltration. Surface water is probably only present following substantial rainfall events. A 32m buffer is proposed for the non-perennial stream and a 200m buffer will be implemented for the pan depression.

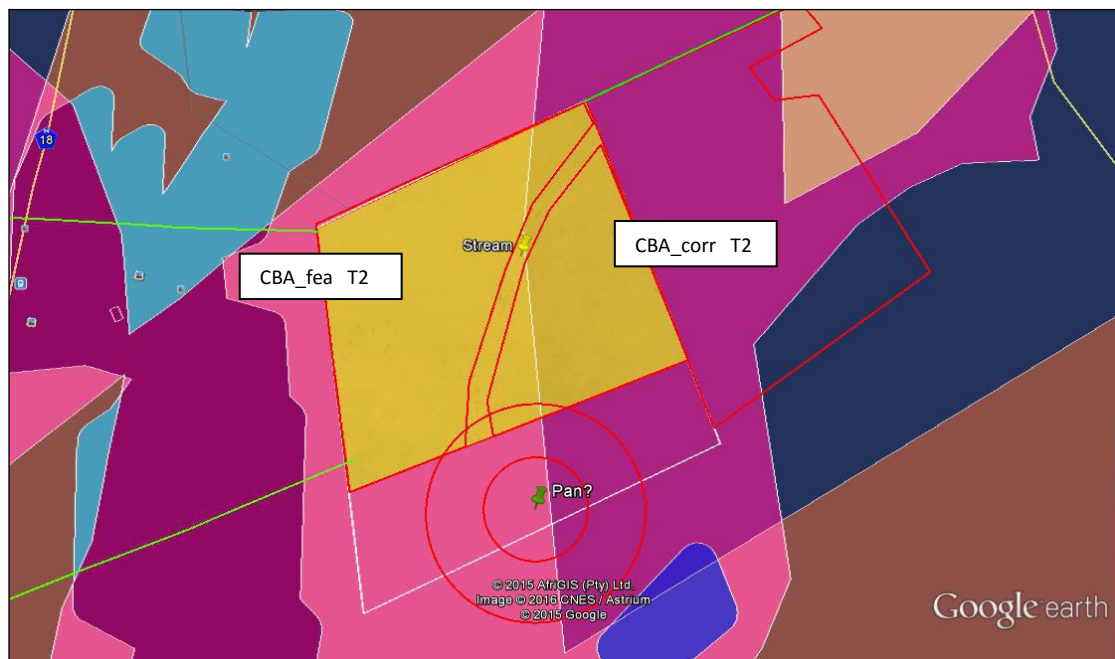


Figure 17: Critical biodiversity areas located on the site

5.3.1.3 Climate

According to Mucina and Rutherford (2006) rainfall peaks in summer and autumn with very dry winters. The mean annual precipitation (MAP) ranges from 300 mm in the southwest to about 500 mm in the northeast with frequent to very frequent frost in winter. Mean maximum and minimum temperatures for the area in question are 36.6°C in December and -5.5°C in July, respectively.

Fthenakis and Yu (2014) published a paper on the Analysis of the Potential for a Heat Island Effect in large Solar Farms. The study focused on the effect on global climate due to the albedo change from widespread installations of solar panels and found that the air temperature at 2.5m of the ground in the centre of the simulated solar farm selection was 1.9°C higher than the ambient air temperature, but that it declined to the ambient temperature at the height of 5 to 18m of the ground. The data also showed a clear decline in air temperature (within 0.3°C) 300m away from the solar farm. The solar panels also cool completely at night, and it is thus unlikely that a heat island effect could occur. The simulations also showed that the access roads between the solar fields allow for substantial cooling, and therefore, it is unlikely that an increase of size of the solar farm will affect the temperature of the surroundings.

5.3.1.4 Biodiversity

The primary cause of loss of biological diversity is habitat degradation and loss (IUCN, 2004; Primack, 2006). In the case of this study special attention was given to the identification of sensitive species or animal life on site. The following section will discuss the state of biodiversity on the site in more detail.

5.3.1.4.1 Avifaunal

According to the Avifaunal Study (refer to Appendix H5), the site proposed for the Khubu SPP is a relatively flat area of shrubs interspersed with grass. An ephemeral watercourse with

associated trees bisects the site. Borehole water from this watercourse is pumped into two cattle watering points. A few isolated trees grow in the broader shrub lands. The main effect of the proposed development will be removal of vegetation. This will cause the forced displacement of locally resident birds currently dependent upon resources in the area. The species concerned all have wide ranges and none are considered threatened. There are extensive areas of similar habitat in areas adjacent to the proposed SPP into which the displaced birds can move. Assuming that the adjoining habitat is already occupied to saturation, displaced birds will have to compete with established residents and the result is likely to be a reduction in the regional population of each species. However, due to the low productivity of the affected habitats the number of individuals per concerned species is small and the overall effect is considered negligible.

It is likely that red listed species may sometimes occur on or over the site in its current condition. However, in the absence of any particular feature to attract them, these species will be at most only transient users of the area to be developed. Thus the development of the proposed SPP will have no marked effect on red-listed species. The species most likely to be negatively impacted is the Northern Black Korhaan. These are ground foragers and feed, and probably breed, in local habitat including that to be developed. Although the population that may be displaced is minimal, disturbance during construction may deter these and other birds from breeding in adjacent habitat.

A feature of potential concern is that, once the Khubu SPP is developed polarized light from the PV panels, which at night gives the impression that there is a waterbody, may cause night-flying birds to descend and die from collision with the structures. It is recommended that bird monitoring is carried out through the two years of the post-construction phase.

5.1.3.4.2 Ecological

The Ecological Fauna and Flora Habitat Survey (refer to Appendix H2) confirms that vegetation at the site is disturbed mainly by grazing and in fairly natural condition with a conspicuous high cover of indigenous plant species. Ecological disturbances such as tracks, concrete dams, wind pumps and fences that are associated with cattle farming are present at the site.

Honey mesquite, *Prosopis glandulosa*, does not occur at the proposed footprint but is present in adjacent areas. *Prosopis* has become the second most widespread invasive alien plant taxon in the country (Shackleton et al., 2015c). These invasions have detrimental effects on biodiversity, ecosystem services and human livelihoods (Shackleton et al., 2015a). In South Africa it was found that native woody species density, basal area, richness and diversity all decreased significantly as the basal area of *Prosopis* stands increased (Shackleton et al., 2015a). Therefore, a declared invader such as the mesquite tree (*Prosopis* species), should not be planted or allowed to spread from adjacent areas to the proposed footprint.

No loss of particularly sensitive or localised habitat type of particular conservation importance is anticipated if the site is developed. No loss of corridors or connectivity of ecosystems is anticipated if the sites are developed according to the proposed footprint (that excludes the watercourse). Ecological sensitivity at the site is medium: There are no indications of any particular ecosystems of conservation importance, any particular conservation corridors or a significant impact on any plant, mammal, reptile, amphibian or invertebrate species of particular conservation concern if the site is developed.

There is no distinct reason why this relatively small footprint allocated for the development, in the vast countryside of the North West Province is of particular conservation concern for any threatened vertebrate species, including those that roam large areas and which may occasionally or coincidentally visit the site.

It is unlikely that there will be a loss of any known plant, mammal, reptile, amphibian or invertebrate species that are threatened or near threatened, if the site is developed.

5.3.1.5 Visual landscape

The visual impact of photovoltaic facility depends on the complex relationship between the visual environment (landscape), the development (object), and the observer/receptor (e.g. farmer). The establishment of a solar facility on the site is not expected to have a significant visual effect, given that the number of sensitive receptors is very low, electrical infrastructure such as power lines are already located in close proximity to the site and the technology considered for this development will be non-reflective. However, due to the extent of the proposed development (~300 hectares) a visual impact study is being conducted to determine to what extent the proposed development will be visible to observers and whether the landscape provides any significant visual absorption capacity.

According to the Visual Impact Assessment (attached as Appendix H6) the proposed development is located in an area with relatively low significance in elevation. The site is located at an above mean sea level (amsl) of approximately 1205m at the highest elevation and at an amsl of 1170m at the lowest elevation. The town of Vryburg's lowest elevation is approximately 1193m amsl and 1231m amsl at the highest elevation. The landform and drainage described above is unlikely to limit visibility. Areas within 5km from the proposed development might have a clear view without taking existing screening, such as trees and bushes, into account.

The areas of Eskom infrastructure are likely to be sensitive to the proposed development. Vryburg's industrial zone is 9km to the north west with a high level of existing screening between the zone and the proposed development. The town of Vryburg is a clear screening mechanism between the industrial zone and the proposed development. Huhudi, one of Vryburg's low cost residential areas is located approximately 7.5km from the proposed development with an amsl of approximately 1206m. The proposed development will not be visible for the residents of Huhudi.

Regarding service development, the N18 national road, the Cape to Cairo railway line, Tiger Kloof Educational Institution and the D1196 gravel road will be most sensitive to the proposed development due to close proximity to site – refer to Figure 18.

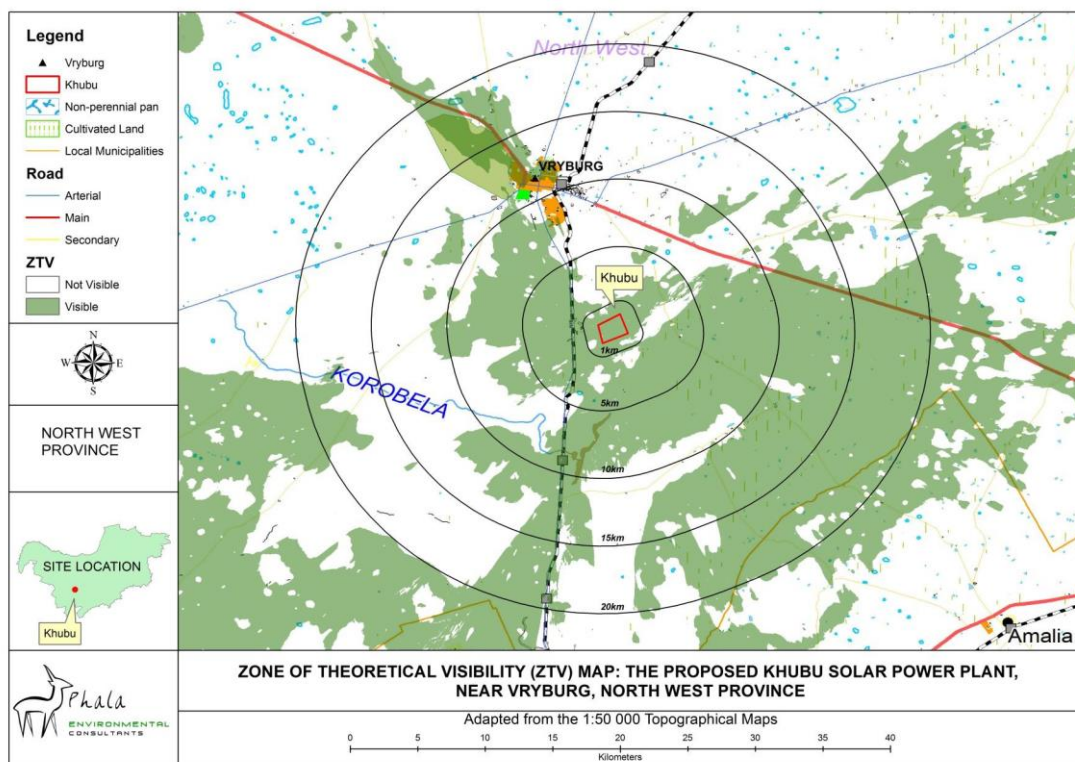


Figure 18: Zone of theoretical visibility

The majority of the affected area falls within the agricultural development area. A small amount of nearby farmsteads will be affected for the duration of the construction period (~14 Months) and the lifespan of the development (25 years).

5.3.1.6 Traffic consideration

Access to the facility will be obtained from the Amalia gravel road off of the R34 Provincial Road. The Amalia gravel road is approximately 6m wide and can accommodate traffic in both directions. The shoulders are well maintained and very little work is needed on this part of the road leading to the PV plant. The Amalia road only serves farms in its proximity. The road is currently underutilised and can accommodate greater volumes of traffic.

A connection to an existing 132kv electrical transmission line is planned that will cross National Route 18, approximately 13km south of Vryburg. A wayleave application to the South African National Roads Agency SOC Ltd. (SANRAL SOC Ltd) will be needed for this crossing. Access to the proposed facility will most probably be off the R34 which is currently administered by the provincial government.

The photovoltaic equipment and all its components will be transported to the Champions Kloof farm over a distance of 840km or 1180km from either Durban or Cape Town harbours. The vehicles used to transport the photo voltaic equipment are standard container trucks and not oversize vehicles. As this route is travelled by the same type of vehicle throughout, no obstacles (e.g. Low overhead services, cattle grids, narrow bridges etc.) are expected.

Tables 5.2 – 5.4 summarises the traffic load figures expected during the construction period:

Table 5.2: Trip Summary for Long Distance Route

Route Description	Delivery trips (None Peak)	Construction Vehicle Trips (None Peak)	Cumulative trips for six SPP's
Durban to Vryburg via R34	9 vpd	5 vpd	84 vpd
Cape Town to Vryburg via N18	9vpd	5 vpd	84 vpd

Table 5.3: Trip Summary with delivery from Durban

Destinations	On N14	On N18	On R34
Current ADT on Route (vpd)	1860	1700	1600
Delivery & Construction Trips (vpd)	42	14	28
Commuter Trips (vpd)	135	45	90
Pass-by trips (vpd) (Delivery & construction trips)	0	0	84
Total Expected Trips	2037	1759	1802

Table 5.4: Trip Summary with delivery from Cape Town

Destinations	On N14	On N18	On R34
Current ADT on Route (vpd)	1860	1700	1600
Delivery & Construction Trips (vpd)	42	14	28
Commuter Trips (vpd)	135	45	90
Pass-by trips (vpd) (Delivery & construction trips)	0	84	0
Total Expected Trips	2037	1843	1718

The *HCM 2010 Chapter 15: Two lane Highways* was consulted as the greatest portion of the route to be travelled by the delivery trucks are rural two lane highways of Class I, II or III. The trips generated by this development were evaluated in relation to the quantum of trips needed to change the Level of Service (LOS) on a portion of the rural highway and the ultimate capacity of two lane highways. The projected truck trips per day are deemed to be of no consequence to the LOS of the travelled route from Durban to Vryburg or Cape Town to Vryburg.

When considering the sections of the routes that are multilane facilities like the N3 from Durban, the projected number of daily trips expected, must be compared to a current Average Annual Daily Traffic (AADT) of approximately 40 000vpd. Again the trips generated by the delivery of equipment to site is insignificant when compared to the AADT.

The ultimate accepted capacity of a two lane highway is 3200 vehicles per hour. From historic traffic count data, it was observed that the roadways around Vryburg have an abundance of spare capacity, (specifically along the N14, R34 and N18) as the current AADT along these roadways are between 1800vpd and 2000vpd. This therefore indicates that the estimated additional traffic generated by the construction staff travelling to and from site, can be accommodated on the existing roadways. Adequate traffic accommodation signage must be erected and maintained on either side of the access on Provincial Road R34 throughout the construction period.

The development of a solar farm on Portion 5 of the Farm Champions Kloof 731 in the North-West Province is supported from a traffic engineering perspective.

5.3.2 Description of the socio-economic environment

The socio-economic environment is described with specific reference to social, economic, heritage and cultural aspects.

5.3.2.1 Socio-economic conditions

The 2012-2017 NLM IDP notes that Vryburg and Naledi are at the hub of the economically most underperforming district in the North West (NLM, 2012-2017: 23). The 2009 Naledi GDP was estimated at ~R1.945 billion. The main sectors of the NLM economy in terms of GDP generation were Agriculture and hunting (21%), Finance and Insurance (8%), Administration (8%), and Transport (5%). Manufacturing (food, beverages and tobacco) accounts for ~1%. Beef production development centered on Vryburg currently constitutes the anchoring economic strategy. Construction and manufacturing (agricultural, especially beef processing) have been identified as further potential growth areas in the 2012-2017 IDP, specifically in order to absorb the large group of unemployed youth (NLM, 2012-2017).

The Naledi population is currently estimated at 68 380 people (~16 338 households). The NLM reflects the DM's high youthful dependence rate. Approximately 49.5% of the NLM population is of school going age, or younger (0-19), while only 4% is retired (65 and older). The 2012-2017 IDP also notes that the number of youthful dependents has significant implications in terms of household income and poverty (NLM, 2012-2017). Approximately 18% of the NLM adult population had no formal schooling, and 66% had some schooling, but less than Grade 12. Only 6.5% of the NLM population has tertiary qualifications, including diplomas. The NLM unemployment rate is estimated at 47%. The bulk of the NLM economically active population cohort is comprised of Black Africans (78%), but the majority of this group however lacks skills and is not functionally literate. The population group with the highest overall unemployment was the Coloured group (~45%). The NLM IDP notes that, as a result of reinforcing factors of unemployment, lack of skills, illiteracy and poverty, average Naledi household income levels are generally low, with ~53% of household heads earning less than R3 500/month.

The key employment sectors in the NLM are Agriculture and hunting (~37%), Community Services (~21%), Private households (~18%), and Trade (~10.5%). Manufacturing provides less than 2% of employment opportunities. The Agriculture subsector is largely responsible for the uptake of lower skilled portion of the Black part of the labour force. The NLM informal economy is sizeable. Approximately half of those employed in the sector is so as street traders, retailers and marketers (NLM, 2012-2017).

5.3.2.2 Cultural and heritage aspects

Special attention was given to the identification of possible cultural or heritage resources on site. The initial site investigation concluded that there are no obvious heritage resources located on the site earmarked for development. However, a Heritage Impact Assessment has been conducted to ensure that there would be no impact on cultural or historical features as a result of the proposed activity.

According to the Heritage Impact Assessment (attached as Appendix H8) the cultural landscape qualities of the region essentially consist of a two components. The first is a rural area in which the human occupation is made up of a pre-colonial (Stone Age and Iron Age) occupation and a much later colonial (farmer) component. The second component is an urban one consisting of a number of smaller towns, most of which developed during the last 150 years or less.

Early history

Very little habitation of the central Highveld area took place during Stone Age times. Tools dating to the Early Stone Age period are mostly found in the vicinity of larger watercourses, e.g. the Vaal River or the Harts River and especially in sheltered areas such as at the Taung fossil site. During Middle Stone Age (MSA) times (c. 150 000 – 30 000 BP), people became more mobile, occupying areas formerly avoided. In many cases, tools dating to this period are found on the banks of the many pans that occur all over. The MSA is a technological stage characterized by flakes and flake-blades with faceted platforms, produced from prepared cores, as distinct from the core tool-based ESA technology.

Late Stone Age (LSA) people had even more advanced technology than the MSA people and therefore succeeded in occupying even more diverse habitats. Some sites are known to occur in the region. These are mostly open sites located near river and pans. For the first time we also get evidence of people's activities derived from material other than stone tools. Ostrich eggshell beads, ground bone arrowheads, small bored stones and wood fragments with incised markings are traditionally linked with the LSA.

The LSA people have also left us with a rich legacy of rock art, which is an expression of their complex social and spiritual beliefs. Some of the farms in the Vryburg region known to have rock engravings are Bernauw, Content, Gemsbok Laagte, Klipfontein, Kinderdam, Melalarig, Schatkist, Verdwaal Vlakte and Wonderfontein, to mention but a few.

Iron Age people started to settle in southern Africa c. AD 300, with one of the oldest known sites at Broederstroom south of Hartebeespoort Dam dating to AD 470. Having only had cereals (sorghum, millet) that need summer rainfall, Early Iron Age (EIA) people did not move outside this rainfall zone, and neither did they occupy the central interior highveld area. Because of their specific technology and economy, Iron Age people preferred to settle on the alluvial soils near rivers for agricultural purposes, but also for firewood and water.

The occupation of the larger geographical area (including the study area) did not start much before the 1500s. By the 16th century things changed, with the climate becoming warmer and wetter, creating conditions that allowed Late Iron Age (LIA) farmers to occupy areas previously unsuitable, for example the treeless plains of the Free State and North West Province.

The earliest Iron Age settlers who moved into the North West Province region were Tswana-speakers such as the Tlhaping, Hurutshe, Fokeng, Kgatla and Rolong. In the region of the study area, it was mostly the booRapulana and booRatlou sections of the Rolong (Breutz 1959).

Historic period

Many early travellers, hunters and missionaries (Burchell 1824, Campbell 1822, Smith 1834-1836 (Lye 1975), Moffat 1842 and Harris 1852) either passed through the area or close to it. Their writings leave us a tantalising description of what life was in these communities before large-scale interaction with white settlers took place. Some of the first whites to settle here were the missionaries Samuel Broadbent and Thomas Hodgson, who settled some distance to the east of what later became known as Wolmaransstad.

White settlers moved into the area during the first half of the 19th century. They were largely self-sufficient, basing their survival on cattle/sheep farming and hunting. Few towns were established and it remained an undeveloped area.

Identified heritage resources			
General protection (NHRA)	Coordinates		Description
Geological sites – Archaeology, palaeontology and meteorites (Section 35)	S 27.05726	E 24.77328	Algal stromatolites were identified to occur in a number of places in the study area. They are evidence of an aquatic environment in ancient times. The algal stromatolites have a number of distinctive shapes such as domes, columns and spheres, their shape being governed by the environment in which they were formed. The coordinates above refer to the best examples identified.
Archaeological sites – Stone age (Section 35)	S 27.05983	E 24.78171	A dry stream bed where tools and flakes dating to both the Middle Stone Age and Later Stone Age were identified. They were made either from hardened shale (MSA) or fine-grained silicates. The density is approximately one tool/flake per 50m ² .

From a heritage point of view, the following condition will apply:

- To address any subsurface cultural or heritage resources it needs to be clearly stated in the construction environmental management plan, submitted with the EIA report, that SAHRA will be informed immediately should any artefacts be exposed during construction. Training of contractors on heritage issues will also form part of the contractor's brief.

According to the Paleontological Heritage Assessment (refer to Appendix H9) the Khubu Solar Power Plant study area is entirely underlain by late Archaean (c. 2.6 billion year-old) sedimentary rocks of the Schmidtsdrif Subgroup (Ghaap Group, Transvaal Supergroup). These mainly comprise shallow marine carbonates and siliciclastic sediments of the Boomplaas Formation.

Densely-packed, well-preserved stromatolite assemblages are recorded within the Boomplaas Formation carbonate rocks in several areas of low-relief bedrock exposure just west of and along the banks of the shallow stream that transects the study area. A range of stromatolitic growth forms is represented here. The Boomplaas Formation stromatolites recorded in the Vryburg area represent some of the oldest examples of these microbially generated fossils in South Africa but they have yet to be comprehensively described while their stratigraphic and geographical distributions are poorly understood. Most of the Boomplaas Formation outcrop area on Champions Kloof 731 is mantled by soils and surface gravels of low palaeontological sensitivity. Stromatolitic horizons may be present within the underlying bedrocks but these are not easily accessible for scientific research and are in part protected by the superficial sediments above that are themselves of low palaeontological sensitivity.

It is recommended that the rocky areas of Boomplaas Formation bedrock exposure west of and along the stream be excluded from the solar plant footprint, with a buffer zone of 20 m.

5.4 SITE SELECTION MATRIX

Due to the nature of the proposed development, the location of the facility is largely dependent on technical and environmental factors such as solar irradiation, climatic conditions, topography of the site, access to the grid and capacity of the grid. Studies of solar irradiation worldwide indicate that the North West Province has a huge potential for the generation of power from solar.

The receptiveness of the site to PV Development includes the presence of optimal conditions for the sitting of a solar energy facility due to high irradiation values and optimum grid connection opportunities. Portion 5 (Shadow Eve) (Portion of Portion 4) of the farm Champions Kloof 731 where the project is proposed to be located is considered favorable and suitable from a technical perspective due to the following characteristics:

- Climatic conditions: Climatic conditions determine if the project will be viable from an economic perspective as the solar energy facility is directly dependent on the annual direct solar irradiation values of a particular area. The regional location of the project includes a low number of rainy days and a high number of daylight hours experienced in the region. Global Horizontal Radiation of 1740 kWh/m²/year is relevant in the area.
- Renewable Energy Development Zone (REDZ): The site is also located in one of the Renewable Energy Development Zones (REDZ). The solar PV assessment domain was based on the location of the majority of existing solar PV project applications at the commencement of the Strategic Environmental Assessment (SEA) and includes the five provinces of Northern Cape, Western Cape, Eastern Cape, Free State and North West. – Refer to figure 20.

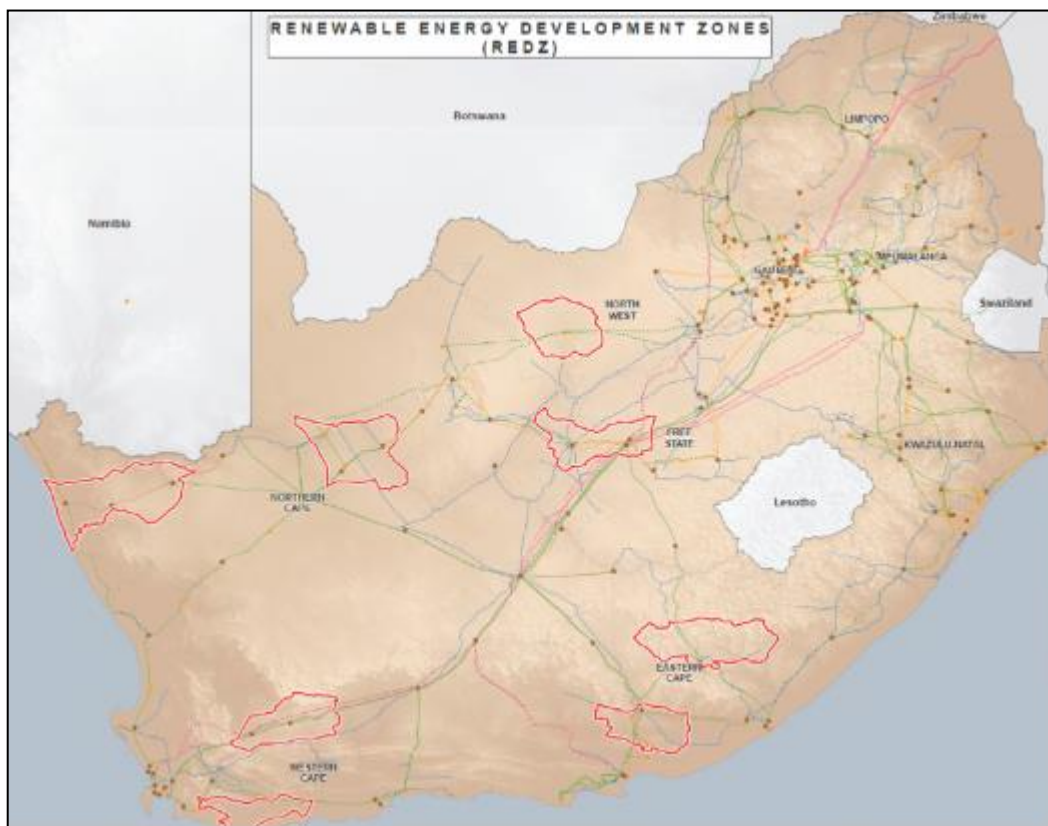


Figure 20: Renewable Energy Development Zones (REDZ)

- Topographic conditions: The surface are on which the proposed facility will be located has a favorable level topography, which facilitates work involved with construction and maintenance of the facility and ensures that shadowing on the panels do not occur.
- Extent of the site: A significant portion of land is required to evacuate the prescribed 115MW and space is a constraining factor in PV facility installations. Provision was made to assess a larger area than is required for the facility to make provision for any other environmental or technical constraints that may arise and avoiding those areas. Larger farms are sought after to make provision for any constraints imposed by the Department of Agriculture on the extent of land that may be used for such facilities per farm. Portion 5 (Shadow Eve) (Portion of Portion 4) of the farm Champions Kloof 731 is 397.3009 hectares in extent.
- Site availability and access: The land is available for lease by the developer. Reluctant farm owners or farmers over capitalizing hamper efforts to find suitable farms. Access will be obtained via a gravel road off the R34.
- Grid connection: In order for the PV facility to connect to the national grid (Mookodi-Magopela 132kV transmission line) the facility will have to construct an on-site substation, Eskom switching station and a power line from the project site to connect to the Eskom grid. Available grid connections are becoming scarce and play a huge role when selecting a viable site.
- Environmental sensitivities: From an environmental perspective the proposed site is considered highly desirable due to limited environmental sensitivities in terms of geology, and soils, agricultural potential, vegetation and landscape features, climate, biodiversity and the visual landscape – refer to Section 5.3.1 of this report. Due to the fact that the area proposed for development exclusively consists of land used for grazing, from an ecological or conservation point the site is deemed less sensitive.

It is evident from the discussion above that Portion 5 (Shadow Eve) (Portion of Portion 4) of the farm Champions Kloof 731 may be considered favourable and suitable in terms of these site characteristics. The challenges were therefore to identify the preferred location for the proposed development within the boundaries of the farm.

5.5 CONCLUDING STATEMENT ON ALTERNATIVES

In conclusion the preferred alternative entails the following:

- The development of the 115MW Khubu Photovoltaic Solar Energy facility on Portion 5 (Shadow Eve) (Portion of Portion 4) of the farm Champions Kloof 731, Registration IN, North West Province - refer to Section 2 of this report.

The preferred layout on Portion 5 (Shadow Eve) (Portion of Portion 4) of the farm Champions Kloof 731, is included in the attached Figures – refer to figure 7. It may be concluded that no other alternatives are considered during the EIA process.

6 DESCRIPTION OF THE IMPACTS AND RISKS

This section aims to address the following requirements of the regulations:

Appendix 3. (3)(h) An EIR (...) must include-

(h) a full description of the process followed to reach the proposed development footprint, within the approved site, including –

(v) the impacts and risks identified, 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;

(vii) positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects; and

(viii) the possible mitigation measures that could be applied and level of residual risk

(i) a full description of the process undertaken to identify, assess and rank the impacts the activity and associated structures and infrastructure 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 EIA 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.

(j) an assessment of each identified potentially significant impact and risk, including-

(i) cumulative impacts;

(ii) the nature, significance and consequences of the impact and risk;

(iii) the extent and duration of the impact and risk;

(iv) the probability of the impact and risk occurring;

(v) the degree to which the impact and risk can be reversed;

(vi) the degree to which the impact and risk may cause irreplaceable loss of resources; and

(vii) the degree to which the impact and risk can be mitigated;

(k) where applicable, a summary of the findings and recommendations of 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 assessment report;

6.1 SCOPING METHODOLOGY

The contents and methodology of the scoping report aims to provide, as far as possible, a user-friendly analysis of information to allow for easy interpretation.

- Checklist (see section 6.1.1): The checklist consists of a list of structured questions related to the environmental parameters and specific human actions. They assist in ordering thinking, data collection, presentation and alert against the omission of possible impacts.
- Matrix (see section 6.1.2): The matrix analysis provides a holistic indication of the relationship and interaction between the various activities, development phases and the impact thereof on the environment. The method aims at providing a first order cause and effect relationship between the environment and the proposed activity. The matrix is designed to indicate the relationship between the different stressors and receptors which leads to specific impacts. The matrix also indicates the specialist studies that have been conducted to address the potentially most significant impacts.

6.1.1 Checklist analysis

The independent consultant conducted a site visit on 26 October 2015. The site visit was conducted to ensure a proper analysis of the site specific characteristics of the study area. Table 6.1 provides a checklist, which is designed to stimulate thought regarding possible consequences of specific actions and so assist scoping of key issues. It consists of a list of structured questions related to the environmental parameters and specific human actions. They assist in ordering thinking, data collection, presentation and alert against the omission of possible impacts. The table highlights certain issues, which are further analysed in matrix format in section 6.2.

Table 6.1: Environmental checklist

QUESTION	YES	NO	Un-sure	Description
1. Are any of the following located on the site earmarked for the development?				
I. A river, stream, dam or wetland	X			Non-perennial stream running through the site.
II. A conservation or open space area	X			The site falls within a Critical Biodiversity Area as described in the relevant bioregional plans.
III. An area that is of cultural importance	X			According to the Heritage Impact Assessment (Appendix H8), a dry stream bed where tools and flakes dating to both the Middle Stone Age and Later Stone Age were identified. The density is approximately one tool/flake per 50m ² .

IV. Site of geological significance	×			According to the Palaeontological Heritage Assessment (Appendix H9), Algal stromatolites were identified to occur in a number of places in the study area. It is recommended that the rocky areas of Boomplaas Formation bedrock exposure west of and along the stream be excluded from the solar plant footprint, with a buffer zone of 20 m.
V. Areas of outstanding natural beauty		×		None.
VI. Highly productive agricultural land		×		None.
VII. Floodplain		×		None.
VIII. Indigenous forest		×		None.
IX. Grass land		×		None.
X. Bird nesting sites		×		None.
XI. Red data species		×		None.
XII. Tourist resort		×		None.
2. Will the project potentially result in potential?				
I. Removal of people		×		None.
II. Visual Impacts	×			The VIA (refer to Appendix H6) confirmed that the visual impact of a low-lying PV facility is not expected to be significant as the number of sensitive receptors in the area is very low.
III. Noise pollution		×		Construction activities will result in the generation of noise over a period of months. The noise impact is unlikely to be significant.
IV. Construction of an access road		×		Access will be obtained via a gravel road off the R34.
V. Risk to human or valuable ecosystems due to explosion/fire/ discharge of waste into water or air.		×		None.
VI. Accumulation of large workforce (>50 manual workers) into the site.	×			Approximately 300 employment opportunities will be created during the construction phase of the project.
VII. Utilisation of significant volumes of local raw materials such as water, wood etc.	×			The estimated maximum amount of water required during the facility's 20 years of production is approximately 3 880m ³ per annum.

VIII. Job creation	×			Approximately 453 employment opportunities will be created during the construction and operational phases.
IX. Traffic generation	×			It is expected that 64 trips per day will be generated over the 12-month construction period.
X. Soil erosion	×			The site will need to be cleared or graded to a limited extent, which may potentially result in a degree of dust being created, increased runoff and potentially soil erosion. The time that these areas are left bare will be limited to the construction phase, since vegetation will be allowed to grow back after construction.
XI. Installation of additional bulk telecommunication transmission lines or facilities		×		None.
3. Is the proposed project located near the following?				
I. A river, stream, dam or wetland	×			The Dry Harts river is located approximately 800m west of the site.
II. A conservation or open space area	×			The site falls within a Critical Biodiversity Area as described in bioregional plans.
III. An area that is of cultural importance		×		None.
IV. A site of geological significance		×		None.
V. An area of outstanding natural beauty		×		None.
VI. Highly productive agricultural land		×		None.
VII. A tourist resort		×		None.
VIII. A formal or informal settlement	×			The Huhudi informal settlement is located approximately 7km north west of the proposed site.

6.1.2 Matrix analysis

The matrix describes the relevant listed activities, the aspects of the development that will apply to the specific listed activity, a description of the environmental issues and potential impacts, the significance and magnitude of the potential impacts and possible mitigation measures. The matrix also highlights areas of particular concern (see Table 6.2) for more in depth assessment. An indication is provided of the specialist studies which was conducted and that informed the initial assessment. Each cell is evaluated individually in terms of the nature of the impact, duration and its significance – should no mitigation measures be applied. This is important since many impacts would not be considered insignificant if proper mitigation measures were implemented.

In order to conceptualise the different impacts, the matrix specify the following:

- **Stressor:** Indicates the aspect of the proposed activity, which initiates and cause impacts on elements of the environment.
- **Receptor:** Highlights the recipient and most important components of the environment affected by the stressor.
- **Impacts:** Indicates the net result of the cause-effect between the stressor and receptor.
- **Mitigation:** Impacts need to be mitigated to minimise the effect on the environment.

Please refer to Annexure G for a more in-depth assessment of the potential environmental impacts.

Table 6.2: Matrix analysis

For ease of reference the significance of the impacts is colour-coded as follow:

Low significance	Medium significance	High significance	Positive impact
------------------	---------------------	-------------------	-----------------

LISTED ACTIVITY (The Stressor)	ASPECTS OF THE DEVELOPMENT /ACTIVITY	POTENTIAL IMPACTS		SIGNIFICANCE AND MAGNITUDE OF POTENTIAL IMPACTS							MITIGATION OF POTENTIAL IMPACTS			SPECIALIST STUDIES / INFORMATION					
		Receptors	Impact description / consequence	Minor	Major	Extent	Duration	Probability	Reversibility	Irreplaceable loss of resources	Possible Mitigation	Possible mitigation measures	Level of residual risk						
CONSTRUCTION PHASE																			
<p><u>Activity 11(i) (Regulation 983):</u> “The development of facilities or infrastructure for the transmission and distribution of electricity- (i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts.”</p> <p><u>Activity 12 (Regulation 983):</u> “The development of- (xii) infrastructure or structures with a physical footprint of 100 square metres or more; where such development occurs- (a) within a watercourse or (c) ...within 32 metres of a watercourse, measured from the edge of a watercourse.”</p> <p><u>Activity 19 (Regulation 983):</u> “The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 5 cubic metres from- (i) a watercourse...”</p>	<p><u>Site clearing and preparation</u> Certain areas of the site will need to be cleared of vegetation and some areas may need to be levelled.</p> <p><u>Civil works</u> The main civil works are:</p> <ul style="list-style-type: none"> • Terrain levelling if necessary– Levelling will be minimal as the potential site chosen is relatively flat. • Laying foundation- The structures will be connected to the ground through cement pillars, cement slabs or metal screws. The exact method will depend on the detailed geotechnical analysis. • Construction of access and inside roads/paths – existing paths will be used where reasonably possible. Additionally, the turning circle for trucks will also be taken into consideration. • Trenching – all Direct Current (DC) and Alternating Current (AC) 	BIOPHYSICAL ENVIRONMENT	Fauna & Flora	<ul style="list-style-type: none"> • Loss or fragmentation of indigenous natural vegetation. • Loss of sensitive species. • Loss or fragmentation of habitats. 											<ul style="list-style-type: none"> - Site clearing must take place in a phased manner, as and when required. - The footprint associated with the construction related activities (access roads, construction platforms, workshop etc.) should be confined to the fenced off area and minimised where possible. - No trapping or snaring to fauna on the construction site should be allowed. 	L	Ecological Fauna and Flora Habitat Survey & Avifaunal Study		
			Air	<ul style="list-style-type: none"> • Air pollution due to the increase of traffic of construction vehicles. 													<ul style="list-style-type: none"> - Dust suppression measures must be implemented for heavy vehicles such as wetting of gravel roads on a regular basis and ensuring that vehicles used to transport sand and building materials are fitted with tarpaulins or covers. 	L	-
			Soil	<ul style="list-style-type: none"> • Soil degradation, including erosion. 													<ul style="list-style-type: none"> - Areas which are not to be constructed on within two months must not be cleared to reduce erosion risks. 	M	Soils and Agricultural Study

<p><u>Activity 1 (Regulation 984):</u> “The development of facilities or infrastructure for the generation of electricity where the electricity output is 20 megawatts or more.”</p> <p><u>Activity 15 (Regulation 984):</u> “The clearance of an area of 20 hectare or more of indigenous vegetation...”</p> <p><u>Activity 4 (Regulation 985):</u> “The development of a road wider than 4 metres with a reserve less than 13.5 metres (e) in North West (i) outside urban areas, in (ee) critical biodiversity areas as identified in bioregional plans..”</p> <p><u>Activity 12 (Regulation 985):</u> “The clearance of an area of 300 square metres or more of indigenous vegetation...(a) in North West (ii) within critical biodiversity areas identified in bioregional plans.”</p>	<p>wiring within the PV plant will be buried underground. Trenches will have a river sand base, space for pipes, backfill of sifted soil and soft sand and concrete layer where vehicles will pass.</p> <p><u>Transportation and installation of PV panels into an Array</u> The panels are assembled at the supplier’s premises and will be transported from the factory to the site on trucks. The panels will be mounted on metal structures which are fixed into the ground either through a concrete foundation or a deep seated screw.</p> <p><u>Wiring to the Central Inverters</u> Sections of the PV array would be wired to central inverters which have a maximum rated power of 2000kW each. The inverter is a pulse width mode inverter that converts DC electricity to alternating electricity (AC) at grid frequency.</p>		<ul style="list-style-type: none"> Disturbance of soils and existing land use (soil compaction). Physical and chemical degradation of the soils by construction vehicles (hydrocarbon spills). Loss of topsoil. 									<ul style="list-style-type: none"> The necessary silt fences and erosion control measures must be implemented in areas where these risks are more prevalent. Vehicles and equipment shall be serviced regularly to avoid the contamination of soil from oil and hydraulic fluid leaks etc. 				
		Geology	<ul style="list-style-type: none"> Collapsible soil. Seepage Active soil (high soil heave). Erodible soil. Hard/compact geology. If the bedrock occurs close to surface it may present problems when driving solar panel columns. The presence of undermined ground. Instability due to soluble rock. Steep slopes or areas of unstable natural slopes. Areas subject to seismic activity. Areas subject to flooding. 									Yes	<ul style="list-style-type: none"> The most effective mitigation will be the minimisation of the project footprint by using the existing roads in the area and not create new roads to prevent other areas also getting compacted. If an activity will mechanically disturb below surface in any way, then any available topsoil should first be stripped from the entire surface and stockpiled for re-spreading during rehabilitation. Retention of vegetation where possible to avoid soil erosion. 	L	Geotechnical Study	
		Existing services infrastructure	<ul style="list-style-type: none"> Generation of waste that need to be accommodated at a licensed landfill site. Generation of sewage that need to be accommodated by the local sewage plant. Increase in construction vehicles on existing roads. 										Yes	-	L	Confirmation from the Local Municipality
		Ground water	<ul style="list-style-type: none"> Pollution due to construction vehicles. 										Yes	- A groundwater monitoring programme (quality and groundwater	L	-

													levels) should be designed and installed for the site. Monitoring boreholes should be securely capped, and must be fitted with a suitable sanitary seal to prevent surface water flowing down the outside of the casing. Full construction details of monitoring boreholes must be recorded when they are drilled (e.g. screen and casing lengths, diameters, total depth, etc). Sampling of monitoring boreholes should be done according to recognised standards.		
			Surface water	<ul style="list-style-type: none"> • Increase in storm water run-off. • Pollution of water sources (non-perennial stream) due to soil erosion. 		-	L	S	Pr	PR	ML	Yes	<ul style="list-style-type: none"> - Silt fences should be used to prevent any soil entering the stormwater drains - New stormwater construction must be developed strictly according to specifications from engineers in order to ensure efficiency. - Any hazardous substances must be stored at least 32m from any of the water bodies on site. 	M	Hydrological Study
		SOCIAL/ECONOMIC/ENVIRONMENT	Local unemployment rate	<ul style="list-style-type: none"> • Job creation. • Business opportunities. • Skills development. 		+	P	S	D	I	N/A	Yes	<ul style="list-style-type: none"> - Where reasonable and practical, Khubu's service providers should appoint local contractors and implement a 'locals first' policy, especially for semi 	L	Social Impact Assessment

													should be kept in good operating order and where appropriate have effective exhaust mufflers.		
			Tourism industry	<ul style="list-style-type: none"> Since there are no tourism facilities in close proximity to the site, the proposed activities will not have an impact on tourism in the area. 	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
			Heritage resources	<ul style="list-style-type: none"> Removal or destruction of archaeological and/or paleontological sites. Removal or destruction of buildings, structures, places and equipment of cultural significance. Removal or destruction of graves, cemeteries and burial grounds. 		-	S	S	Po	I	ML	Yes	- Any discovered artifacts shall not be removed under any circumstances. Any destruction of a site can only be allowed once a permit is obtained and the site has been mapped and noted. Permits shall be obtained from the SAHRA should the proposed site affect any world heritage sites or if any heritage sites are to be destroyed or altered.	L	Heritage Impact Assessment & Palaeontological Impact Assessment
OPERATIONAL PHASE															
	The key components of the proposed project are described below: <ul style="list-style-type: none"> <u>PV Panel Array</u> - To produce 115MW, the proposed facility will require numerous linked cells placed behind a protective glass sheet to form a panel. Multiple panels will be required to form the solar PV arrays which will comprise the PV facility. The PV panels will be tilted at a northern angle in order to capture the most sun. 	BIOPHYSICAL ENVIRONMENT	Fauna & Flora	<ul style="list-style-type: none"> Fragmentation of habitats. Establishment and spread of declared weeds and alien invader plants (operations). Impact on avifauna. 		-	P	L	Po	PR	ML	Yes	<ul style="list-style-type: none"> Indigenous vegetation must be maintained and all exotics removed as they appear and disposed of appropriately. Re-vegetation of the disturbed site is aimed at approximating as near as possible the natural vegetative conditions prevailing prior to construction. Implement an Avifauna Monitoring plan. 	M	Ecological Fauna and Flora Habitat Survey & Avifaunal Study
			Air quality	<ul style="list-style-type: none"> The proposed development will not result in any air 	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

	<ul style="list-style-type: none"> • <u>Supporting Infrastructure</u> – Auxiliary buildings with basic services such as water and electricity will be constructed on the site and will have an approximate footprint 820m². Other supporting infrastructure includes voltage and current regulators and protection circuitry. • <u>Roads</u> – Access will be obtained via a gravel road off of the R34. An internal site road network will also be required to provide access to the solar field and associated infrastructure. All site roads will require a width of approximately 5-6m. • <u>Fencing</u> - For health, safety and security reasons, the facility will be required to be fenced off from the surrounding farm. 			<ul style="list-style-type: none"> • Increased consumption of water. Approximately 4 000 000 liters of water per annum will be required for the operation of the solar plant. 												
			Ground water	<ul style="list-style-type: none"> • Leakage of hazardous materials. The development will comprise of a distribution substation and will include transformer bays which will contain transformer oils. Leakage of these oils can contaminate water supplies. 	-	L	L	Po	PR	ML	Yes	- All areas in which substances potentially hazardous to groundwater are stored, loaded, worked with or disposed of should be securely banded (impermeable floor and sides) to prevent accidental discharge to groundwater.	L	-		
			Surface water	<ul style="list-style-type: none"> • Increase in storm water runoff. The development will potentially result in an increase in storm water runoff that needs to be managed to prevent soil erosion. • Leakage of hazardous materials. The development will comprise of a distribution substation and will include transformer bays which will contain transformer oils. Leakage of these oils can contaminate water supplies. • Destruction of watercourses (non-perennial stream). 									- The storm water management plan must include the construction of appropriate design measures that allow surface and subsurface movement of water along drainage lines so as not to impede natural surface and subsurface flows.	L	Hydrological Study	
			Local unemployment rate	<ul style="list-style-type: none"> • Job creation. Security guards will be required for 24 hours every day of the week and general laborers will also be required for the cleaning of the panels. • Skills development. 	+	L	L	D	I	N/A	Yes	- Where reasonable and practical, Khubu's service providers should implement a 'locals first' policy, especially for semi and low-skilled job categories.	N/A	Social Impact Assessment		
			Visual landscape	<ul style="list-style-type: none"> • Change in land-use/sense of place. The site is characterized by open veldt 		L	L	D	PR	ML	Yes	- Screening should be implemented by means of	M	Visual Impact Assessment		

			<p>with a rural agricultural sense of place. The use of the area for the construction and operation of the PV plant will result in the area not being used for livestock grazing anymore.</p> <ul style="list-style-type: none"> Potential visual impact on residents of farmsteads and travellers in close proximity to proposed facility. 									<p>vegetation in conjunction with security fencing.</p> <ul style="list-style-type: none"> Security lighting should make use of down-lights to minimise light spill, and motion detectors where possible so that lighting at night is minimised. Care should be taken with the layout of the security lights to prevent motorists on the dirt road from being blinded by lights at the approach to the site. 		
Traffic volumes	<ul style="list-style-type: none"> The proposed development will not result in any traffic impacts during the operational phase. 	-		L	L	Po	CR	NL	Yes	-	L	Traffic Study		
Health & Safety	<ul style="list-style-type: none"> The proposed development will not result in any health and safety impacts during the operational phase. 	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		
Noise levels	<ul style="list-style-type: none"> The proposed development will not result in any noise pollution during the operational phase. 	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		
Tourism industry	<ul style="list-style-type: none"> Enhance tourism in the area. The facility may become an attraction or a landmark within the region that people would want to come and see. 	+		P	L	Po	I	N/A	Yes	-	N/A	-		
Heritage resources	<ul style="list-style-type: none"> It is not foreseen that the proposed activity will impact on heritage resources or vice versa. 	-		S	L	Po	PR	ML	Yes	-	L	-		
Electricity supply	<ul style="list-style-type: none"> Generation of additional electricity. The facility will generate electricity that will be fed into the grid. 	+		I	L	D	I	N/A	Yes	-	N/A	-		
Local community	<ul style="list-style-type: none"> The establishment of a Community Trust. 		+	L	L	Pr	I	N/A	Yes	- Khubu, in consultation with the NLM, should	N/A	Social Impact Assessment		

				<ul style="list-style-type: none"> Increase in construction vehicles. 											
			Ground water	<ul style="list-style-type: none"> Pollution due to construction vehicles. 	-		S	S	Pr	CR	ML	Yes	-	L	-
			Surface water	<ul style="list-style-type: none"> Increase in storm water run-off. Pollution of water sources due to soil erosion. Destruction of watercourses (non-perennial streams). 									<ul style="list-style-type: none"> Removal of any historically contaminated soil as hazardous waste. Removal of hydrocarbons and other hazardous substances by a suitable contractor to reduce contamination risks. Removal of all substances which can result in groundwater (or surface water) contamination. 	M	Hydrological Study
		SOCIAL/ECONOMIC ENVIRONMENT	Local unemployment rate	<ul style="list-style-type: none"> Loss of employment. 			L	L	Po	PR	NL	Yes	<ul style="list-style-type: none"> Khubu should ensure that retrenchment packages are provided for all staff retrenched when the facility is decommissioned. 	M	Social Impact Assessment
			Visual landscape	<ul style="list-style-type: none"> Potential visual impact on visual receptors in close proximity to proposed facility. 	-		L	S	D	CR	NL	Yes	<ul style="list-style-type: none"> Locate laydown and storage areas in zones of low visibility i.e. behind tall trees or in lower lying areas. 	L	Visual Impact Assessment
			Traffic volumes	<ul style="list-style-type: none"> Increase in construction vehicles. 	-		L	S	Pr	CR	NL	Yes	<ul style="list-style-type: none"> Movement of heavy construction vehicles through residential areas should be timed to avoid peak morning and evening traffic periods. In addition, movement of heavy construction vehicles through residential areas should not take place over weekends. 	L	Traffic Study

			Health & Safety	<ul style="list-style-type: none"> Air/dust pollution. Road safety. Increased crime levels. The presence of construction workers on the site may increase security risks associated with an increase in crime levels as a result of influx of people in the rural area. 	-		L	S	Pr	PR	ML	Yes	<ul style="list-style-type: none"> Demarcated routes to be established for construction vehicles to ensure the safety of communities, especially in terms of road safety and communities to be informed of these demarcated routes. Where dust is generated by trucks passing on gravel roads, dust mitigation to be enforced. Any infrastructure that would not be decommissioned must be appropriately locked and/or fenced off to ensure that it does not pose any danger to the community. 	L	-	
			Noise levels	<ul style="list-style-type: none"> The generation of noise as a result of construction vehicles, the use of machinery and people working on the site. 	-		L	S	D	CR	NL	Yes	<ul style="list-style-type: none"> The decommissioning phase must aim to adhere to the relevant noise regulations and limit noise to within standard working hours in order to reduce disturbance of dwellings in close proximity to the development. 	L	-	
			Tourism industry	<ul style="list-style-type: none"> Since there are no tourism facilities in close proximity to the site, the decommissioning activities will not have an impact on tourism in the area. 	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
			Heritage resources	<ul style="list-style-type: none"> It is not foreseen that the decommissioning phase will impact on any heritage resources. 		-	S	S	Pr	PR	ML	Yes	-	L	Heritage Impact Assessment & Palaeontologic	

6.2 KEY ISSUES IDENTIFIED

From the above it is evident that mitigation measures should be available for potential impacts associated with the proposed activity and development phases. The scoping methodology identified the following key issues which should be addressed in more detail in the EIA report.

6.2.1 Impacts during the construction phase

During the construction phase the following activities will have various potential impacts on the biophysical and socio-economic environment:

- Activity 11(i) (Regulation 983): *“The development of facilities or infrastructure for the transmission and distribution of electricity- (i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts.”*
- Activity 12(xii)(a)(c) (Regulation 983): *“The development of- (xii) infrastructure or structures with a physical footprint of 100 square metres or more; where such development occurs- (a) within a watercourse or (c) ...within 32 metres of a watercourse, measured from the edge of a watercourse.”*
- Activity 19(i) (Regulation 983): *“The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 5 cubic metres from- (i) a watercourse...”*
- Activity 28(ii) (Regulation 983): *“Residential, mixed, retail, commercial, industrial or institutional developments where such land was used for agriculture or afforestation on or after 1998 and where such development (ii) will occur outside an urban area, where the total land to be developed is bigger than 1 hectare.”*
- Activity 1 (Regulation 984): *“The development of facilities or infrastructure for the generation of electricity where the electricity output is 20 megawatts or more.”*
- Activity 15 (Regulation 984): *“The clearance of an area of 20 hectare or more of indigenous vegetation...”*
- Activity 4(e)(i)(ee) (GN.R. 985): *“The development of a road wider than 4 metres with a reserve less than 13.5 metres (e) in North West (i) outside urban areas, in (ee) critical biodiversity areas as identified in bioregional plans..”*
- Activity 12(a)(ii) (GN.R. 985): *“The clearance of an area of 300 square metres or more of indigenous vegetation...(a) in North West (ii) within critical biodiversity areas identified in bioregional plans.”*

During the construction phase minor negative impacts are foreseen over the short term. The latter refers to a period of months. The potentially most significant impacts relate to the impacts on the fauna and flora, soils, geology, surface water (non-perennial stream), existing services infrastructure, traffic impacts, socio-economic impacts such as the provision of temporary employment and other economic benefits, and the impacts on health and safety and heritage resources.

6.2.2 Impacts during the operational phase

During the operational phase the study area will serve as a solar plant . The potential impacts will take place over a period of 20 – 25 years. The negative impacts are generally associated with impacts on the fauna and flora, soils, geology, surface water (non-perennial stream), the pressure on existing services infrastructure, and visual impacts. The provision of sustainable services delivery also needs to be confirmed. The operational phase will have a direct positive impact through the provision of employment opportunities for its duration, and the generation of income to the local community.

6.2.3 Impacts during the decommissioning phase

The physical environment will benefit from the closure of the solar facility since the site will be restored to its natural state. The decommissioning phase will however potentially result in impacts on soils, surface water, heritage objects, and the loss of permanent employment. Skilled staff will be eminently employable and a number of temporary jobs will also be created in the process.

6.1 ASPECTS TO BE ASSESSED

Table 6.3 below provides a summary of the aspects that need to be assessed as part of the EIR. The aspects are also linked to specialist information that has been obtained. Refer to Table 6.2 for a description of the potential impacts.

Table 6.3: Aspects to be assessed

Aspects	Potential impacts	Specialist studies / technical information
Construction of the PV Solar facility	<ul style="list-style-type: none"> Impacts on the fauna and flora 	Ecological Fauna and Flora Habitat Survey & Avifauna study
	<ul style="list-style-type: none"> Impacts on agricultural potential (soils) 	Soil, Land Capability and Agricultural Potential Study
	<ul style="list-style-type: none"> Impacts associated with the geology of the site 	Geotechnical Study
	<ul style="list-style-type: none"> Impacts on existing services infrastructure 	Confirmation from the Local Municipality
	<ul style="list-style-type: none"> Impacts on surface water 	Hydrological assessment
	<ul style="list-style-type: none"> Temporary employment, impacts on health and safety 	Social Impact Assessment
	<ul style="list-style-type: none"> Impacts on heritage resources 	Heritage Impact Assessment & Palaeontological Heritage Assessment
	<ul style="list-style-type: none"> Impacts on Traffic 	Traffic Impact Study
Operation of the PV Solar facility	<ul style="list-style-type: none"> Impacts on the fauna and flora 	Ecological Fauna and Flora Habitat Survey & Avifauna study

	<ul style="list-style-type: none"> • Impacts on agricultural potential (soils) 	Soil, Land Capability and Agricultural Potential Study
	<ul style="list-style-type: none"> • Impacts associated with the geology of the site 	Geotechnical study
	<ul style="list-style-type: none"> • Increased consumption of water 	EAP assessment
	<ul style="list-style-type: none"> • Impacts on surface water 	Hydrological assessment
	<ul style="list-style-type: none"> • Pressure on existing services infrastructure 	Confirmation from the Local Municipality
	<ul style="list-style-type: none"> • Visual Impact 	Visual Impact Assessment
	<ul style="list-style-type: none"> • Provision of employment & generation of income for the local community 	Social Impact Assessment
Decommissioning of the PV Solar facility	<ul style="list-style-type: none"> • Impacts on agricultural potential (soil) 	Soil, Land Capability and Agricultural Potential Study
	<ul style="list-style-type: none"> • Impacts on surface water 	Hydrological assessment
	<ul style="list-style-type: none"> • Impacts on heritage resources 	Heritage Impact Assessment & Palaeontological Heritage Assessment
	<ul style="list-style-type: none"> • Socio-economic impacts (loss of employment) 	Social Impact Assessment
Cumulative Impacts	<ul style="list-style-type: none"> • Cumulative biophysical impacts resulting from similar developments in close proximity to the proposed activity. 	EAP assessment & Specialist Assessment

6.2 SUMMARY OF RECOMMENDATIONS FROM SPECIALIST STUDIES

To address the key issues highlighted in the previous section the following specialist studies and processes were commissioned:

- A Geotechnical Study – conducted by Johann Lanz (see Appendix H1).
- Ecological Fauna and Flora Habitat Survey – Anthene Ecological CC (see Appendix H2).
- Wetland Assessment – Anthene Ecological CC (see Appendix H3).
- Hydrological Assessment – Eco Monitoring CC (see Appendix H4).
- Avifaunal Study – Dr. T. Williams (see Appendix H5).
- A Visual Impact Assessment - conducted by Phala Environmental Consultants (Pty) Ltd. (see Appendix H6).
- Soil, Land Capability and Agricultural Potential Study – conducted by Johann Lanz (see Appendix H7).
- A Heritage Impact Assessment - conducted by Mr. J.A. van Schalkwyk (see Appendix H8).
- Paleontological Heritage Assessment – conducted by Natura Viva CC (see Appendix H9).
- Social Impact Assessment - conducted by Leandri Kruger (see Appendix H10).

- Traffic Impact Study – conducted by BVi Consulting Engineers (see Appendix H11).
- A detailed assessment of the cumulative impacts associated with the proposed development – conducted by the lead consultant, Environamics in conjunction with the project specialists (refer to Section 7 of this report and Appendix L).

The following sections summarise the main findings from the specialist reports in relation to the key issues raised during the scoping phase.

6.4.1 Issue 1: Geotechnical suitability

The geotechnical suitability of the site for the proposed development needed to be determined. The main question which needs to be addressed is:

“Are the geotechnical conditions favorable for the development of a PV solar plant?”

According to the Geotechnical Study (Appendix H1) the entire site is underlain by shallow, hard dolomite bedrock, with a thin covering (0-30cm) of unconsolidated, sandy soil. The bedrock outcrops in several places. The foundations for mounting structures will therefore need to be erected into hard bedrock.

None of the following occur on the site:

- Shallow water table (less than 1.5m deep)
- Sinkhole or doline areas. But the underlying geology is dolomite.
- Seasonally wet soils (often close to water bodies)
- Unstable rocky slopes or steep slopes with loose soil
- Dispersive soils (soils that dissolve in water)
- Soils with high clay content (clay fraction more than 40%)
- Any other unstable soil or geological feature
- An area sensitive to erosion

The geotechnical conditions are assessed, in terms of this investigation, as suitable for the development of a solar energy facility.

6.2.2 Issue 2: Heritage and archeological impacts

South Africa’s heritage resources comprise a wide range of sites, features, objects and beliefs. According to Section 27(18) of the National Heritage Resources Act (NHRA), No. 25 of 1999, no person may destroy, damage, deface, excavate, alter, remove from its original position, subdivide or change the planning status of any heritage site without a permit issued by the heritage resources authority responsible for the protection of such site. In accordance with Section 38 of the NHRA, an independent heritage consultant was therefore to conduct a Heritage Impact Assessment (HIA) to determine if any sites, features or objects of cultural heritage significance occur within the proposed site. The main question which needs to be addressed is:

“Will the proposed development impact on any heritage or archeological artifacts?”

The Heritage Impact Assessment (Refer to Appendix H8) confirmed the following: The aim of this survey was to locate, identify, evaluate and document sites, objects and structures of cultural

significance found within the areas of the proposed development, to assess the significance thereof and to consider alternatives and plans for the mitigation of any adverse impacts. The cultural landscape qualities of the region is made up of a pre-colonial element consisting of limited Stone Age occupation, as well as a much later colonial (farmer) component, which gave rise to an urban component.

Impact analysis of cultural heritage resources under threat of the proposed development, are based on the present understanding of the development.

- Algal stromatolites were identified to occur in a number of places in the study area. They are evidence of an aquatic environment in ancient times.
- A small isolated area where a very low density of MSA and LSA stone tools occur was identified in the study area. Due to the low density of the material, this site is seen to be fully recorded after inclusion in this report.

From a heritage point of view, it is recommended that the proposed development be allowed to continue.

6.2.3 Issue 3: Ecological Impacts

The potential impact of the proposed development on threatened flora and fauna known to occur in North West Province had to be determined. The main question which needs to be addressed is:

“How will the proposed development impact on the ecology?”

The Ecological Fauna and Flora Habitat Survey (refer to Appendix H2) confirmed that the ecological sensitivity at the site is medium: There are no indications of any particular ecosystems of conservation importance, any particular conservation corridors or a significant impact on any plant, mammal, reptile, amphibian or invertebrate species of particular conservation concern if the site is developed.

A Protected Tree species, *Vachellia erioloba* (= *Acacia erioloba*) (also listed as Declining) is found at the site. Protected Tree species are listed under the National Forests Act No. 84 of 1998. Average abundance of Camel Thorn trees at the proposed footprint per hectare is 0.3 which gives an indication of the absence of this species at most of the proposed footprint. Approximately 75 Camel Thorn trees taller than 2 m have been observed for the total footprint area of which most are concentrated at the beacon area of the site. It is recommended that a permit should be applied for at the relevant authorities in case any removal or damage of Camel Thorn trees.

There is no distinct reason why this relatively small footprint allocated for the development, in the vast countryside of the North West Province is of particular conservation concern for any threatened vertebrate species, including those that roam large areas and which may occasionally or coincidentally visit the site. It is unlikely that there will be a loss of any known plant, mammal, reptile, amphibian or invertebrate species that are threatened or near threatened, if the site is developed.

6.2.4 Issue 4: Avifaunal Impacts

The potential impact of the proposed development on birds known to occur in North West Province had to be determined. The main question which needs to be addressed is:

“How will the proposed development impact on the avifauna?”

The Avifaunal Study (refer to Appendix H5) confirmed that the loss of habitat due to development of the SPP will have the greatest impact on those bird species that are dependent on the shrubland habitats. These species have generally extensive distributions in the North West Province and the small number of individuals displaced from the proposed development is not considered of conservation importance. None of the conservation priority species will be particularly affected as they range over considerably wider areas than that to be affected. Nor, currently, are there other marked developments known in the Vryburg region that might stress the regional populations through an accumulation of negative impacts. Those bird species – the majority in terms of both diversity and numbers – that occur in the wider area but primarily outside the scrubland habitat are unlikely to experience notable negative impacts as a result of the development. The one issue of concern is the potential for waterbirds traversing the area at night to mistake the polarized light from the PV panels for a waterbody with the subsequent risk of their death through collision with the structures. Based on currently available information the impact significance on birds is expected to be low.

6.2.5 Issue 5: Visual Impacts

Due to the extent of the proposed photovoltaic solar plant (300 hectares) it is expected that the plant will result in potential visual impacts. The main question which needs to be addressed is:

“To what extent will the proposed development be visible to observers and to will the landscape provides any significant visual absorption capacity”

The Visual Impact Assessment (Refer to Appendix H6) the post mitigation impact is a “Negative Low” impact during the construction and decommissioning phases and “Negative Medium” during the operational phase. People travelling on the N18, the Tiger Kloof Educational Institution, travellers on the Cape to Cairo railway line and people travelling on the D1196 gravel road will be the most sensitive to the proposed development due to close proximity.

In terms of possible landscape degradation, the landscape does appear to have existing screening up to a certain level. Camel thorn trees are sparsely scattered surrounding the proposed development. Rural areas are clearly defined particularly from a distance and it is assumed that the majority of people would prefer rural views over views of heavy industrial development.

Taking into account all positive factors of such a development including economic factors, social factors and sustainability factors, the visual impact of this proposed development will be insignificant and is suggested that the development commence, from a visual impact point of view.

6.2.6 Issue 6: Agricultural / impacts on the soil

In order to determine the potential impacts that the proposed development will have on agricultural production, the soil forms and current land capability of the area where the proposed project will be situated a soil survey has been conducted. The main question which needs to be addressed is:

“How will the proposed development impact on agricultural resources and the soil?”

The Agricultural and Soils Impact Assessment (refer to Appendix H7) concludes that because of the low agricultural potential of the site, the development should, from an agricultural impact perspective, be authorised. Authorisation is promoted by the fact that the site falls within a proposed renewable energy development zone, where such land use has been assessed as very suitable in terms of a number of factors, including agricultural impact. It is preferable to incur a loss of agricultural land in such a region, 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. Because the site is uniformly low potential, from an agricultural point of view, there is no preferred location or layout within the assessed site.

6.2.7 Issue 7: Socio-economic impacts

A Social Impact Assessment has been compiled in order to provide a description of the environment that may be affected by the activity and the manner in which the environment may be affected by the proposed facility; to provide a description and assessment of the potential social issues associated with the proposed facility; and the identification of enhancement and mitigation aimed at maximizing opportunities and avoiding and or reducing negative impacts (refer to Appendix H10). The main question which needs to be addressed is:

“How will the proposed development impact on the socio-economic environment?”

The findings of the SIA (Refer to Appendix H10) indicate that during the construction and the operational phase of the proposed development project, various employment opportunities, with different levels of skills will be created. In addition, this will also create local business opportunities benefitting the socioeconomic development of the local community of Vryburg and Huhudi. The local community will however benefit from the establishment of a Community Trust if it is managed effectively. The challenges posed by climate change and global warming will be addressed by the investment in renewable energy facilities like the proposed Khubu SPP.

The establishment of the proposed Khubu SPP is supported by the findings of this SIA report and therefore, also creating a positive social benefit for society. It is however recommended that the environmental authorities consider the potential visual impacts addressed in the Visual Impact Assessment (VIA) of this proposed project and impacts to the sense of place, regarding this proposed development of the Khubu SPP.

6.2.8 Issue 8: Wetland Impacts

In order to determine the potential impacts that the proposed development will have on the wetland in close proximity to the site, a wetland study has been conducted. The main question which needs to be addressed is:

“How will the proposed development impact on the wetland on site?”

The Wetland Assessment (H3) confirmed that a small temporary wetland of approximately 0.8 ha is found outside and south of the proposed footprint but within 500 m of the edge of the proposed footprint. The present ecological status (PES) of the wetland system is CATEGORY B which means the system is largely natural with few modifications, but with some loss of natural habitats (Table 4.2 and Table 4.3). The ecological importance and sensitivity (EIS) of the wetland system is Moderate because the wetland is small and ecologically somewhat disturbed. Furthermore, the wetland is not of distinct known ecological importance (Table 4.4 and Table 4.5). Presence or particular association of any threatened wetland plant or animal species at the wetland has not been found and is unlikely. The wetland depression outside the proposed footprint could be managed in particular to fulfil its role in providing ecosystem services.

It is anticipated that the proposed development would not have a major influence on the hydrological regime of the small depression outside the proposed footprint. There appears to be no distinct reason (such as would have been the case for gatherings of large rare water birds; associated unique wetland vegetation; extensive edge effects of impacts; sensitive extensive wetlands) why the buffer zone should be large. A buffer zone of 30 m is thought to be adequate to maintain the functioning of the wetland systems outside the proposed footprint.

6.2.9 Issue 9: Hydrological Impacts

In order to determine the potential impacts that the proposed development will have on the non-perennial stream crossing the site, a hydrological study has been conducted. The main question which needs to be addressed is:

“How will the proposed development impact the non-perennial stream?”

The Wetland Assessment (H3) confirmed that the small, perennial stream has no clear and distinct channel that clearly defines its borders. The Assessment concludes that: as is to be expected, unmitigated impacts can lead to environmental and property damage. However, if the proposed mitigations are followed, or even improved upon, then mitigated impacts will lead to very limited environmental and property damage, which is what the desired outcome of a risk assessment is.

6.2.10 Issue 10: Paleontological Impacts

South Africa’s heritage resources comprise a wide range of sites, features, objects and beliefs. According to Section 27(18) of the National Heritage Resources Act (NHRA), No. 25 of 1999, no person may destroy, damage, deface, excavate, alter, remove from its original position, subdivide or change the planning status of any heritage site without a permit issued by the heritage resources authority responsible for the protection of such site. The main question which needs to be addressed is:

“How will the proposed development impact on the Palaeontological resources?”

According to the Palaeontological Impact Assessment (Appendix H9) the Khubu Solar Power Plant study area is entirely underlain by late Archaean (c. 2.6 billion year-old) sedimentary rocks of the Schmidtsdrif Subgroup (Ghaap Group, Transvaal Supergroup). These mainly comprise shallow marine carbonates and siliciclastic sediments of the Boomplaas Formation.

Densely-packed, well-preserved stromatolite assemblages are recorded within the Boomplaas Formation carbonate rocks in several areas of low-relief bedrock exposure just west of and along the banks of the shallow stream that transects the study area. A range of stromatolitic growth forms is represented here. Most of the Boomplaas Formation outcrop area on Champions Kloof 731 is mantled by soils and surface gravels of low palaeontological sensitivity. Stromatolitic horizons may be present within the underlying bedrocks but these are not easily accessible for scientific research and are in part protected by the superficial sediments above that are themselves of low palaeontological sensitivity.

It is recommended that the rocky areas of Boomplaas Formation bedrock exposure west of and along the stream be excluded from the solar plant footprint, with a buffer zone of 20 m. Provided that these mitigation measures are fully implemented, the anticipated impact of the proposed solar plant is rated as negative low significance in palaeontological heritage terms.

6.2.11 Issue 11: Traffic Impacts

Large developments are normally associated with an increase in construction vehicle traffic. The main question which needs to be addressed is:

“How will the proposed development impact on the traffic on main delivery routes to the site?”

According to the Traffic Impact Assessment (Appendix H11) the impact of the construction traffic on the general traffic and the surrounding communities along the haulage route is considered to be low. All the components will be transported by truck from Durban or Cape Town to the site using the routes as defined. Both these routes are of acceptable standard and should not impede travel from a riding quality perspective. No abnormal loads will be transported to the site. The access to the site is off road R34 and may require upgrading. Temporary traffic accommodation signage must be erected and maintained on either side of the access on road R34 throughout the construction period. The development of a solar farm on Portion 5 of the Farm Champions Kloof 731 in the North-West Province is therefore supported from a traffic engineering perspective.

6.3 METHOD OF ENVIRONMENTAL ASSESSMENT

The environmental assessment aims to identify the various possible environmental impacts that could result from the proposed activity. Different impacts need to be evaluated in terms of their significance and in doing so highlight the most critical issues to be addressed.

Significance is determined through a synthesis of impact characteristics which include context and intensity of an impact. Context refers to the geographical scale i.e. site, local, national or global whereas intensity is defined by the severity of the impact e.g. the magnitude of deviation from

background conditions, the size of the area affected, the duration of the impact and the overall probability of occurrence. Significance is calculated as shown in Table 6.4.

Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The total number of points scored for each impact indicates the level of significance of the impact.

6.3.1 Impact Rating System

Impact assessment must take account of the nature, scale and duration of impacts on the environment whether such impacts are positive or negative. Each impact is also assessed according to the project phases:

- planning
- construction
- operation
- decommissioning

Where necessary, the proposal for mitigation or optimisation of an impact should be detailed. A brief discussion of the impact and the rationale behind the assessment of its significance should also be included. The rating system is applied to the potential impacts on the receiving environment and includes an objective evaluation of the mitigation of the impact. In assessing the significance of each impact the following criteria is used:

Table 6.4: The rating system

NATURE		
Include a brief description of the impact of environmental parameter being assessed in the context of the project. This criterion includes a brief written statement of the environmental aspect being impacted upon by a particular action or activity.		
GEOGRAPHICAL EXTENT		
This is defined as the area over which the impact will be experienced.		
1	Site	The impact will only affect the site.
2	Local/district	Will affect the local area or district.
3	Province/region	Will affect the entire province or region.
4	International and National	Will affect the entire country.
PROBABILITY		

This describes the chance of occurrence of an impact.		
1	Unlikely	The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).
2	Possible	The impact may occur (Between a 25% to 50% chance of occurrence).
3	Probable	The impact will likely occur (Between a 50% to 75% chance of occurrence).
4	Definite	Impact will certainly occur (Greater than a 75% chance of occurrence).
DURATION		
This describes the duration of the impacts. Duration indicates the lifetime of the impact as a result of the proposed activity.		
1	Short term	The impact will either disappear with mitigation or will be mitigated through natural processes in a span shorter than the construction phase (0 – 1 years), or the impact will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).
2	Medium term	The impact will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).
3	Long term	The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 30 years).
4	Permanent	The only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered indefinite.
INTENSITY/ MAGNITUDE		
Describes the severity of an impact.		

1	Low	Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.
2	Medium	Impact alters the quality, use and integrity of the system/component but system/component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).
3	High	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.
4	Very high	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component permanently ceases and is irreversibly impaired. Rehabilitation and remediation often impossible. If possible rehabilitation and remediation often unfeasible due to extremely high costs of rehabilitation and remediation.

REVERSIBILITY

This describes the degree to which an impact can be successfully reversed upon completion of the proposed activity.

1	Completely reversible	The impact is reversible with implementation of minor mitigation measures.
2	Partly reversible	The impact is partly reversible but more intense mitigation measures are required.
3	Barely reversible	The impact is unlikely to be reversed even with intense mitigation measures.
4	Irreversible	The impact is irreversible and no mitigation measures exist.

IRREPLACEABLE LOSS OF RESOURCES

This describes the degree to which resources will be irreplaceably lost as a result of a proposed activity.

1	No loss of resource	The impact will not result in the loss of any resources.
2	Marginal loss of resource	The impact will result in marginal loss of resources.
3	Significant loss of resources	The impact will result in significant loss of resources.
4	Complete loss of resources	The impact is result in a complete loss of all resources.
CUMULATIVE EFFECT		
<p>This describes the cumulative effect of the impacts. A cumulative impact is an effect which in itself may not be significant but may become significant if added to other existing or potential impacts emanating from other similar or diverse activities as a result of the project activity in question.</p>		
1	Negligible cumulative impact	The impact would result in negligible to no cumulative effects.
2	Low cumulative impact	The impact would result in insignificant cumulative effects.
3	Medium cumulative impact	The impact would result in minor cumulative effects.
4	High cumulative impact	The impact would result in significant cumulative effects
SIGNIFICANCE		
<p>Significance is determined through a synthesis of impact characteristics. Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The calculation of the significance of an impact uses the following formula: (Extent + probability + reversibility + irreplaceability + duration + cumulative effect) x magnitude/intensity.</p> <p>The summation of the different criteria will produce a non-weighted value. By multiplying this value with the magnitude/intensity, the resultant value acquires a weighted characteristic which can be measured and assigned a significance rating.</p>		
Points	Impact significance rating	Description
6 to 28	Negative low impact	The anticipated impact will have negligible negative effects and will require little to no mitigation.
6 to 28	Positive low impact	The anticipated impact will have minor positive effects.

29 to 50	Negative medium impact	The anticipated impact will have moderate negative effects and will require moderate mitigation measures.
29 to 50	Positive medium impact	The anticipated impact will have moderate positive effects.
51 to 73	Negative high impact	The anticipated impact will have significant effects and will require significant mitigation measures to achieve an acceptable level of impact.
51 to 73	Positive high impact	The anticipated impact will have significant positive effects.
74 to 96	Negative very high impact	The anticipated impact will have highly significant effects and are unlikely to be able to be mitigated adequately. These impacts could be considered "fatal flaws".
74 to 96	Positive very high impact	The anticipated impact will have highly significant positive effects.

7 CUMULATIVE EFFECTS ASSESSMENT

This section aims to address the requirements of Section 2 of the NEMA to consider cumulative impacts as part of any environmental assessment process.

7.1 INTRODUCTION

The EIA Regulations (2014) determine that cumulative impacts, *“in relation to an activity, means the past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that activity, that in itself may not be significant, but may become significant when added to the existing and reasonably foreseeable impacts eventuating from similar or diverse activities.”* Cumulative impacts can be incremental, interactive, sequential or synergistic. EIAs have traditionally failed to come to terms with such impacts, largely as a result of the following considerations:

- Cumulative effects may be local, regional or global in scale and dealing with such impacts requires coordinated institutional arrangements;
- Complexity - dependent on numerous fluctuating influencing factors which may be completely independent of the controllable actions of the proponent or communities; and
- Project level investigations are ill-equipped to deal with broader biophysical, social and economic considerations.

Despite these challenges, cumulative impacts have been afforded increased attention in this EI Report and for each impact a separate section has been added which discusses any cumulative issues, and where applicable, draws attention to other issues that may contextualise or add value to the interpretation of the impact – refer to Appendix G. This chapter analyses the proposed project’s potential cumulative impacts in more detail by: (1) defining the geographic area considered for the cumulative effects analysis; (2) providing an overview of relevant past and present actions in the project vicinity that may affect cumulative impacts; (3) presenting the reasonably foreseeable actions in the geographic area of consideration; and (4) determining whether there are adverse cumulative effects associated with the resource areas analysed.

The term "Cumulative Effect" has for the purpose of this report been defined as: the summation of effects over time which can be attributed to the operation of the Project itself, and the overall effects on the ecosystem of the Project Area that can be attributed to the Project and other existing and planned future projects.

7.2 GEOGRAPHIC AREA OF EVALUATION

The geographic area of evaluation is the spatial boundary in which the cumulative effects analysis was undertaken. The spatial boundary evaluated in this cumulative effects analysis generally includes an area of a 30km radius surrounding the proposed development – refer to figure 21 below.

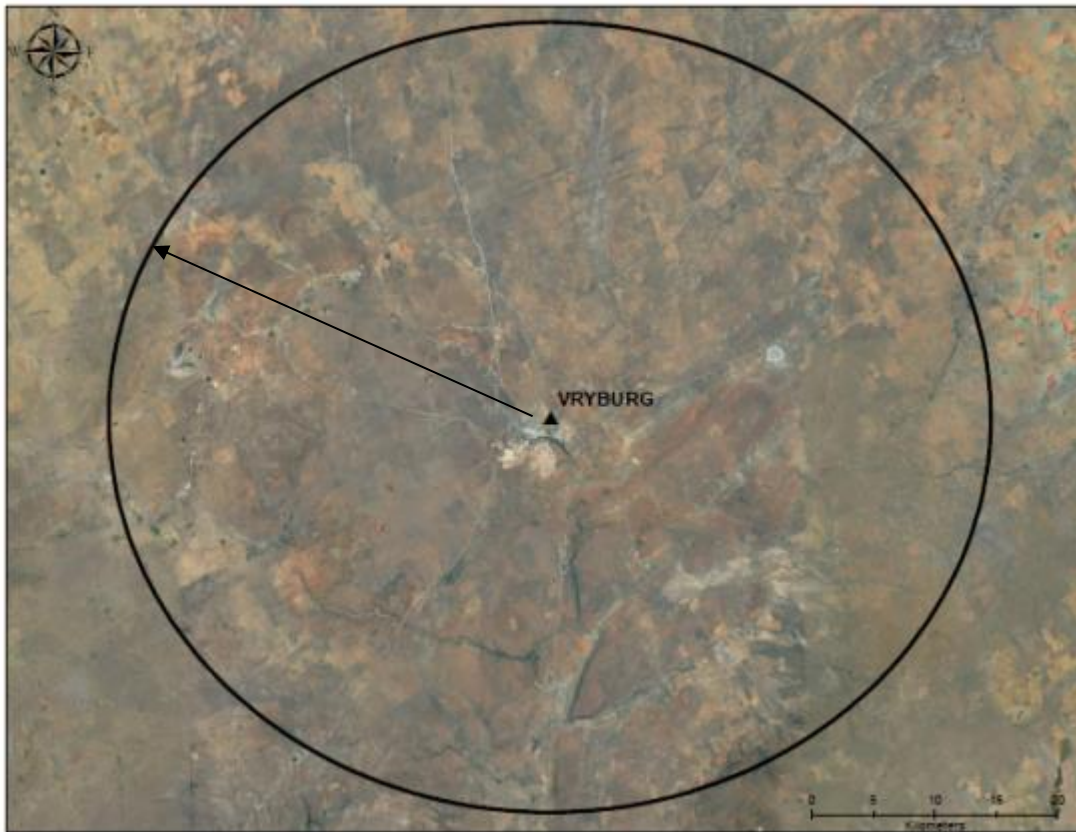


Figure 21: Geographic area of evaluation

The geographic spread of PV solar projects, administrative boundaries and any environmental features (the nature of the landscape) were considered when determining the geographic area of investigation. It was argued that a radius of 30km would generally confine the potential for cumulative effects within this particular environmental landscape. Within this area, only one PV project has received preferred bidder status. The geographic area therefore only includes projects located within the North West Province. A larger geographic area may be used to analyse cumulative impacts based on a resource 's specific temporal or spatial impacts. For example, the socioeconomic cumulative analysis may include a larger area, as the construction workforce may draw from a much wider area. The geographic area of analysis is specified in the discussion of the cumulative impacts for that resource if it differs from the general area of evaluation described above.

7.3 TEMPORAL BOUNDARY OF EVALUATION

A temporal boundary is the timeframe during which the cumulative effects are reasonably expected to occur. The temporal parameters for this cumulative effects analysis are the anticipated lifespan of the Proposed Project, beginning in 2019 and extending out at least 20 years, which is the minimum expected project life of the proposed project. Where appropriate, particular focus is paid to near-term cumulative impacts of overlapping construction schedules for proposed projects in the area of evaluation.

7.4 OTHER PROJECTS IN THE AREA

7.4.1 Existing projects in the area

According to the Energy Blog's database only one solar PV plant has been granted preferred bidders status within the geographic area of investigation – refer to figure 22 below. The following plant has yet to commence with construction:

- Waterloo Solar Park with a capacity of 75MW near Vryburg, North West Province (Approvals, planning and financing phase).

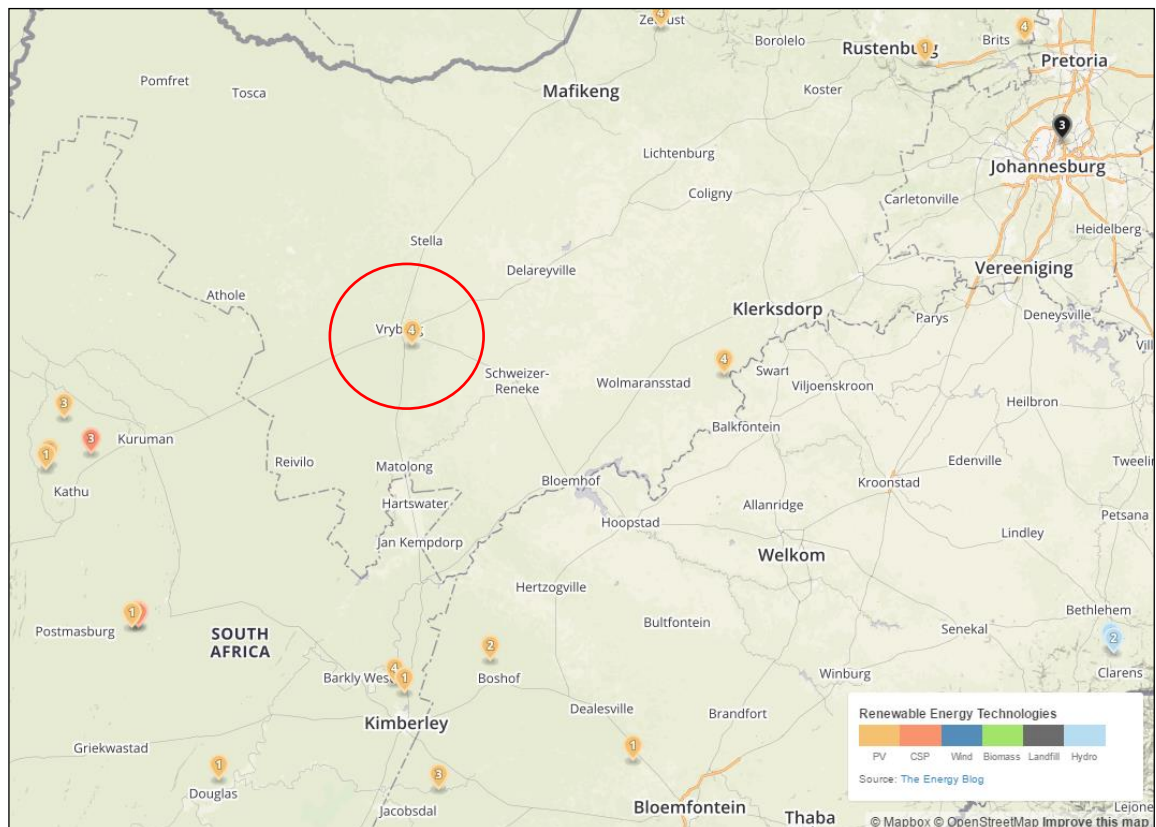


Figure 22: Utility-scale Renewable Energy Generation Sites

It is unclear whether other projects not related to renewable energy is or has been constructed in this area. In general, development activity in the area is focused on agriculture. Agriculture in the area is primarily associated with cattle grazing.

It is quite possible that future solar farm development may take place within the general area. The next section of this report will aim to evaluate the potential for solar projects for this area in the foreseeable future.

7.1.2 Projects in the foreseeable future

As part of the SEA for Wind and Solar Energy in South Africa, the CSIR and the DEA mapped the location of all EIA application submitted within South Africa – refer to figure 23 below. According

to this database approximately 6 applications have been submitted for renewable energy projects within the geographical area of investigation.

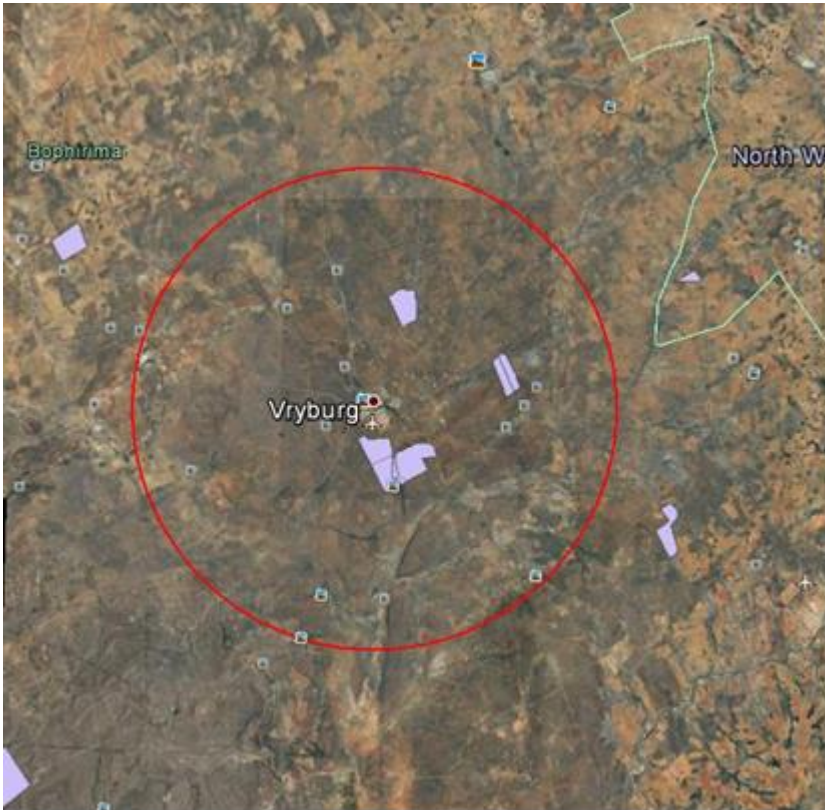


Figure 23: National Wind and Solar PV SEA: Renewable Energy EIA Application Received before Dec. 2016

Environamics and other environmental consultants are also in the process of applying for Environmental Authorisation for ten (14) PV projects in the area, namely:

- The proposed Gamma Solar Power Plant near Vryburg, North West Province.
- The proposed Sonbesie Solar Power Plant near Vryburg, North West Province
- The proposed Khubu Solar Power Plant near Vryburg, North West Province.
- The proposed Alpha Solar Power Plant near Vryburg, North West Province.
- The proposed Meerkat Solar Power Plant near Vryburg, North West Province.
- The proposed Protea Solar Power Plant near Vryburg, North West Province.
- The proposed Delta Photovoltaic Power Plant on the Remaining Extent of Klondike No 670 near Vryburg, North West Province.
- The proposed Foxtrot Photovoltaic Power Plant on the Remaining Extent of Klondike No 670 near Vryburg, North West Province.

- The proposed Echo Photovoltaic Power Plant on the Remaining Extent of Klondike No 670 near Vryburg, North West Province.
- The proposed Sendawo 1 Solar Photovoltaic (PV) Plant, near Vryburg, North West.
- The proposed Sendawo 2 Solar Photovoltaic (PV) Plant, near Vryburg, North West.
- The proposed Sendawo 3 Solar Photovoltaic (PV) Plant, near Vryburg, North West.
- The proposed Woodhouse 1 and 2 PV plants, near Vryburg North West.

The following sections will aim to assess the potential cumulative impacts associated with the projects that may be developed in the foreseeable future.

7.5 SPECIALIST INFORMATION ON CUMULATIVE EFFECTS

In line with the Terms of Reference (ToR) provided as part of the scoping report, specialists were asked to, where possible, take into consideration the cumulative effects associated with the proposed development and other projects which are either developed or in the process of being developed in the local area.

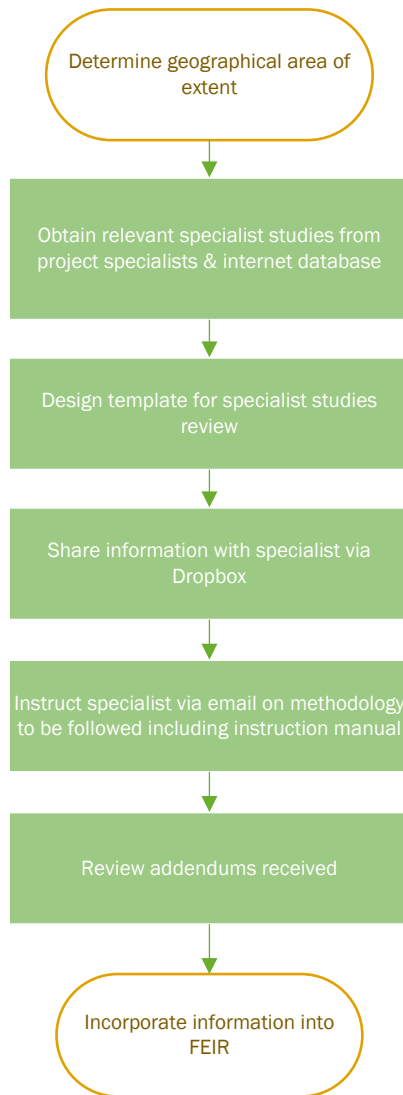
Projects within the geographical area of extent were identified and their specialist assessments were obtained with the help of project EAPs or doing an internet search. From the 21 proposed photovoltaic Solar energy facilities in the area, 14 project's information could be obtained (refer to Tabel 7.1).

Table 7.1: Specialist Assessments obtained

PROPOSED DEVELOPMENT	DEA REFERENCE NO.	CURRENT EIA STATUS	FARM DETAILS
Sonbesie Solar Power Plant	14/12/16/3/3/2/915	EIA ongoing	Remaining Extent of the farm Retreat No. 671
Gamma Solar Power Plant	14/12/16/3/3/2/917	EIA ongoing	Portion 4 of the farm Champions Kloof No. 731
Khubu Solar Power Plant	14/12/16/3/3/2/912	EIA ongoing	Portion 4 of the farm Champions Kloof No. 731
Alpha Solar Power Plant	14/12/16/3/3/2/916	EIA ongoing	Portion 3 of the farm Vyflings Pan No. 598
Meerkat Solar Power Plant	14/12/16/3/3/2/913	EIA ongoing	Portion 3 of the farm Middel Pan No. 605
Protea Solar Power Plant	14/12/16/3/3/2/914	EIA ongoing	Remaining Externt of the farm Hartsboom No. 734
Sediba Power Plant 75MW PV Solar Facility	14/12/16/3/3/2/390 AM1	Environmental authorisation received	A portion of the remaining extent of the Farm Rosendal No. 673
Waterloo Solar Park	14/12/16/3/3/2/308 AM3	Environmental authorisation (REIPPP window 4).	Southern portion of the Farm Waterloo No. 992

Delta Photovoltaic Power Plant	-	Scoping and EIA processes underway.	Remaining Extent of the farm Klondike No. 670
Echo Photovoltaic Power Plant	-	Scoping and EIA processes underway.	Remaining Extent of the farm Klondike No. 670
Foxtrot Photovoltaic Power Plant	-	Scoping and EIA processes underway.	Remaining Extent of the farm Klondike No. 670
Sendawo 1	14/12/16/3/3/2/891	EIA ongoing	Portion 1 of the Farm Edinburgh No. 735
Sendawo 2	14/12/16/3/3/2/892	EIA ongoing	Portion 1 of the Farm Edinburgh No. 735
Sendawo 3	14/12/16/3/3/2/893	EIA ongoing	Portion 1 of the Farm Edinburgh No. 735

The project specialist were then given access to the relevant specialist information and were required to assess the available reports by completing table designed by Environamics. They were instructed to assess the cumulative effect of the projects in question by using the approved significance rating methodology and concluding with an impact statemnt on the significance of these impacts – refer process flow below.The following sections present their findings.



The detailed assessments conducted by the specialists are included as Addendums to their reports and the reviews of the specialist studies are included in Appendix L.

7.5.1 Geology

The Geotechnical Study (refer to Appendix H1) confirmed that based on the available information a fatal flaw cannot be identified that may prematurely terminate the development of the proposed solar farm. Soil cover (unconsolidated, sandy soil) is continuous across the site, but is shallow (40-120cm) on underlying, hard rock across the site. Soil conditions are very uniform across the site, except for the variation of depth to the underlying rock. They are also uniform with depth, above the rock. Hard material was encountered in almost all of the sample augers. According to the specialist the site should be regarded as suitable for the proposed development. No cumulative impacts are foreseen. The geotechnical study is regarded as a suitability assessment rather than an environmental assessment; therefore, a cumulative impact could not be determined.

7.5.2 Soil, Land Capability and Agricultural Potential

Although the agricultural impact on individual project portions of land has low significance, as shown from all the specialist reports reviewed – refer to Appendix L, the cumulative impacts of loss of production potential becomes more significant regionally. The regional cumulative impact is assessed as having medium significance. However, despite this cumulative impact, it is still agriculturally strategic from a national perspective to steer as much of the country's renewable energy development as possible to regions such as this one, with low agricultural potential. It is preferable to incur a higher cumulative loss in such a region, than to lose agricultural land with a higher production potential elsewhere in the country.

7.5.3 Hydrology

Cumulative impacts on unique or sensitive wetlands:

Cumulative effects on the loss of sensitive wetlands are kept to a minimum because such wetlands are avoided with the inclusion of substantial corridors around these wetlands. At the proposed Meerkat the footprint avoids two prominent wetlands (pans) and also allow for the pans to be linked to adjacent open areas and not to be isolated by the proposed footprint.

Cumulative impacts on wetland fragmentation:

Corridors and linkages of areas with similar habitat are present in the local district where a number of solar power plants are planned. Watercourses and wetlands are avoided by the proposed footprint so that stepping stone corridors (pans) and a network of linked corridors (active channels with riparian zones) remain. At the proposed Meerkat two pan depressions of particular conservation concern were identified and these with their buffer zones were not isolated but stay connected to adjacent natural or semi-natural areas. No particular habitats of threatened wetland species that could be isolated exist within the footprints.

Emissions and pollutants into the air, soil and water:

Overall because of the restricted nature of power plants and few or no emissions and pollutants into air when operational, soil and water cumulative impacts to the environment are limited (if compared for example to emissions from fossil fuel burning). Ultimately power plants could relieve the pressures to use fossil fuels that are associated with numerous cumulative impacts and habitat losses, the latter could include impacts on the connectivity and statuses of wetlands.

In the bigger regional context, the vast tracks of relatively similar habitat in the interior are ideal for such power generating facilities. Current developments of solar power plants could therefore not be seen in the same context as many other more developed parts of the world where natural habitats are often severely fragmented. Fragmentation of wetlands could in the case the proposed solar power plants be avoided by spreading solar power plant sites individually or in clusters so that corridors and linkages, or stepping stone corridors could function. Buffer zones around wetlands are very important to secure the integrity of these wetlands. All these important considerations have been addressed in the plans of the present proposed footprints.

7.5.4 Ecology

The ecological impact assessment (refer to Appendix H2) found that cumulative impacts on unique or sensitive habitats are kept to a minimum because such habitats are avoided at large.

Cumulative impacts on habitat fragmentation:

Regionally landscape fragmentation could create barriers to the movement of species and their genes (Saunders et al., 1991). The answer to the width and extent of corridors depends on the conservation goal and the focal species (Samways, 2005). Corridors for mammalian species are especially important for migratory species (Mwalyosi, 1991, Pullin 2002). For an African butterfly assemblage this is about 250m when the corridor is for movement as well as being a habitat source (Pryke and Samways 2003). Hill (1995) found a figure of 200m for dung beetles in tropical Australian forest. In the agricultural context, and at least for some common insects, even small corridors can play a valuable role (Samways, 2005).

Corridors and linkages of areas with similar habitat are present in the local district where a number of solar power plants are planned. Watercourses and wetlands are avoided by the proposed footprint so that stepping stone corridors (pans) and a network of linked corridors (active channels with riparian zones) remain. No particular habitats of threatened species that are easily isolated (e.g. beetles with flightless females) are known to be impacted locally in the larger study area where a number of solar power plants are planned to be developed.

Because of the restricted nature of power plants and few or no emissions and pollutants into air when operational, soil and water cumulative impacts to the environment are limited (if compared for example to emissions from fossil fuel burning). Ultimately power plants could relieve the pressures to use fossil fuels that are associated with numerous cumulative impacts and habitat losses.

Therefore, in the bigger regional context, the vast tracks of relatively similar habitat in the interior are ideal for such power generating facilities. Current developments of solar power plants could therefore not be seen in the same context as many other more developed parts of the world where natural habitats are often severely fragmented. Some fragmentation of habitats will take place and the key issue would be to avoid sensitive habitats and to allow for enough corridors and linkages between habitats such as in the present proposed planned footprints.

7.5.5 Birds

The immediate, and most important, impact on birds of the development of solar arrays is transformation of the area through the destruction of all vegetation. This removes almost all resources for birds and forces them to leave the area.

It is generally assumed that birds occupy areas at a level close to carrying capacity in terms of current local resources. Birds that are displaced from the array area must then compete with birds already occupying the areas in which they try to relocate. Whether the displaced birds or the residents survive the result is likely to be mortality of individuals and a depletion of the local population of the affected species. In terms of numbers of individuals, the species most affected

will be the smaller bodied species which have larger population densities. However, these are usually “commoner” and widespread species. Provided there are ample areas of suitable vegetation these species are of relatively low conservation concern. Only when the affected species has a small global, national, or in some instances provincial, distribution or has very specialised habitat requirements, is there conservation concern for these smaller birds. The effect of displacement is generally greater on the larger bodied species which require larger areas and so have lower overall populations. These larger birds are also generally being more impacted by wider human related activities – disturbance, hunting, collision with structures, etc.

Though no red data listed bird species were observed at the site it is likely that individuals of red-listed species may sometimes occur on or over the site in its current condition. However, in the absence of any particular feature to attract them, these individuals will be at most only transient users of the area to be developed. Thus the development of the proposed SPP will have no marked effect on red-listed species.

Most impacts have low significance for the regional avifauna. Those impacts of moderate significance can, in most cases, be reduced to a low rating by mitigation. The key concern is that the cumulative effect of the congregated solar developments in the Vryburg sub-region will create a nocturnal impression of a large waterbody. This will act as a magnet for transient waterbirds and could then lead to unacceptably high levels of mortality through collision, injury, starvation, or predation of “downed” waterbirds. – Refer to Appendix H4 and Appendix L.

7.5.6 Social Impact Assessment

Previous similar projects described that the potential cumulative impacts associated with wind farms can also be regarded as pertinent to SEFs. The relevant issues that need to be taken into consideration when it comes to the impacts on sense of place is, combined visibility (if two or more SEFs are visible from one location), sequential visibility (seeing two or more SEFs along a road or trail), the perceived or actual change in the land use across a region, loss of characteristic environment and element, and the visual compatibility of different SEFs in the same vicinity. It is further noted that cumulative impacts need to be considered in relation with dynamic and static viewpoints. It is also important that aesthetic perception regarding the sense of place, are a key determinant of people’s attitudes and is subjective of matter.

As indicated in this report the potential cumulative social impacts associated with the establishment of an SPP will have a visual impact on the environment and its surroundings, however, the impact on the sense of place is likely to be low. The proposed Khubu SPP might slightly be visible from the Amalia gravel road entrance off the R34 to the site, but the impact hereof on the sense of place is likely to be low. In addition, the transmission lines to the substation is also linked to visual impact and the areas sense of place. However, the potential social impacts associated with the transmission lines will be low. The potential negative impact of the proposed development on the areas’ sense of place still needs to be considered, because of South Africa’s strong attachment to land and the number of SEFs increasing. The Visual Impact Assessments (VIAs) of all applications also needs to be evaluated and considered in this regard.

In addition, hereto, the proposed Khubu SPP has the potential to result in significant positive cumulative impacts. The establishment of the proposed Khubu SPP and other SEFs in the North West Province will create a positive socio-economic contribution to the province and the local municipality, and in turn will create a positive social benefit. The positive cumulative impacts in the case of the Khubu SPP will include the creation of employment opportunities, training and skills development opportunities, downstream business opportunities and more movement will be made towards the use of renewable energies. For this reason, the proposed development should be supported. It is therefore recommended that the proposed Khubu SPP be supported as it was proposed. However, this recommendation is made subject to the implementation of the suggested enhancement and mitigation measures contained in the full SIA for the proposed Khubu SPP, as well as inputs from other specialist studies for the proposed Khubu SPP.

7.5.7 Visual

The Visual Impact Assessment (Refer to Appendix 4) confirmed that the significance rating for the pre and post mitigation impact is a Negative Low impact during the construction and decommissioning phases. Mitigation measures will ensure a Negative Low impact to prevent loss of visual resources. On some days dust can be seen from a far distance and dust suppression will play a cardinal role. Furthermore, the construction and decommissioning phases are short term and will only affect the local community and the area around Vryburg.

The operational phase received a Negative Medium significant rating. The Negative Medium rating of the operational phase is mainly due to the long term duration of the projects of approximately 20-25 years. Implementing mitigation measures will further ensure that a negative visual impact be minimised. Furthermore, solar PV panels are designed to absorb light, and accordingly only reflect a small amount of the sunlight that falls on them compared to most other everyday objects. Most notably, solar panels reflect significantly less light than flat water.

Referring to the combined cumulative assessment, the post mitigation impact is Low for the construction phase, Medium for the operational phase and Low for the decommissioning phase. The pre mitigation impact for the construction phase is Medium, Medium for the operational phase and Low for the decommissioning phase. According to the impact assessment, mitigation measures will lower the potential impact from Medium to Low, even if all projects receives preferred bidder status. At the time of this report it is still uncertain which of the projects near Vryburg will receive preferred bidder status. The most significant visual impact will be that of dust generation, and as previously mentioned, dust suppression will play an important role.

Taking into account all positive factors of such developments including economic factors, social factors and sustainability factors, the cumulative impact of all the projects near Vryburg will be Low, taking into account post mitigation, and is suggested that the proposed development be approved, from a visual impact point of view.

7.5.8 Heritage

The Heritage Impact Assessment (refer to Appendix H8) confirmed that a review of the available information indicates that overall the heritage potential, with the exception of some exclusion zones such as hills and river regions, is very low.

According to Section 7 of the National Heritage Resources Act, Act no. 25 of 1999, all the sites identified for the various projects are classified as having Grade III significance, i.e., being described as “Other heritage resources worthy of conservation on a local authority level.” No sites with a Grade I or Grade II significance have been identified.

An evaluation of the possible cumulative impacts (Refer to Appendix L) from the combined solar power plant developments in the region on sites, features and objects of cultural heritage significance would be very low and is therefore seen as acceptable. Through the implementation of mitigation measures the impact, locally or cumulative, can be turned into a positive impact through the study of such sites, adding to local as well as regional knowledge.

7.5.9 Traffic

The table below is a summary of the expected trips generated by the development of the solar power plants along with the background traffic on each of the major routes into Vryburg. These volumes are for the immediate surrounding road network.

Table 7.2: Cumulative Trip Summary

Destinations	On N14	On N18	On R34
Current ADT on Route (vpd)	1860	1700	1600
Delivery & Construction Trips (vpd)	172	172	172
Commuter Trips (vpd)	603	630	630
Total Expected Trips	2662	2502	2402

The projected trips per day for the scenario that includes fourteen solar developments, are deemed to be of no consequence to the LOS of the travelled route from Durban to Vryburg or Cape Town to Vryburg as it does not exceed or even approach the maximum AADT of 4900vpd. From the table above it is therefore apparent that the cumulative additional trips will not impact negatively on the immediate or wider road network and that the significance of the impact experienced by the normal road users will be negligible.

7.6 IMPACT ASSESSMENT

Following the definitions of the term, the “residual effects on the environment”, i.e. effects after mitigation measures have been put in place, combined with the environmental effects of past, present and future projects and activities will be considered in this assessment. Also, a “combination of different individual environmental effects of the project acting on the same environmental component” can result in cumulative effects.

7.6.1 Potential Cumulative Effects

The receptors (hereafter referred to as Valued Ecosystem Components (VECs)) presented in Section 6 (refer to the matrix analysis) have been examined alongside other past, present and future projects for potential adverse cumulative effects. A summary of the cumulative effects discussed are summarized in Table 7.3 Specific VECs were identified with reference to the Solar Project (Table 6.2), which relates to the biophysical and socio-economic environments. Table 7.3 indicates the potential cumulative effects VECs and the rationale for inclusion/exclusion.

Table 7.3: Potential Cumulative Effects for the proposed project

Valued Ecosystem Components (VECs)	Rationale for Inclusion / Exclusion	Level of Cumulative Effect
Construction Phase		
Loss or fragmentation of indigenous natural fauna and flora	The loss of habitat on-site has the potential to add to the cumulative impacts that habitat loss in the region is having on avifauna. However, the condition of the natural vegetation appears to be moderate.	- Medium
Loss or fragmentation of habitats	The developments are not located in a Critical Biodiversity Area. Regionally landscape fragmentation could create barriers to the movement of species and their genes. Corridors and linkages of areas with similar habitat are present in the local district where a number of solar power plants are planned.	- Medium
Physical and chemical degradation of the soils by construction vehicles (hydrocarbon spills)	Should these impacts occur, there may be a cumulative impact on soils in the study area. Soil pollution within and outside the site boundary can be prevented through mitigation.	- Low
Disturbance of soils and existing land use (soil compaction)	Should these impacts occur, there may be a cumulative impact on storm water runoff in the study area. However, the effect of compaction mitigation will be localised within the area and will only have an effect during the construction and operational years.	- Low
Impacts of the geology on the proposed development	A fatal flaw cannot be identified that may prematurely terminate the development of the proposed solar farm.	N/A

Hydrology	It is anticipated that the proposed development would not have a major influence on the hydrological regime of the non-perennial stream and small depression outside the proposed footprint.	- Low
Generation of waste	An additional demand for landfill space could result in significant cumulative impacts if services become unstable or unavailable, which in turn would negatively impact on the local community.	- Medium
Employment opportunities	The community will have an opportunity to better their social and economic well-being, since they will have the opportunity to upgrade and improve skills levels in the area.	+ Medium
Visual intrusion	The construction of the PV plant and 132kV evacuation line may increase the cumulative visual impact together with farming activities and people using the existing gravel roads adjacent to site. Dust will be the main factor to take into account.	- Low
Increase in construction vehicles	If damage to roads is not repaired, then this will affect the farming activities in the area and result in higher maintenance costs for vehicles of local farmers and other road users. If other projects in the area are approved, this may result in having a cumulative effect on the traffic on the transportations routs to Vryburg.	- Low
Impact of construction workers on local communities & influx of job seekers	Impacts on family and community relations that may, in some cases, persist for a long period of time. Also in cases where unplanned / unwanted pregnancies occur or members of the community are infected by an STD, specifically HIV and or AIDS, the impacts may be permanent and have long term to permanent cumulative impacts on the affected individuals and/or their families and the community.	- Medium

Risk to safety, livestock and farm infrastructure.	If Risk to livestock through theft. Negligible cumulative effects, provided losses are compensated for.	- Negligible
Increased risks of grass fires.	The risk of grass fires can be mitigated and managed.	- Negligible
Heritage resources	Due to its low significance and proposed buffer zones, the potential for cumulative impact is also considered to be minimal.	- Low
Operational Phase		
Avifauna	The key concern is that the cumulative effect of the congregated solar developments in the Vryburg sub-region will create a nocturnal impression of a large waterbody.	- High
Soil erosion	The largest risk factor for soil erosion will be during the operational phase when storm water run-off from the surfaces of the photovoltaic panels could cause erosion. Should these impacts occur, there may be a cumulative impact on storm water runoff in the study area. However, the soils are classified as having low susceptibility to water erosion.	- Medium
Change in land use	Overall loss of farmland could affect the livelihoods of the affected farmers, their families, and the workers on the farms and their families. However, disturbed areas can be rehabilitated and the additional land use income however aids struggling farming activities and can have a positive cumulative impact in the area.	- Low
Visual intrusion	The operation of the PV plant and 132kV evacuation line may increase the cumulative visual impact together with the existing Eskom power infrastructure and agricultural infrastructure.	- Medium
Consumption of water	An additional demand on water sources could result in a significant cumulative impact with regards to the availability of water.	- Medium

Generation of additional electricity	The evacuation of generated electricity into the Eskom grid will strengthen and stabilize the grid (especially in the local area). In combination, the six projects being proposed by Subsolar energy around Vryburg will potentially add 600MW to the grid.	+ Medium
Establishment of a community trust	Promotion of social and economic development and improvement in the overall well-being of the community.	+ Medium
Change in the sense of place	The construction of the solar plant and associated infrastructure will increase the cumulative change in the sense of place due to industrial type infrastructure that is being proposed in the region.	- Low
Development of infrastructure for the generation of clean, renewable energy	Reduce carbon emissions via the use of renewable energy and associated benefits in terms of global warming and climate change.	+ Medium
Decommissioning Phase		
Visual intrusion	The decommissioning of the PV plant and 132kV evacuation line may increase the cumulative visual impact together with farming activities and people using the existing gravel roads adjacent to site. Dust and housekeeping will be the main factors to take into account.	- Low
Generation of waste	An additional demand on municipal services could result in significant cumulative impacts with regards to the availability of landfill space.	- Medium

7.7 CONCLUSION

This chapter of the EIR addressed the cumulative environmental effects of the construction, operation and decommissioning project phases. The information to date has shown that no significant adverse residual impacts are likely. However, cumulative impacts could arise as other similar projects are constructed in the area.

The potential most significant cumulative impacts relate to:

- Cumulative effects during construction phase:
 - Loss or fragmentation of indigenous natural fauna and flora (- Medium)

- Loss or fragmentation of habitats (- Medium)
- Generation of waste (- Medium)
- Temporary employment (+ Medium)
- Impact of construction workers on local communities & influx of job seekers (- Medium)
- Traffic impacts (- Low)
- Cumulative effects during the operational phase:
 - Avifauna (-High)
 - Soil erosion (- Medium)
 - Consumption of water (- Medium)
 - Establishment of a community trust (+ Medium)
 - Development of infrastructure for the generation of clean, renewable energy (+ Medium)
- Cumulative effects during the decommissioning phase:
 - Generation of waste (- Medium)

8 ENVIRONMENTAL IMPACT STATEMENT

This section aims to address the following requirements of the regulations:

Appendix 3. (3) An EIR (...) must include-

- (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;
- (m) based on the assessment, and where applicable, recommendations from specialist reports, the recording of proposed impact management objectives, and the impact management outcomes for the development for inclusion in the EMPr as well as for inclusion as conditions of authorisation;
- (p) a description of any assumptions, uncertainties and gaps in knowledge which relate to the assessment and mitigation measures proposed;
- (q) 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;

8.1 SUMMARY OF KEY FINDINGS AND ASSESSMENT RESULTS

Based on the contents of the report the following key environmental issues were identified, which were addressed in this EIA report:

- Impacts during construction phase:
 - Impacts on the fauna and flora (- Low)
 - Impacts on soil (- Low)
 - Impacts associated with the geology of the site (- Low)
 - Impacts on existing services infrastructure (- Low)
 - Impacts on surface water features (non-perennial stream and wetland) (- Low)
 - Temporary employment and other economic benefits (+ Medium)
 - Impacts on health and safety (- Low)
 - Impacts on heritage resources (- Low)

- Traffic impacts (- Low)
- Impacts during the operational phase:
 - Impacts on the fauna and flora
 - Avifauna Fatalities (- Medium)
 - Nesting for Birds (+ Medium)
 - Impacts associated with the soil (- Low)
 - Impacts associated with the geology of the site (- Low)
 - Increased consumption of water (3880m³ per annum) (- Medium)
 - Impacts on surface water features (non-perennial stream and wetland) (- Low)
 - Increase in employment and other economic benefits (+ Medium)
 - Visual impacts (- Low)
 - Generation of income to the Local Community (+ Medium)
 - Pressure on existing services infrastructure and water sources. (- Low)
 - Impacts on heritage resources (- Low)
- Impacts during the decommissioning phase:
 - Impacts on soil (- Low)
 - Pressure on existing services infrastructure (- Low)
 - Loss of permanent employment (- Low) & the creation of temporary employment (+ Low)
 - Impacts on surface water features and soil erosion (non-perennial stream and wetland) (- Low)
 - Impacts on heritage resources (- Low)
- Cumulative biophysical impacts resulting from similar development in close proximity to the proposed activity.

8.2 RECOMMENDATION OF EAP

The final recommendation by the EAP considered firstly if the legal requirements for the EIA process had been met and secondly the validity and reliability of the substance of the information contained in the EIA report. In terms of the legal requirements it is concluded that:

- The scoping phase complied with the agreement and specification set out in Regulation 21 and Appendix 2 of the 2014 EIA Regulations – already approved by the environmental authority.
- All key consultees have been consulted as required by Chapter 6 of the 2014 EIA Regulations - already approved by the environmental authority.

- The EIA process has been conducted as required by the 2014 EIA Regulations, Regulations 23 and Appendix 3.
- The EMPr has been compiled in accordance with Appendix 4 of the 2014 EIA Regulations.
- The proposed mitigation measures will be sufficient to mitigate the identified impacts to an acceptable level.
- No additional specialist studies are proposed on any environmental issue raised and thus, no terms of reference are provided for such studies.

In terms of the contents and substance of the EIA report the EAP is confident that:

- All key environmental issues were identified during the scoping phase.
- These key issues were adequately assessed during the EIA phase to provide the environmental authority with sufficient information to allow them to make an informed decision.

The final recommendation of the EAP is that:

It is the opinion of the independent EAP that the proposed development will have a net positive impact for the area and will subsequently ensure the optimal utilisation of resources. All negative environmental impacts can further be effectively mitigated through the proposed mitigation measures. Based on the contents of the report it is proposed that an environmental authorisation be issued, which states (amongst other general conditions) that the Khubu Solar Power Plant and associated infrastructure, on Portion 5 (Shadow Eve) (Portion of Portion 4) of the farm Champions Kloof 731, Registration Division HN, North West Province be approved subject to the following conditions:

- Implementation of the proposed mitigation measures set out in the EMPr.
- Implementation of the proposed mitigation measures set out in the specialist studies.
- The proposed solar facility must comply with all relevant national environmental laws and regulations.
- All actions and task allocated in the EMP should not be neglected and a copy of the EMP should be made available onsite at all times.
- Should archaeological sites or graves be exposed during construction work, it must immediately be reported to a heritage practitioner so that an investigation and evaluation of the finds can be made.

We trust that the department find the report in order and eagerly await your final decision in this regard.

Marelle Griesel

Environamics - Environmental Consultants

9 REFERENCES

ACTS *see* SOUTH AFRICA

ALMOND J. E. 2016. Palaeontological Heritage Assessment: Combined Desktop & Field Based Study. Proposed Khubu Solar Power Plant on portion 5 of the farm Champions Kloof 731 near Vryburg, North-West Province.

ANON. nd. Guidelines for Environmental Impact Assessments. <http://redlist.sanbi.org/eiaguidelines.php>

BOTHA, A. J. 2016. The proposed Khubu Solar Power Plant near Vryburg, North West Province. Visual Impact Assessment.

CONSTITUTION *see* SOUTH AFRICA. 1996.

DEPARTMENT OF ENERGY (DoE). Integrated Resource Plan 2010-2030

DEPARTMENT OF ENVIRONMENTAL AFFAIRS. 2014. Strategic Environmental Assessment (SEA) for wind and solar energy in South Africa.

DEPARTMENT OF MINERALS AND ENERGY (DME). 2003. White Paper on Renewable Energy.

DR RUTH SEGOMOTSI MOMPATI DISTRICT MUNICIPALITY. 2014/2015. Integrated Development Plan (IDP).

ENERGY BLOG. 2015. Energy Blog – Project Database. [Web:] <http://www.energy.org.za/knowledge-tools/project-database?search=projectlookup&task=search> [Date of assess: 28 September 2015].

FIRST SOLAR. 2011. PV Technology comparison.

NW PROVINCIAL GOVERNMENT. 2004-2014. North West Province Growth and Development Strategy. Pretoria: Government Printer.

INTERNATIONAL FINANCE CORPORATION (IFC). 2012. International Finance Corporation's Policy on Environmental and Social Sustainability.

IFC & WORLD BANK GROUP. 2007. Environmental, Health, and Safety General Guidelines.

KRUGER L. 2016. Social Impact Assessment for Khubu Solar Power Plant (RF) (Pty) Ltd. Energy Facility North West Province.

LANZ, J. 2016. Agricultural and Soils Impact Assessment for Proposed Khubu Solar Power Plant near Vryburg North West Province. EIA Phase Report.

MUCINA, L. AND RUTHERFORD, M.C. 2006. The vegetation of South Africa, Lesotho and Swaziland. *Strelitzia* 19. South African National Biodiversity Institute, Pretoria.

NALEDI LOCAL MUNICIPALITY. 2012-2017. Integrated Development Plan (IDP).

NALEDI LOCAL MUNICIPALITY. Spatial Development Framework (SDF).

NATIONAL DEPARTMENT OF AGRICULTURE. 2006. Development and Application of a Land Capability Classification System for South Africa.

NERSA. 2009. South Africa Renewable Energy Feed-in Tariff (REFIT) – Regulatory Guidelines.

SANBI. 2016. Guidelines for Environmental Impact Assessments. [Web:] <http://redlist.sanbi.org/eiaguidelines.php>. Date of access: 26 April 2016.

SOLARGIS. 2011. Global Horizontal Irradiation (GHI). [Web:] <http://solargis.info/doc/71> [Date of access: 7 May 2014].

SOUTH AFRICA. 1996. Constitution of the Republic of South Africa as adopted by the Constitutional Assembly on 8 May 1996 and as amended on 11 October 1996. (B34B-96.) (ISBN: 0-260-20716-7.)

SOUTH AFRICA(a). 1998. The National Environmental Management Act, No. 107 of 1998. Pretoria: Government Printer.

SOUTH AFRICA(b). 1998. The National Water Act, No. 36 of 1998. Pretoria: Government Printer.

SOUTH AFRICA(c). 1998. The Conservation of Agricultural Resources Act, No. 85 of 1983. Pretoria: Government Printer.

SOUTH AFRICA. 1999. The National Heritage Resources Act, No. 25 of 1999. Pretoria: Government Printer.

SOUTH AFRICA. 2004. The National Environment Management: Air Quality Act, No. 39 of 2004. Pretoria: Government Printer.

SOUTH AFRICA(a). 2008. The National Energy Act, No. 34 of 2008. Pretoria: Government Printer.

SOUTH AFRICA(b). 2008. The National Environmental Management: Waste Act, No. 59 of 2008. Pretoria: Government Printer.

SOUTH AFRICA. 2010. Regulations in terms of Chapter 5 of the National Environmental Management Act, 1998. (GNR. 543, 544 and 545. 2010.). Pretoria: Government Printer.

SOUTH AFRICA. Minister in the Presidency: Planning (2009). *Medium Term Strategic Framework. – A Framework to guide Governments Programme in the Electoral Mandate Period 2009-2014.*

SWINGLER, S. 2006. Statistics on Underground Cable in Transmission networks, Final Report of CIGRE Working Group B1.07.

TERBLANCHE. R. F. 2016. Ecological Fauna & Flora Habitat Survey. Portion 5 (Shadow Eve) (Portion of Portion 4) of the Farm Champions Kloof 731, HN Registration Division, Province of the North-West, measuring 397.3009 (three hundred and ninety seven comma three zero zero nine) hectares, Title Deed No.: 1648/2012

TERBLANCHE. R. F. 2016. Wetland Assessment

VAN DER MERWE, D. 2016. Traffic Impact Study for the Transport of Solar Energy Equipment – Khubu SPP Vryburg.

VAN EEDEN, P. H. 2016. A hydrological impact assessment for the Khubu Solar Power Plant, Vryburg, Northwest Province. EcoMonitor cc, Report no. EM4603, Kempton Park, 15 pp.

VAN SCHALKWYK, J. 2016. Cultural Heritage Impact Assessment for the Development of the Proposed Khubu Solar Power Plant on Portion 5 of the farm Champions Kloof 731, HN, Vryburg Region, North West Province.

WILLIAMS, A. J. 2015. Bird report for the proposed Khubu Solar Power Plant.

WORLD BANK GROUP. 2006. The Equator Principles.